DEMAND ESTIMATION IN A PUBLIC UTILITY
AN EMPIRICAL MODEL

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ABSTRACT

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Public utilities often must serve a large number of different types of industrial users. These customers differ greatly in their demand requirements and purchase characteristics. Estimating the demand requirements of these customers is necessary if effective and equitable rates, product offerings, and selling strategies are to be developed.

This study provides increased understanding of the major factors that influence demand in the industrial market segment of a public utility. It does so by (a) providing a conceptual framework for analyzing the variables that might affect the industrial concern's demand behavior, (b) employing empirical data to measure and test the degree to which these factors influence the demand for a specific utility's offerings, and (c) developing statistical models that specify the relationship between the most critical explanatory factors and selected demand criteria.

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The utility selected for analysis was the Michigan Bell Telephone Company. A stratified sample of manufacturers, wholesalers, retailers, realtors, and dry cleaners was drawn from a geographic segment of Michigan Bell's market. Questionnaires were sent to owners or managers of each sampled firm. Information was obtained concerning the structural characteristics of the firms and the respondent's attitudes toward the value and usage of various telephone communication offerings. These data were used as the independent variables in the analysis.

The principle demand variables investigated in the study include both intrastate and interstate toll service, Yellow Page Advertising usage, total telephone equipment expenditures, trunk demand, and the number of telephone locations demanded. Data concerning these variables were gathered from Michigan Bell Telephone Company records and serve as the dependent variables in the study.

Factor analysis and simple correlation analysis were used to identify and extract the most important explanatory variables from the large set of initial predictors. Multiple regression analysis was then performed on the reduced set of predictors and each demand criterion. The regression models served as the basic forecasting models in the study.

Both structural and attitudinal variables were analyzed to determine their effect on the firm's telephone communications patterns. Structural factors best explained the variances in individual firm demand behavior. Variables associated with firm size were correlated highly with equipment demand for most business segments. Structural factors related to the geographical location of customers and suppliers were correlated highly with toll usage--particularly for firms in the manufacturer and wholesaler segments. In all cases, linear forecasting models best fit the relationships between structural characteristics and demand criteria.

Attitudinal factors did not contribute a significant amount of additional information to the structurally based demand models. Although these factors varied among business segments, they did not differ substantially for respondents within each segment. Variations in attitudinal responses, however, did suggest that marketing or selling strategies should vary for different customer types.

The respondent's perceived or expected reaction to an increase in toll rates varied both within and across customer groupings. In general, respondents from smaller firms expected toll usage to decrease much more in response to a rate increase than did those in larger firms. Also, telephone communications with suppliers were expected to be affected more by a rate increase than were communications with customers.

Several findings also pointed to a need for more effective communications between the utility and its customers. A large number of respondents perceived their understanding of the communications alternatives available to them to be quite poor. Also, many respondents indicated that they depended almost completely on the utility salesman for suggestions concerning both the types and amount of telephone communications equipment or services to utilize.

In summary, this research focused on the factors influencing the business firm's demand for a number of telephone utility offerings. However, many of the findings, implications, and recommendations derived from the study

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are of value to other types of utilities and non-regulated industries as well. It is hoped that one of the most significant contributions of this research is to provide a framework or focus for structuring and carrying out further utility-related studies. Certainly, further managerial and regulatory-oriented research is needed in all utility-based industries if a better matching of utility resources with customer needs and a more efficient allocation of company marketing efforts is to be attained.

ACKNOWLEDGMENTS

Many individuals contributed to the successful completion of this dissertation. Although it is impossible to acknowledge all of those who provided time, energies, and encouragement to this work, special mention should be made of some.

To the anonymous companies that responded to requests for information, I extend my thanks. Their assistance provides hope for an expanded interraction between the business and academic communities.

The Michigan Bell Telephone Company provided detailed data on customer demand characteristics even though the gathering of such data resulted in a partial disruption of their normal business activities. I especially want to thank Mr. Al Mathers of Michigan Bell for his many hours of help in searching out and tabulating much of the required information. My appreciation is also extended to a number of other Michigan Bell employees for their free exchange of ideas and helpful suggestions.

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CHAPTER I

INTRODUCTION

Firms concerned with the production, marketing, and distribution of such products as gas, electricity, and communication devices comprise the "public utility" sector of our economy. As part of the "regulated industries" they have long been the object of detailed local, state and federal regulation.

The subject of marketing in the regulated industries has received scant attention and study. Various authors have concerned themselves with the general subject of regulatory economics.[1] But little has been done in examining the application of various marketing principles to the public utilities, or in developing systematic analysis of marketing strategies in regulated environments. Although many of the modern marketing concepts and techniques

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[1]For examples of this see: Charles F. Phillips, Jr., The Economics of Regulation (Homewood, Illinois: Richard D. Irwin, Inc., 1965), pp. 656-707; Dudley F. Pegrum, Public Regulation of Business (Homewood, Illinois: Richard D. Irwin, Inc., 1965), pp. 637-721; Martin G. Glaeser, Public Utilities in American Capitalism (New York: The MacMillan Company, 1957).

apply to regulated as well as the non-regulated industries, research and testing have been performed primarily with firms existing in the nonregulated environment.

Yet the regulated industries, particularly the public utilities, are performing an increasingly vital role in the workings of our economy. The importance of these industries can be seen in their contribution to National Income. Approximately eight percent of the National Income originates in the regulated industries with close to one-half of this originating in the public utilities.[1]

The communications sector of the public utilities, on which this study concentrates, contributes nearly two percent to total National Income and since 1960 has accounted for nearly ten percent of all new plant and equipment expenditures.[2] Also, as measured in total assets, the telephone segment of the public utilities industries has grown at a faster rate than any other--nearly tripling in size since 1947. Over eighty percent of the families in the United States, as well as an even larger share of

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[1]The Economics of Regulation, p. 7.

[2]Business Statistics, 1969 Edition, U. S. Department of Commerce, p. 9.

the business sector, presently utilize this service.[1]

The fact that the regulated industries of this country are a combination of private ownership and public control causes significant problems and conflict between the goals of profit maximization and public service at the lowest possible price. It generally is felt that regulation of public utilities seeks to provide goods and services to the consumer at "reasonable rates." However, if regulation in such industries is to provide the impetus and motivation for technological innovation, then it must be approached in terms of its effect on the total benefits to society and not just in respect to some particular "reasonable rate of return."

One of the prime ways in which a firm benefits society is by satisfying the changing wants and needs of its customers. The relative success of a firm operating in a competitive environment often depends greatly on how well it meets the needs of the consumer. The search for a differential advantage through greater want satisfaction is what leads to continuing technological innovations and

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[1] The Economics of Regulation, pp. 8-11.

a dynamic competitive environment.[1] Although most public utilities operate under regulatory constraints and in monopolistic types of market structures, varying amounts and types of competition do exist. For example, firms operating in the natural gas industry face competition in many markets from the electric and oil utilities. Most transportation industries compete directly with each other for certain segments of the market. In most utilities there is the long run threat of substitute products being developed by other regulated or non-regulated firms. Also, new technology is a constant threat to the monopolistic position that many utilities enjoy today.[2] Even where no direct substitutes are available for a particular utility's offerings, the firm still must vie for its share of the consumer's increasing discretionary income.

Competition in all of these forms has caused the public utilities in recent years to become more market

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[1]For a rigorous discussion of the concept of "competition for differential advantage" see Wroe Alderson, Marketing Behavior and Executive Action (Homewood, Illinois: Richard D. Irwin, Inc., 1957), pp. 101-129.

[2]For an example of this type of threat, see B. Herber, "The Impact of Microwave on the Telephone Business," Public Utilities Fortnightly, LXX (August 16, 1962), pp. 214-15.

oriented. Utilities have increased their advertising budgets, developed a variety of new and diversified products and services, and conducted studies to determine the effect of both demographic and socio-psychological variables on demand.[1] These are but a few indications of the utility's effort to understand its customers better and to compete with other durables and non-durables for the consumer dollar. Independent researchers are performing other studies which will provide additional knowledge of consumer purchase behavior and buyer attitudes toward the products and services which the public utilities offer.[2]

The attempts of the utilities to anticipate, stimulate, and foster change in customer thinking are not only occurring in the consumer or residential sector of the market, but in the business sector as well. However, before the requirements of either of these segments can be determined and before successful marketing strategies can be

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[1]For example, see Report Issued jointly by the Opinion Research Corporation and the Long-Range Planning Group of Michigan Bell Telephone Company entitled Profile of the Michigan Bell Consumer in May, 1967.

[2]For example, see William Stephenson, "Public Images of Public Utilities," Journal of Advertising Research (December 1963), pp. 34-39, and Thomas S. Robertson, "An Analysis of Innovative Behavior and Its Determinants," (Unpublished Ph.D. Dissertation, Northwestern University, 1967).

developed, the needs of individual customers in each buying situation and the roles of the major buying influences must be understood.

Purpose of the Research

"Effective marketing strategies, with respect to both industrial and consumer goods and services, require knowledge of the buying process, the buyer's behavior, and the various influences and motivations that affect this behavior."[1] This is especially true in the industrial market where there are fewer customers but where the amount of a product or service that a single buyer demands is often large. To develop proper product offerings and marketing strategies for these customers, the selling firm must profile the characteristics associated with various types of business customers and understand their respective effects on demand.

This study seeks to provide increased understanding of the major determinants and variables that influence demand in the industrial market segment of a public utility. It

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[1]Patrick J. Robinson, Charles W. Faris, and Yoram Wind, Industrial Buying and Creative Marketing (Boston: Allyn & Bacon, Inc., 1967), p. 214.

does so by (a) laying a theoretical framework for analyzing the factors that might affect the industrial concern's demand behavior; (b) employing empirical data to measure the degree to which these factors influence the demand for a specific utility's offerings; and (c) developing statistical models that indicate the relationship between the most critical explanatory factors and specific demand criteria.

The utility selected for analysis in this study is the telephone industry. Telephone utilities are in the somewhat unique position of renting and selling their equipment and services to all business firms in a given geographical area. It would be very useful, therefore, for such a utility to be able to estimate the potential usage of its equipment and services by individual firms.

Accordingly, the main purposes of this study are:

1. To develop statistical forecasting models that recognize the role that selected "structural"[1]

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[1]"Structural" will be used in this study to characterize specific variables associated with the firm much as "demographic" is used to represent certain variables related to households. Since these "structural" variables are traditionally used as the basis for classification (i.e., number of employees, gross sales, etc.), these variables will also be referred to as "classificatory" factors. For a comprehensive listing of the basic structural or classificatory variables used in this study, see Chapter III.

variables associated with a given industrial concern play in determining the demand for various types of telephone communications equipment and service.

2. To determine the degree to which the decision maker's personal attitudes toward the value of communication influence the accuracy of these demand models.
3. To implement and test the models.
4. To evaluate the managerial implications of the models.
5. To investigate the regulatory implications of the models.
6. To illustrate how the models can be used to assist management in strategy and planning decisions.

The Telephone Communications Industry

A comprehensive analysis of all aspects of the telephone industry and its various regulatory constraints is not critical to the development of this study. However, a brief review of some of the unique characteristics of the telephone market is necessary. This section of the paper examines briefly the changing technology and market structure in certain areas of the communications industry. Also some of the factors that affect rate-making policy in the local exchange and toll telephone markets will be described.

The telephone industry in the United States is privately owned but heavily regulated by the Federal Communications Commission and various state agencies. American Telephone and Telegraph is the dominant firm in the industry; however, a few moderate sized firms such as International Telephone and General Telephone and a large number of small independent firms exist to serve primarily rural areas.

The telephone utility, like most other utilities, is characterized by a large investment in plant and equipment. To satisfy the potential demand that exists for communications services at any one time, a high fixed investment in lines, switching apparatus, and associated equipment is needed. Despite the fact that this equipment is fully utilized only during peak demand periods, rates must be set to recover the costs associated with full capacity requirements. This means that a portion of the rates are paid by potential as well as actual users.

There is little direct competition today among communication industries for much of the residential and business telephone services. This is particularly true in the residential sector where, for many product and service offerings, the local telephone utility enjoys a near monopoly position. In recent years, however, several factors have led to increased competition in the communications industry. Direct competition among communication utilities has developed for such offerings as private lines and data transmission services. Technological advances have also introduced competitive elements into the larger scale areas of supplying communication needs to both big business and government.[1] Competition was also intensified following the 1959 Federal Communications Commission's decision,[2] which allowed firms to develop their own microwave systems for the transmission of both voice and nonvoice messages. This decision led several large firms and the federal government to adopt or increase their usage of private

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[1] Charles F. Phillips, Jr., *op. cit.*, p. 692.

[2] *In the Matter of Allocation of Frequencies in the Bands Above 89Mc.*, Docket No. 11866, Temporary Decision, August 6, 1959 (issued on July 30, 1959).

microwave systems,[1] and in turn caused AT&T to offer new communications offerings to customers with extensive communication needs.[2]

An additional result of the microwave decision was the raising of some critical questions concerning the role of regulatory policy in the communications industry. It has been suggested that there are certain inequalities in existing regulatory practices since ". . . one side of the competitive market--the private systems and their suppliers--face little or no regulation. However, the other side of the competitive market, the established common carriers such as Bell and Western Union, are closely regulated as public utilities."[3]

Directly related to the research in this study is the suggestion that a new regulatory philosophy be developed. This new philosophy is based on a recognition of the monopolistic character of the residential market and the

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[1]Herber, "The Impact of Microwave . . .," _op_. _cit_., p. 220.

[2]"Offering Similar to Telpak Would Have Been Made," _Telecommunications Report_ (July 16, 1962).

[3]Bernard P. Herber, "Telephone Industry Reaction to Microwave Competition," _Public Utilities Fortnightly_, LXX (October 25, 1962), pp. 634-35.

more competitive situation in the business-government market.[1] Before any new regulatory or rate-making policies can be developed, more detailed analysis of the demand elasticities of the various communications markets is needed. Also required is an evaluation of the possible effects that a dynamic technology and an increased competitive environment will have on the structure of the different communication markets. Only by accurately identifying and measuring the effects of these forces can a flexible pricing policy be developed. This regulatory policy must not unfairly discriminate between the residential and commercial market segments or among the many sub-markets within these segments.

Local, Intra-State, and Inter-State Exchange Rates

Little is known about the exact characteristics or elasticities of telephone demand. Based on a general understanding of customer demand elasticities, however, some discriminatory rates have been established. For example, most local service demand and some residential and commercial long distance demand is considered highly inelastic. Some other types of demand, such as long distance

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[1] *Ibid.*, p. 636.

social calls and certain types of business toll communications are more elastic. While the rate structures for these telephone services are based primarily on the costs associated with each offering, rates are often also based on the perceived price sensitivities of the different demand segments. A familiar example of this rate-making strategy is the different rates charged day and night users of toll services. In this case, the higher day rate applies to the more inelastic business calls while the lower evening rate applies to the more elastic family or social calls. Several other examples of discriminatory rate-making policies are given in the following paragraphs in which the structure of both local exchange service and toll service is examined in greater detail.[1]

The fundamental unit used to establish local rates is called an exchange. The exchange typically includes all inhabitants of a city or town and certain outlying or suburban areas. The geographical limits of the exchange are not fixed but may vary as local population configurations dictate. Price differentiation among exchange units is

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[1]For a more detailed examination of the telephone industry rate structure, see Chalres F. Phillips, Jr., op. cit., pp. 362-370.

based primarily on the size of the exchange or the number of telephones that can be called within an exchange without a toll charge being added. In addition to differences in cost, price discriminations within an exchange are based on the class of user (residential vs. commercial) and the number of subscribers using a single line. In this way, flat rates, based primarily on cost but modified according to differing elasticities of demand, are charged to broad classes or categories of users. Some cities also offer what are termed message rates to subscribers. In these cases a flat rate is charged a subscriber as long as he does not exceed a specified number of message units. Any calls over the specified number of units are then billed at some additional uniform price.

In addition to the various local exchange rates, users are also charged for all installations of equipment and for specialized or extra vertical types of equipment. For example, those buyers who are willing to pay the added price may adopt equipment such as private-branch exchanges, extension telephones, and colored or special design telephone equipment.

Toll rates for both intrastate and interstate service are also differentiated for both different types of uses and users. As in the local exchange case, price discrimination is based both on cost and user demand elasticities. These rates reflect such factors as "(1) distance; (2) whether completion is requested to a specified person or to anyone who answers; (3) time of day; and (4) length of conversation (holding time)."[1]

In general, local and statewide exchange and toll rates are set to provide rates that are similar under like conditions and provide the supplying utility with a reasonable rate of return. This process might discriminate against some users by granting equal rates to both high and low cost areas. However, it leads to a system whereby users in different exchanges pay equal amounts for the same relative amount of service.

Background of the Problem

Traditionally, most firms selling to the industrial market sectors have relied on government statistics as a basis for generating market demand estimates. For example, statistics concerning the number, type, and size of business firms located in any given city are readily available in various government publications. These statistics

[1] *Ibid.*, p. 367.

provide the firm with rough macro estimates of potential demand in given regions or specific industrial groupings.[1] This information does not, however, help a firm develop estimates of individual firm demand behavior. This demand problem has not received the consideration or emphasis devoted to the more macro oriented estimation techniques. There are several basic reasons for this:

1. Many firms do not feel the need of estimating demand on other than a region or industry basis.
2. Individual firms, like individual consumers, are extremely varied in their wants and needs. This heterogeneity causes problems in forecasting individual firm demand.
3. Individual biases and value systems of purchasing agents or corporate managers often interfere with the rational selection of goods and services based solely on firm needs or requirements.

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[1]For example see: E. J. Hermer, "On Mapping Industrial Markets," Dunn's Review, Vol. LXI (May, 1953), p. 39, and Code Koning, "Effective Techniques in Industrial Marketing Research," Journal of Marketing, Vol. XXVIII (April, 1964), pp. 57-61.

4. It is more difficult to forecast sales for a particular firm than it is for an entire industry. This stems from the fact that most of the data needed for forecasting are available on an industry-wide rather than an individual-firm basis.

If demand and the determinants of demand in the industrial sector are to be understood and accurately quantitifed, analysis must take place on as small a customer unit or segment as possible. For if such marketing strategies as personal selling, new product development, and advertising are to be effective, they must be based on detailed knowledge of the customer's needs and requirements.

To anticipate and foster change in the requirements of its business customers, a public utility should have insight concerning:

1. The needs of the individual customer in each buying situation.
2. The roles of the major buying influences.
3. The organizational procedures in the procurement process.

4. The environment in which the customer operates.[1] Only by classifying and identifying as many buying influences and determinants as possible can the firm adequately (1) predict future requirements, (2) allocate marketing and production expenses and facilities optimally, and (3) develop products and strategies consistent with market requirements.

Problem Statement

A public utility as contrasted with a firm operating in a more competitive industry, has a unique problem when dealing with the commercial segment of its market. Whenever a new firm enters the utility's geographical market area, or an existing customer modifies its market position through an acquisition, product-line expansion, extension of sales to a new area, or by building a new plant, the public utility has the problem of estimating the probable effect of this change on existing equipment and/or service demand. In other words, the utility must be ready and able to meet and service all new demand that might develop. Although a similar problem exists for some non-regulated firms, it is especially critical for a utility that has a

[1]Robinson, *op. cit.*, p. 214.

monopoly or near-monopoly position in a given geographical area. For in such an instance, it is known that the new or enlarged firms have to purchase any needed products and services from the local utility.

There are typically three questions to be answered prior to modeling or predicting the demand for a given product or service:

1. Does the firm exhibit a need for the basic product or service under study?
2. In what quantity or amount is the firm expected to demand the product?
3. What brand will the firm buy or from what company will the firm purchase the product?

Since the public utility affords an environment where such variables as competitive factors, channel considerations and brand choice problems are negligible, the last of the above three problem areas will not be considered. The difference between a firm's actual demand for a specific product offering and its needs or potential demand for that product is of primary importance.

The public utility, therefore, would like to predict, as accurately as possible, the types and amount of service and/or equipment that new and existing companies might require. There are four basic reasons for this:

1. To insure that any additional needs required in the near future can be satisfied from existing equipment.
2. To provide an accurate prediction of future plant or equipment needs if existing facilities are not sufficient.
3. To provide its salesmen with any information about the buying firm which might aid in the allocation, selling and installation of the "right equipment and/or services at the right rates."
4. To aid and guide management in the development of new products and services and in the establishment of equitable rate and price structures.

If forecasts and strategies compatible with the above four areas are to be designed, two basic problems must be solved. First, the types of information needed to make accurate decisions in these four areas must be determined and monitored. Second, some method must then be developed whereby this information can be used to generate forecasts of the buying firm's expected usage and purchase behavior.

General Hypotheses

This research can be considered an exploratory or pilot study in the general area of modeling demand in the industrial sector of a public utility's market. The five hypotheses used to guide the research are:

1. The influence that certain structural variables associated with given types and sizes of business firms exert on the demand for telephone communications equipment, services and usage can be identified and measured.
2. Top management in a firm will have varying attitudes and biases toward the value of telephone communications. The effect that these personal values and attitudes have on individual firm demand for telephone communications equipment, services and usage can be identified and measured.
3. The effect of structural variables on firm demand for telephone communications offerings will vary from one sector of the industrial market to another.

4. The predictive power of the demand model using structural factors as independent variables will be significantly greater than that expected solely by chance.

5. The predictive power of the model will be increased significantly if attitudinal factors are added to the array of structural independent variables.

Method of Investigation[1]

To make the modeling, hypothesis testing, and associated experimentation as realistic and accurate as possible, a regulated industry and firm that would cooperate in furnishing accurate data concerning itself and its commercial customers was chosen. The telephone industry and, in particular, Michigan Bell Telephone Company, adequately fulfilled this need. Michigan Bell offered customers a large variety of both hardware and service offerings. Also, its market included nearly all types and sizes of business establishments. Finally, with approximately 51% of Michigan Bell's total revenue derived from the business sector,[2] there

[1]For a more complete statement of the methodology used in this study see Chapter III.

[2]1967 Michigan Bell Telephone Company records.

was a clearly stated need for the types of information outlined and sought in this research.

To make the study operational and to facilitate data collection, the scope of the study was limited in three ways. First, the research was limited to firms in a single geographical area. This eliminated the problem of gathering data from a large number of widely dispersed Michigan Bell business offices. It also minimized the effects of factors that varied according to a firm's particular location in the state.

Second, the firms included in the study were selected from five segments of the business sector. These five sectors were:

1. Dry cleaning establishments
2. Real estate establishments
3. Retail firms
4. Wholesale firms
5. Manufacturing firms

These segments included firms ranging from very homogeneous groupings (based on the structural variables used in the analysis) to extremely heterogeneous categories. The forecasting models were expected to be more accurate for the homogeneous segments than for those segments that included firms with widely varying structural characteristics.

Third, those few firms large enough to merit a permanent full time telephone sales representative were dropped from the study. These firms typically have extremely complex communication needs, and the development of a generalizable model for firms of this nature would be nearly impossible.

A non-random stratified sample was selected from several different sources, including the Dunn and Bradstreet Reference Book, the Yellow Pages of the Greater Lansing telephone directory, the Directory of Michigan Manufacturers and the Polk City Directory for Lansing.

A mail questionnaire was constructed for each of the five business segments previously listed. Data was sought concerning both the structural and attitudinal characteristics of the selected firms. These characteristics constitute the major independent variables used in the predictive demand models.

The primary demand variables investigated in this study include both intrastate and interstate toll service, Yellow Page Advertising usage, total equipment demand, trunk demand, and the number of telephone locations demanded.[1] Data concerning the types of equipment, service, and usage patterns of each firm included in the sample were gathered from Michigan Bell records and serve as the dependent variables.

Limitations of the Study

Since this study is empirical in nature, there are certain limitations associated with the collection and analysis of the data. These general limitations are as follows:

1. While an attempt was made to include all factors associated with a given business segment that might affect the demand for communications offerings, it is very likely that some have been omitted. The exclusion of certain variables from the analysis may influence the predictive accuracy of the demand models. It is hoped, however, that this effect will not be significant.

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[1]For a more detailed discussion of the explanatory and demand variables used in this study, see Chapter III.

2. The usual limitations associated with the use of a mail questionnaire survey apply here. These are discussed in more detail in the analysis chapter.

3. Since ordinal measurements were used in the attitudinal section of the questionnaire, the conclusions that can be drawn from this data are limited and subjective in nature.

4. The respondents studied represent certain types of firms in a confined geographical area. Therefore, any findings can only be related directly to a limited segment of the total market. While extrapolating the results to firms in other segments seems fairly logical in this instance, the statistical accuracy of such generalizations must be verified by further study.

Terms and Definitions[1]

Certain terms associated with the products, services and operations of the telephone utility require operational

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[1]Definitions of those terms denoted by an asterisk (*) have been taken from a pamphlet entitled Glossary of Telephonese published by the Michigan Bell Telephone Company.

definitions. Following is a list of various terms used in this study, along with their corresponding definitions:

<u>Telephone Communications Equipment</u> - Telephone communications equipment refers to the hardware that a customer rents from Michigan Bell. The specific types of equipment referred to in this study are:

*Call Director - The call director is a single, compact telephone unit which provides the capacity of up to 30 telephone lines.

*Key Set - A key set is another name for a push button telephone wherein the buttons are used for intercom, holding, signaling and/or pick-up of additional telephone lines.

*PBX (Private Branch Exchange) - A switching system, often on a telephone customer's premises, which serves that customer's telephones over a common group of lines from the central office. The PBX can receive incoming calls, place outgoing calls as well as inter-connect office extensions. Many sizes of switchboards are available.

<u>Telephone Communications Services</u> - Telephone communications services refer to the offerings--other than hardware--which Michigan Bell offers to its customers.

The specific type of services referred to in this study are:

*Private Line - A point to point arrangement which has no connection with the exchange or toll system of the telephone company.

*Trunk Line - A channel from a telephone company central office to a customer's private branch exchange used to provide service to the PBX central equipment.

*WATS (Wide Area Telephone Service) - A special "access" line to a nationwide network over which a customer can make as many calls as he likes (within a selected wide area which may be nationwide) for a fixed monthly charge.

*Communications Consultant - A communications consultant is an individual who evaluates the data transmission needs of a business customer and recommends and specifies the types of equipment and services the firm would use to best satisfy these requirements.

*Exchange - An exchange is a defined area, served by one or more central offices, within which the telephone company furnishes telephone service at the exchange rates, and under regulations applicable in that area as prescribed in the company's Filed Tariffs.

*Local Service Area - A local service area is the area, consisting of one or more exchanges, within which calls may be made without a toll charge, in accordance with the class of service offerings.

*Long Distance Call - Any call beyond the local or multi-message unit calling area.

*Station - An installed telephone or teletypewriter on a customer's premises which, in the exchange network, has been given a telephone number and is the instrument through which service is furnished to the customer.

Contributions

It has been stated that one of the directions which marketing theory should take is the development of better analytical tools of analysis.[1] That this is necessary is illustrated by a statement taken from a recent Marketing

[1]E. T. Grether, "A Theoretical Approach to the Analysis of Marketing," Theory in Marketing, Reavis Cox and

Science Institute publication:

> The development of an effective and efficient approach to the matching of buyer requirements and seller capacities is dependent on the marketer's understanding, and consequently his ability to classify or structure the decision making process underlying industrial buying behavior. The basic objective is to try to develop and explain an operationally-useful classification system, focusing directly on the nature of individual customers, or potential customer's requirements and the resulting buying situations.[1]

The development of a classification and forecasting scheme for a single utility should lead to a better understanding of the factors that influence the purchase of telephone communications products and services. By structuring models that relate various classificatory and attitudinal factors to purchase behavior, the public utility should be able to develop new and better marketing strategies. Also, the models and associated experimentation focus directly on the nature of different customer requirements by examining the factors that influence demand across various market segments. This information should enable the utility to be more effective when selling, advertising, pricing, and

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Wroe Alderson, Ed. (Homewood, Illinois: Richard D. Irwin, 1950), p. 114.

[1]Robinson, _op_. _cit_., p. XII.

developing products for specific types of industrial buyers.

The research results, although limited in scope, should help determine the feasibility of using this approach in the development of either long-range micro or macro-models of industry demand. The ability to extrapolate from a study similar to this to a larger scale model will depend upon both the importance of certain variables in the demand models and the general accessibility of data pertaining to these variables. If this data is readily accessible, and reasonable estimates can be made about the movement of these factors through time, the long range planning function of a firm should be improved substantially.

The results of this study will also lend empirical evidence to researchers developing similar models in other industries. Because of an increased number of influencing factors, constructing empirical forecasting models for firms operating in a competitive environment would be more complex than those developed in this study. The potential benefits of such models to industrial firms, however, should stimulate research efforts in this direction.

Finally, the research should indicate how salesmen might best be assigned to specific customers. With a variety of product offerings, a conglomerate grouping of firms, and a range of customer sizes, some system must be designed whereby salesmen can be allocated to customers according to the varying needs and requirements of the purchasing firm. This study provides the supplying firm with information on the individual business customer and his perceived needs. Therefore, valuable insight should be gained as to how the selling function and variations in product offerings might be adjusted to best match buyer requirements.

Overview

In Chapter II, a discussion is presented concerning the previous research conducted in the areas of modeling industrial markets and forecasting demand in the business sector. Chapter III contains a detailed review of the research methodology including sample selection, questionnaire construction and administration, and the statistical techniques used for analysis. Chapter IV considers the total array of independent and dependent variables used in the analysis and delineates those explanatory factors which appear to be the best predictors of demand. In Chapter V, the basic forecasting models are developed, and a discussion of the models' application to the problem of salesman allocation is presented. Finally, Chapter VI contains a review of the significant findings and a summary of the conclusions and further research which the findings suggest.

CHAPTER II

MODELING DEMAND IN THE INDUSTRIAL MARKET SECTOR A CONCEPTUAL FRAMEWORK

Introduction

Much has been written pertinent to the general topic of marketing in the industrial sector. Most of the writings, however, focus on concepts related to industrial firms operating in a competitive environment. This chapter will review those writings and methodologies which have a significant bearing on the specific problem of forecasting demand for commercial users of telephone utility offerings.

Classification Methods in Industrial Markets

Before a firm that sells products or services in the industrial market can develop realistic and accurate marketing strategies, management in that firm must segment its actual and potential customers. The characteristics used in categorizing customers is of major importance. Often, however, these characteristics are not easily isolated due to the large number of complex variables associated with different types of business customers. The importance of developing and utilizing classificatory schemes, however, is indicated by the entymologist Sokal who stated:

> Classification is one of the fundamental concerns of science. Facts and objects must be arranged in an orderly fashion before their unifying principles can be discovered and used as a basis for prediction. Many phenomena occur in such variety and profusion that unless some system is created among them, they would be unlikely to provide any useful information.[1]

Developing proper classification schemes to aid in the decision making process has long been a difficult problem facing the management of both industrial and consumer based firms. As Frank and Green state:

> Marketing managers and researchers often comment on their difficulty in developing useful ways of classifying customers for formulating marketing policy. The source of the difficulty frequently stems from the abundance of alternative classification methods rather than from a lack of possibilities.[2]

It is important that management choose those classification schemes which best meet the requirements of the specific

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[1]R. R. Sokal, "Numerical Taxonomy," Scientific American, 215 (December, 1966), p. 67.

[2]Ronald E. Frank and Paul E. Green, "Numerical Taxonomy in Marketing Analysis: A Review Article," Journal of Marketing Research, Vol. V (February, 1968), p. 83.

problem under consideration.

Traditionally, firms selling or buying industrial goods have relied on several basic classification schemes. The three most popular bases for classification are: "market segments or classes of trade reached; products or services marketed; and end-use applications. Classification according to classes of trade characteristics helps in analyzing the company or division buyers . . . according to products or services marketed, and according to end-use application in developing technical specifications and preparing promotional materials."[1]

Classification by Product

The most basic classification system considers the types of products and services sold and bought by industrial firms. The five groups into which industrial goods are usually divided are (1) installations or major equipment; (2) accessory equipment; (3) operating supplies: (4) fabricating materials and components; (5) primary materials.[2] The majority of products and services offered

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[1]Patrick J. Robinson, *et al.*, *op. cit.*, p. XI.

[2]For a more detailed description of these goods and the buying motives associated with each, see Melvin T. Copeland,

by public utilities to business customers are either operating supplies or accessory equipment. More specifically, the goods and services supplied to business firms by the telephone utilities can be classified as accessory equipment.

An analysis of the industrial buyers of accessory equipment must include a cross-section of many types of business establishments. This is especially true for telephone equipment and services since nearly all industrial firms purchase these products. The major problem in analyzing these buyers is to determine the basic underlying factors that cause variations in individual firm purchase and usage behavior.

Segmentation by Class of Trade

To make accurate and timely marketing decisions, management must also predict the collective behavior of market participants.[1] In the industrial market, these

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Principles of Merchandising (Chicago: A. W. Shaw Company, 1924), pp. 130-154, 190-215; and Ralph S. Alexander, James S. Cross, and Ross M. Cunningham, Industrial Marketing (Homewood, Illinois: Richard D. Irwin, Inc., 1961), pp. 6-13.

[1]Paul E. Green and Donald S. Tull, Research for Marketing Decisions (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966), p. 120.

market participants are different types of business firms. Before the collective behavior of these firms can be modeled or predicted, some system must be found to group these customers into homogeneous segments.

The most frequent starting point in classifying business firms or institutions is the Standard Industrial Classification system. The federal government designed the SIC code to categorize all types of business establishments according to either the product produced or the operation performed. This classification system is most useful when it "can be viewed in the light of the buying motives of industrial purchasing agents. . . If the problem of all industrial plants could be categorized into those that can or cannot be solved through the use of certain products, it could be determined what plants are in a certain market and the exact problems each one faces."[1]

Classification by SIC assumes that the problems faced by the industrial concern originate primarily with the product manufactured and/or the manufacturing process used. For some industrial goods, this is a valid premise. For

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[1]Francis E. Hummel, "Pinpointing Prospects for Industrial Sales," Journal of Marketing (July, 1960), p. 27.

others it is not. For example, when considering the accessory equipment marketed by a telephone utility, the traditional product or type of firm-oriented classification schemes may be too general. Therefore, this approach is often partially or entirely inadequate. A number of other factors associated with the buying firm, his customers, and suppliers may dominate the variables associated with the product produced or the operation performed. Thus, businesses classified under the same SIC code might manufacture or sell the same basic kinds of products and have similar production problems and techniques. The degree of dissimilarity in other phases of their operations, however, could rule out the usefulness of the SIC system as the basic means of forecasting product or service requirements and demand.

Although customer behavior is multidimensional in that it generally is influenced by a large number of variables, "researchers often sidestep its complexity by picking some unidimensional attribute assumed to be an indicator of the more complex phenomena to be understood."[1] Because of its general availability, simple employment data

[1]Ronald E. Frank and Paul E. Green, _op_. _cit_., pp. 83-84.

is used by a great many sellers of industrial products to supplement the SIC system and provide additional information about the size of a particular market or customer. This one factor falls far short of being a good indicator of demand for most products. For this reason, many firms also supplement SIC data with value added, production, or wages and salary statistics.[1] In addition, variations in the purchasing habits and marketing strategies of different firms, as well as varying end-use characteristics of certain products, have forced some industrial good manufacturers to develop even more detailed classification systems.

The behavioral factors influencing the purchasing behavior of individual firms have also been used to categorize buyers. This has led to classification schemes based on a variety of buying situations and purchase motives,[2] "since for any given buyers purchasing the same product, individual purchasing patterns and the buying process itself have been found to differ distinctly with subsequent purchases over time and in dealing with different

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[1]Robert J. Piersol, "Accuracy of Estimating Markets for Industrial Products by Size of Consuming Industries," _Journal of Marketing Research_, Vol. V (May, 1968), p. 147.

[2]Patrick J. Robinson, _op_. _cit_., p. 22.

suppliers."[1] The basis for these latter classification schemes usually rests on the assumption that there are several suppliers competing for the buyer's loyalty.[2] The majority of the variables used in these classification models, however, are not relevant for the public utility. In the utility case, the problem is not one of classifying customers on the basis of their likelihood of purchase from a particular seller, but, rather to determine whether they will purchase a given product at all. One method of answering this question is to determine either directly or indirectly each purchaser's end-use characteristics for different products. Estimates are then made of the buyer's specific needs and demand based on these varying end-use situations.

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[1] _Ibid._, pp. 22-38.

[2] For example, a type of classification scheme often used to categorize the industrial customers is one which attempts to classify buyers according to the different factors that influence their decision to purchase a given product from one supplier rather than a competitor. This type of classification system often forms the basis for prediction models comparable to the consumer brand-switching models.

Classification by End-Use

The ability to expand sales to both existing and potential customers is severely limited when specific end-use information is not available. For this reason, many firms marketing capital goods perform research to discriminate among the end-use characteristics of their products for different customers. The strength of the end-use method of classification rests in the fact that it "considers each customer as a heterogeneous unit by focusing on his numerous requirements. This is essentially the 'consumer viewpoint' which is said to be the heart of the 'marketing concept'; the ultimate user's mode of consumption is implicit in this scheme."[1] This method of analysis allows the salesman to determine the product, or product variation, which a particular firm should purchase based on the specific characteristics associated with its end-use.

In general, formal classification schemes have not been developed that consider the specific purposes for which industrial products are purchased. Instead, the motives

[1]Charles L. Hinkle, Unpublished paper presented to the American Marketing Association International Congress, June 17-19, 1968 at Philadelphia, Pennsylvania.

associated with the purchase of a product, and the end-use to which it is put are inferred or implied from the basic type or class of firm purchasing the product. It is often difficult, however, to locate and identify firms with similar product applications simply on the basis of class of trade. For in this case, the classification scheme may not recognize that a single customer uses a product in more than one way or that customers of the same type or size may use fundamentally different products.

Classifying a public utility's commercial customers by end-use should lead to a better match between customer needs and the products and services provided. This is particularly true for the telephone industry in which the types and amount of equipment and service purchased is dependent upon a number of end-use factors. For example, the degree to which products are used to communicate with suppliers, customers, branch facilities, or other departments varies among customers. Also, firms differ in the importance they place on not having a customer receive a busy signal.[1] Finally, the use of telephone equipment for

[1]For example, an airline ticket agency or central taxi office would be expected to be much more concerned with having an open line available at all times than the typical manufacturer. This is true since the probability of a lost

computer hook-ups or data transmission varies substantially among customers.

The relative importance of these factors can vary both among similar firms and across industry classes. Thus, to match accurately product and service offerings with customer needs, the telephone salesman must determine the variable influence which these factors have on different industry classes. Because of the large number of customers served by a public utility and the wide variance in customer characteristics, this task is made extremely difficult. Therefore, the traditional classification schemes discussed previously may be of little value when used alone. What is needed is a more generalized technique which is capable of isolating the most important purchase indicators from the total array of possible influencing variables.

Factors Influencing the Demand for Industrial Goods

Before a predictive model can be developed to relate user characteristics to product demand, the researcher should have some conception of those factors that are most likely to influence the purchase decision. Most research

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sale resulting from a busy signal would be much higher in the first two cases than in the latter.

has dealt with the consumer buying process; however, the literature does contain a number of constructs relevant to the problem of modeling industrial demand. The purpose of the following paragraphs is to relate certain empirical findings and theoretical concepts dealing with industrial purchasing processes to the problem of modeling industrial demand for utility products and services.

Traditionally, the industrial purchase process has been viewed as a rational decision making procedure in which the variables of quality, price, delivery time, quantity, and service are most influential. The Industrial Marketing Committee Review Board has stated that "Rational buying motives appear to predominate in the industrial field (as against emotional motives in the consumer field), but their influence declines with the increase in product similarity."[1] Modeling buying behavior in the industrial market has long been dominated by the concepts and principles stated in classical economic theory. "Yet there is "an increasing recognition that industrial buyers are influenced by emotional 'noneconomical' as well as 'rational-economical'

[1]Industrial Marketing Committee Review Board, "Fundamental Difference Between Industrial and Consumer Marketing," Journal of Marketing, XIX (October, 1954), p. 153.

consideration."[1]

Much of the recent industrial marketing literature has focused on the relative importance of non-economic factors in the industrial purchasing decision.[2] Generally, this research has dealt with the purchasing agent and the various psychological and behavioral determinants associated with his decision to buy from one supplier rather than another. By gathering empirical evidence on industrial buyers' purchasing habits, researchers have attempted to quantify and model the relationships between certain psychological and behavioral variables and their resultant effect on buying decisions.[3]

This study is concerned primarily with a firm operating in a non-competitive environment. Brand choice

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[1]Patrick J. Robinson, et al., op. cit., p. 153.

[2]For examples of this see F. R. Shoaf, "Here's Proof--The Industrial Buyer's Human," Industrial Marketing, XLIV (May, 1959), pp. 126-128; H. Lazo, "Emotional Aspects of Industrial Buying," in R. S. Hancock, ed. Dynamic Marketing for a Changing World: American Marketing Association Proceedings of the 43rd National Conference: 1960, pp. 260-261; and D. J. Duncan, "Some Basic Determinants of Behavior in Industrial Purchasing," Pacific Purchasor, XLVII (May, 1965), pp. 17-18.

[3]For a discussion of some of the psychological and behavioral variables that influence the industrial buyer's purchase decision see Patrick J. Robinson, et al., op. cit., pp. 155-571.

and supplier preference considerations are not factors in the purchase decision. The only types of variables to consider in the monopoly situation are those influencing the basic "buy-no-buy" decision.[1] There may be some differences in the psychological and behavioral characteristics of various purchasers or users. These differences may cause variations in the amount of a product or service demanded by structurally similar firms. However, for firms in a monopoly or near-monopoly position, non-behavioral factors should be accurate indicators of customer demand patterns.

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[1]The "buy-no-buy" decision as used here infers that the customer has a choice between two or more alternatives. This means that the customer is aware of the offering and that the product or service is actually available to him. If information on new offerings is not disseminated to potential customers or if certain new products are only available to buyers in specific industries or geographical locations, there exists an unserved market. These customers do not actually face the "buy-no-buy" alternative and the predictive model is trivial.

Although the availability problem does not exist in this study, the amount of information which various firms have concerning telephone products and services may well have an impact on certain demand offerings. In fact, as later discussions will show, many firms included in this analysis were either totally unaware or had only a slight familiarity with certain telephone analysis. For a more detailed discussion of this problem and the specific products and services involved, see Chapter III and IV.

Building an industrial market forecasting model with structural variables requires a thorough listing of all characteristics that might influence a buyer's demand behavior. Careful analysis of these factors is necessary prior to including them in the model since:

> The analysis of a market defined in this way can be no more valid than the set of characteristics (market factors) on which it is based. If the market factors are really not the primary causes of demand or if some primary factors are omitted, the resulting market potential will be imprecise. On the other hand, a complete list of market factors would be impossible. Hence, it is necessary to make judgments regarding those which are to be included and those which are to be excluded.[1]

In some cases, these "judgments" are difficult to make. This is true when the buyer and seller perceive different factors as having the greatest influence on demand. It is also true when the seller has a large number of different types and sizes of customers whose basic needs vary both within and across the traditional business segments. Even though certain of these segments possess seemingly homogeneous characteristics, they may actually differ greatly in their use of the product.

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[1]Mark E. Stern, Marketing Planning: A Systems Approach (New York: McGraw-Hill Book Company, 1966), p. 22.

Techniques Used to Model Demand in the Industrial Market

Forecasts of both expected and potential demand usually are developed through one of the following three procedures:

1. The selling firm relates various economic indicators to the sale of a product and, ignoring individual firm demand, develops macro estimates of total potential demand.

2. The selling firm segments the total market by geography or class of firm and based on these classifications:

    a. "identifies specific end-use situations for the product,

    b. identifies the major market segments in which these end-use situations will exist, and

    c. estimates the potential market for the product within each segment. (The total market potential is simply the sum of these.)"[1]

3. The selling firm analyzes customers on an individual basis and determines the factors associated with each company that affect its

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[1]National Industrial Conference Board, op. cit., p. 70.

product usage. These findings are then extrapolated to either homogeneous segments or total markets to obtain values of total market potential.

Which of these three methods is used depends upon the accessibility of information and the purpose of the forecast. If the goal is to develop strategies on a national or regional basis, then one of the first two methods or some modification of them is most appropriate. However, if the purpose is to define and develop policies on an individual customer basis, as in this research, then some version of the third method is most beneficial. Several techniques that are used to analyze and forecast the demand behavior of individual firms are reviewed in the following paragraphs.

Sales Force Estimates

Probably the most common method of estimating demand for a particular firm is through salesmen's projections. If a salesman is familiar with a particular firm, he usually can provide reliable demand information about the firm. This information should include data on both potential demand and that portion of the total which his company can expect to obtain (expected demand). The biases and disadvantages inherent in this method are well known, particularly where estimates are used as a basis for establishing sales quotas.[1] Despite these disadvantages, the salesman is in close contact with the market, and his knowledge of customers can at least serve as a starting point for more formalized estimating techniques. They can also provide readily accessible checks on figures derived by some other estimation method.

Regression/Correlation Analysis

Another technique used to estimate demand on the firm level is regression analysis. Here certain quantifiable factors associated with the firm are used to generate statistical estimates of demand. These factors and their relative influence are determined through sampling a number of customers similar to those for which demand estimates are to be made. By determining the quantitative interrelationships of these factors and their resulting impact on demand, regression equations are derived and used to obtain forecasts of the demand variable. In essence, however,

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[1]National Industrial Conference Board, Forecasting Sales (New York: NICB, 1964), p. 21.

the value of demand arrived at by such a technique is an average, or conditional mean value. As such, they may not be reliable estimates of potential demand.

When describing how math models might be used in the public utilities, Robert Williams suggests a technique similar to this for establishing market potentials for business customers:

> A telephone company makes a study of the communications equipment and service usage of trucking firms in the trucking-firm panel and determines the average equipment and service for each of several sizes of firms. (Perhaps the number of trucks operated is the measure of size.) The average communication development of the top 10 per cent in each size group is also determined. The company's salesmen then start 'caterpillaring,' bringing the below average firms in all districts (pointed out by the Model) at least up to the average, and others up to the top ten percenters. The salesman does not have to tell the customer that the telephone company has decided his firm's communications needs; he merely shows him the standards the trucking industry itself has set.[1]

Of course, more than one independent variable should be used in this type of analysis, provided the accuracy of the demand forecast is improved sufficiently. Several techniques are available to assist the researcher in

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[1]Robert H. Williams, "A Simple Math Model for Public Utilities," Public Utilities Fortnightly, Vol. LXIX, No. 11 (May 24, 1962).

determining which influencing factors contribute most to "explaining" demand fluctuations.[1] Thus, factors that contribute little or no information to the forecast can be eliminated from the model.

Discriminant Analysis

Regression analysis is a technique used by firms to estimate the amount of a given product a buyer will purchase, given certain characteristics associated with the buying firm. However, if the dependent-variable is not continuous but multichotomous, as is the case when trying to predict whether a customer will purchase machine A, B or C or when attempting to distinguish one group of customers from another, multiple regression analysis cannot be used.[2] In this type of situation, N-way multiple discriminant analysis is used frequently.

Two ways that discriminant analysis can serve the marketer are:

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[1]For an excellent discussion of the methods used to select the "best" regression equation, see Norman R. Draper and Harry Smith, Jr., Applied Regression Analysis (New York: John Wiley & Sons, Inc., 1966), pp. 163-195.

[2]Regression analysis can be used in the dichotomous situation where only two groups exist.

1. as a basis for building models aimed at predicting customer behavior.

2. as a determiner of the relative importance of various customer characteristics as they contribute to the prediction.[1]

A search of the literature revealed no direct application of discriminant analysis to predicting customer behavior in the industrial market. The literature, however, does indicate many uses of this technique in the consumer area. For example, a number of articles have been published in recent years using this technique to predict and discriminate between the audiences of different FM stations,[2] the purchasers of major brands of automobiles,[3] the households most likely to adopt new products,[4] and the individuals most

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[1]Ronald E. Frank, William F. Massy, and Donald G. Morrison, "Bias in Multiple Discriminant Analysis," Journal of Marketing Research, Vol. II (August, 1965), p. 250.

[2]William F. Massy, "Discriminant Analysis of Audience Characteristics," Journal of Advertising Research, Vol. V, No. 1 (March, 1965), pp. 39-48.

[3]Franklin B. Evans, "Psychological and Objective Factors in the Prediction of Brand Choice: Ford Versus Chevrolet," Journal of Business, XXXII, No. 4 (October, 1959), pp. 340-369.

[4]Ronald E. Frank, William F. Massy, and Donald G. Morrison, "The Determinants of Innovative Behavior with Respect to a Branded Frequently Purchased Food Product," Proceedings of the Winter Meeting of the American Marketing Association, New York, December, 1964, pp.312-323.

likely to use thrift deposits in savings and loan establishments or commercial banks.[1] Similar applications should be possible for discriminating among the users of different types of telephone communication products and services.

Probabilistic Models

It is helpful for the selling firm to have estimates of a buyer's potential as well as actual demand. It would be of much greater strategic value, however, if information were also available on the likelihood of each customer increasing his demand by some specified amount. If values were derived to indicate the probabilities of different buyers demanding additional products or services, customers could then be given priority according to their demand potential. In this way, selling expenses and effort could be allocated in a more optimal manner.

The probabilistic approach provides a useful conceptual framework for considering the expected purchase behavior of customers--whether they be consumers or business firms. In the consumer area, the use of probabilistic

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[1]Henry Claycamp, "Characteristics of Thrift Deposit Owners," Journal of Marketing Research, II, No. 2 (May, 1965), pp. 163-170.

models to reflect buyer behavior has been increasing rapidly in recent years. This is indicated by the number of articles published in various professional journals dealing with such subjects as brand switching,[1] Bayesian analysis,[2] decision-tree analysis,[3] and learning process.[4] Probabilistic models should be of equal value in the industrial market, yet the number of articles concerning applications in this area remain quite scant.

Many of the demand models discussed in the literature involve the use of conditional probability. Where the amount of a particular product an individual or firm purchases is dependent upon or affected by some other factors, demand is viewed as "conditional" on the occurrence

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[1]Alfred A. Huehn, "Consumer Brand Choice - A Learning Process?" in Quantitative Techniques in Marketing Analysis, Ronald E. Frank *et al*., eds. (Homewood, Illinois: Richard D. Irwin, Inc., 1962), pp. 390-403.

[2]For a discussion of Bayesian analysis as it applies to marketing problems see Ronald E. Frank and Paul E. Green, Quantitative Methods in Marketing (Englewood Cliffs: Prentice-Hall, Inc., 1967), pp. 6-30.

[3]John F. Magee, "Decision Trees for Decision Making," Harvard Business Review, XLII (July-August, 1964), pp. 126-38.

[4]Emir H. Shuford, "Some Bayesian Learning Processes," Human Judgments and Optimality, Maynard W. Shelly and Glenn L. Bryan, eds. (New York: John Wiley & Sons, Inc., 1964), pp. 127-152.

of these other events. In these cases, conditional probability models can be developed. The notation p(E/F) is used to indicate the probability of the event E given the event F exists or has occurred.

This concept can be used to develop probabilistic models of industrial demand for telephone communications offerings. Using the notation given above, E would represent the probability of a firm demanding X units of a certain product while F represents the value of some characteristic associated with the firm, such as a specific number of employees. This analysis can be extended to include more than one conditional variable, in which case multistage probability models can be developed.[1]

If a utility has information about particular business customers and their respective buying characteristics, the necessary parameters can be derived and probabilistic estimates of demand generated. The data can be used to guide management in its decision making procedures by providing information concerning the likelihood of certain

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[1]For a more detailed discussion of conditional probability models see G. Hadley, Introduction to Probability and Statistical Decision Theory (Cambridge: Holden-Day, Inc., 1967, pp. 282-296.

industrial customers increasing their purchases of specific products and services. Also, these static models of individual firm buyer behavior can be used as building blocks in constructing dynamic aggregative models of industrial purchasing behavior.

Summary

This chapter has described some of the concepts and methodologies that are useful for modeling individual firm demand in the industrial market. The material concentrated primarily on three areas - (1) the classification methods available to strategically segment industrial buyers, (2) the types of behavioral and non-behavioral variables that must be considered in modeling firm demand, and (3) the basic techniques that have been used to structure the interrelationships between buyer characteristics and purchasing behavior. Most of the literature referred to in this chapter dealt with industrial firms operating in a competitive environment. However, the general approaches and fundamental concepts developed provide a framework for structuring an empirical demand model of the business sector of a public utility.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Questionnaires were constructed for each of the five business segments listed in Chapter I. The purpose of the questionnaire was to obtain insight and data on as large a number of the factors hypothesized to influence demand as possible, so that accurate models relating individual firm characteristics to demand could be developed. The structuring of several questionnaires was necessary because each of the five segments is somewhat unique in operating characteristics and basic communication needs.

A mail survey was used to obtain data on the independent variables associated with each firm. Because each respondent completed only one questionnaire and the data were collected during a relatively short time period, the research was cross-sectional in nature. The inherent limitations associated with cross-sectional analysis and mail surveys are well known.[1] However, possible alternative

[1] For a discussion of the limitations of cross-sectional analysis and mail surveys, see Mildred Parten, Surveys, Polls, and Samples (New York: Harper & Brothers, 1950), pp. 391-402.

procedures did not prove feasible. For example, consideration was given to using a longitudinal study to examine the variation of certain independent variables through time and their effects on firm demand. Time and money constraints prevented such an effort. Similar constraints prevented the use of in-depth personal interviews as a method of obtaining the data, although this procedure may have provided more insight on demand variations than did the mail survey.

Data regarding the dependent variables indicating the different types of demand exhibited by each firm were obtained from Michigan Bell Telephone records. Since this information was considered confidential by Michigan Bell, written permission from a major officer in each firm was required before the desired data were released. This requirement undoubtedly created some hesitancy on the part of certain individual respondents and lowered the final response rate.

Questionnaire Construction

Two types of information were required from each respondent. First, data were sought on those factors characterizing firms in the five business segments that were hypothesized to affect telephone usage behavior. Second, information regarding the respondent's attitudes toward telephone communication was needed. The questionnaire was divided into two parts, analagous to these two categories.

The objective of the first part of each questionnaire was to obtain detailed information on certain specific aspects of the responding firm and its activities. This portion of the questionnaire was structured differently for each of the five business segments, since each class of business had unique characteristics. Interviews with Michigan Bell personnel and a review of industrial survey material were used to generate a list of variables relevant to each segment. A general lack of knowledge of the specific factors that affect customer demand behavior for telephone offerings in the industrial market, however, necessitated an exploratory type of study using a variety of possible influencing variables. Statistical techniques were then used to extract those variables which were most important in explaining variations in the independent factors from the larger set.[1]

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[1]For a more detailed discussion of the statistical procedures used, see pp. 142-152.

Certain independent variables, such as gross revenue and number of employees, were common to all segments. Other characteristics, such as the number of sales clerks or number of production employees, were appropriate to only one or two of the business categories. Table 3.1 lists the variables included in the first part of the questionnaire for each business segment and indicates those variables common to more than one segment. As Table 3.1 indicates, the types of telephone communications equipment and services demanded and used were hypothesized to be dependent not only on the characteristics of the buying firm but on the location and composition of its customers and suppliers as well. The measurements of most of the variables listed in Table 3.1 conform to a ratio scale. These factors will be referred to hereafter in the study as structural or classificatory variables.

In the original survey instrument, data were sought concerning the present status of each classificatory variable as well as the expected status or value of these factors five years hence. Pretesting the questionnaire, however, showed that respondents were either unwilling or unable to estimate future factor values. This forced the

TABLE 3.1

CLASSIFICATORY FACTORS HYPOTHESIZED TO AFFECT DEMAND-BY BUSINESS SEGMENT

Variable Description	Business Segment*
1. Number of years in operation in present facility	M,W,R,r,D
2. Number of buildings used in local business operation	M,W,R,D
3. Number of square feet of floor space	M,W,R,D
4. Number of separate offices	M,W,R,r,D
5. Gross Sales	M,W,R,r,D
6. Total number of employees	M,W,R,r,D
7. Number of salaried employees	M,W,R,D
8. Number of administrative employees	M,W,R,D
9. Number of engineering employees	M,W
10. Number of production employees	M,W
11. Number of clerical employees	M,W,R,r,D
12. Number of sales personnel	M,W,R,D
13. Number of other personnel	M,W,R,D
14. Number of buyers	R
15. Number of brokers	r
16. Average number of orders taken/month	M,W
17. Percent orders taken by phone	M,W
18. Percent orders taken by mail	M,W
19. Number of salesmen in field	M,W
20. Average number hours/months used for data transmission	M,W
21. Number of additional plants or facilities	M,W,R,r,D
22. Location of additional plants or facilities	M,W,R,r,D
23. Location of main offices	M,W,R,r,D
24. SIC classification	M,W,R,r,D

TABLE 3.1 (Continued)

Variable Description	Business Segment*
Percent of revenue derived from:	
25. Manufacturing activities	M,W,R
26. Wholesaling activities	M,W,R
27. Retailing activities	M,W,R
28. Other activities	M,W,R
29. Number of suppliers	M,W,R
30. Location of suppliers	M,W,R
31. Percent of supplies purchased by location	M,W,R
32. Number of customers	M,W
33. Location of customers	M,W
34. Percent of revenue by location	M,W,R,r
35. Percent revenue by type of customer	r,D
36. Type of services offered	r,D

*M = Manufacturer, W = Wholesaler, R = Retailer, r = Realtor, D = Dry Cleaner. Thus, the notion M,W,R in this column following a variable would mean that data concerning this variable was sought only from firms in the manufacturer, wholesaler, and retailer segments.

deletion of this aspect of the survey.

The objective of the second part of each questionnaire was to ascertain the importance of various types of telephone services to the buyer, as perceived by the owner or some other high ranking official of the purchasing firm. This portion of the questionnaire was identical for each of the five business segments, and permitted a comparison of responses both within and across each of the five categories.

The questions in Part II of the questionnaire were divided into three groups. The purpose of the first seven questions was to discern how important the management of each firm perceived local, intra-state, and interstate telephone communications to be for their firm's operations. Information was sought concerning the perceived importance of each of these offerings for several business activities. Since a measure of relative importance was desired, the respondents were asked to rank the contribution of telephone services to several activities using the following criteria:

(a) the estimated telephone time spent on each activity during an average month.

(b) the expected importance of telephone communications on various activities in the future.

(c) the percentage increase (decrease) in toll usage for each activity that would be expected if a decrease (increase) in rates occurred.

Information on these three criteria should provide an accurate reading of the telephone usage habits of individual firms. This information should also lead to a better understanding of the communication activities in each segment for which various types of telephone offerings are perceived to be most vital.

The objective of question number eight in Part II was similar to that of 1-7. However, here the respondent was asked to compare his firm's usage of telephone communications in certain areas with what he felt or knew to be true of other firms of a similar type and size. By comparing these responses to actual usage values, generalizations could be made concerning the buyer's awareness of competitor's communication behavior. It has been inferred that a major selling point regarding telephone services might be a reference to competition's heavier usage patterns.[1] This information, combined with an

[1]Robert H. Williams, *op. cit.*, pp. 730-732.

understanding of how important telephone communications are to each user, should help the seller develop effective personal selling strategies.

The remainder of the questions in Part II were constructed to determine the customer's awareness of the telephone communication alternatives available to his firm. Although this information was not sought on the pre-test questionnaire, specific comments by pre-test respondents indicated a basic unfamiliarity with certain types of telephone equipment and services. This lead to the inclusion of a general question dealing with customer awareness in the final draft. Table 3.2 summarizes the major independent variables included in Part II of each questionnaire. These measures, primarily ordinal in nature, relate basically to attitudes and/or opinions of management and shall be referred to as attitudinal or behavioral factors in this study.

Several questions were dropped from the survey instrument following the pre-test. The most important factors that forced the deletion of these questions were:

(a) a general feeling that the questionnaire was too detailed and time consuming.

TABLE 3.2

ATTITUDINAL FACTORS HYPOTHESIZED TO AFFECT DEMAND

1 - 6	Relative amount of time (perceived by user) spent communicating by phone in the local calling area: 1 with customers 2 with suppliers 3 with other departments 4 with salesmen 5 with branch facilities 6 for data transmission
7 - 11	Relative amount of time (perceived by user) spent communicating via long-distance phone: 7 with customers 8 with suppliers 9 with salesmen 10 with branch facilities 11 for data transmission
12 - 17	Relative importance of telephone usage as perceived by the user in present and future communication: 12 with customers 13 with suppliers 14 with salesmen 15 with other departments 16 with branch facilities 17 for data transmission
18 - 22	Expected percentage decrease in in-state telephone communications: 18 with customers 19 with suppliers 20 with salesmen

TABLE 3.2 (Continued)

	21 with branch facilities 22 for data transmission that would result from a 20% increase in toll rates.
23 - 27	Expected percentage decrease in out-state telephone communication: 23 with customers 24 with suppliers 25 with salesmen 26 with branch facilities 27 for data transmission that would result from a 20% increase in toll rates.
28 - 35	Relative amount of: 28 local telephone service 29 toll telephone service 30 telephone equipment 31 yellow page advertising 32 data transmission 33 telephone usage to contact suppliers 34 telephone usage to contact customers 35 telephone utilization by salesmen perceived as used by respondent's firm as compared to other firms of similar type and size.
36	Perceived understanding of telephone offerings available.
37	Methodology used when evaluating or adopting a new service or piece of telephone equipment.

(b) both an inability and an unwillingness on the part of the respondents to provide detailed sales information--either by product line or geographical area.

(c) an inability on the part of the respondent to answer questions regarding specific types of telephone equipment or services. For example, it was originally planned that several questions related to specific services such as WATS (Wide Area Telephone Service) would be included in the questionnaire. The pre-test indicated that non-users were generally unaware of the nature of the WATS service and that respondents in the firms presently utilizing WATS were not aware of the exact nature of its use.

The questionnaires remained lengthy even after a number of deletions; however, completeness of the returned questionnaires and the total response-rate justified the intensiveness of the survey instrument. Also, the amount of effort required to obtain a comprehensive listing of firms in each of the five segments and to obtain a sufficient response rate from a mailed questionnaire did not, in the researcher's opinion, justify a superficial treatment.

Dependent Variables

Table 3.3 lists the dependent variables used to reflect individual firm demand for various kinds of equipment, services, and usage. Figure 3.1 summarizes the basic taxonomy of all variables examined.

Limitations were placed on both the amount and types of information that could be gathered relevant to these dependent factors. First, to ensure privacy, toll usage data had to be gathered and analyzed on a summary basis (total monthly in-state and out-state billings) rather than on an individual call basis. Thus, no information could be collected on geographic usage patterns other than that reflected by summarized in- and out-state data or inferred from information derived from the questionnaire. Second, no information could be secured on the amount or types of local telephone usage except that which could be inferred from questionnaire data. This was due to the fact that Michigan Bell does not regularly tabulate local communication data. Third, ready access was only available on two months toll billings. This meant that seasonal

TABLE 3.3

DEPENDENT VARIABLES REFLECTING FIRM DEMAND
FOR TELEPHONE OFFERINGS

1. Average monthly toll billings.
2. Monthly Intra-state toll billings.
3. Monthly Inter-state toll billings.
4. Monthly billing for equipment usage.
5. Monthly billing for yellow page advertising.
6. Number of lines or trunks.
7. Utilization of a PBX (switchboard).
8. PBX station capacity.
9. PBX line capacity.
10. Number of call directors.
11. Number of Key-sets.
12. Number of extensions.
13. Number of stations.
14. Total number of telephone locations.

variations in long-distance usage could not be incorporated in the demand model. The demand for equipment and most services, however, is not a function of the season or time of year. Therefore, this limitation was not critical to the development of demand models for these offerings.

Sample Selection

The original survey design called for a sampling of all types of business firms throughout the state of Michigan. Preliminary study indicated several problems inherent in this approach.

A. Geographic Limitations

1. A portion of the State of Michigan is not serviced by Michigan Bell Telephone Co., but by a number of other telephone utilities. Since it was necessary to gather telephone usage data from the particular utility servicing the selected firms, the geographical area was first limited to that serviced solely by Michigan Bell.

2. Early discussions with Michigan Bell personnel indicated that both product demand and product offerings vary according to geographic

FIGURE 3.1

BASIC INPUTS TO DEMAND MODEL

Independent Variables

Classificatory Variables

1. Gross Sales
2. Distribution of sales by geographic area
3. Number of employees by type
4. Number and types of customers
5. Location of customers
6. Number of suppliers
7. Location of suppliers

etc.

Behavioral Variables

1. Perceived present and future importance of telephone communication
2. Perceived understanding of alternatives available
3. Perceived usage of various offerings as compared to similar types and size firms

etc.

Dependent Variables

1. Amount and types of telephone equipment utilized
2. Toll usage of telephone equipment
3. Types and amount of telephone services utilized

location. Since this variance added complexity to the research design while not being of particular relevance to the major hypotheses under study, the decision was made to confine the research to a small geographic area.

3. Further discussions with Michigan Bell personnel showed that any data required on firm usage and demand was only available from local business office files. To facilitate the collection of this data, the Greater Lansing Area was chosen as the region from which the sample would be drawn. Collecting the data was also extremely time consuming and caused a partial disruption of business office activities. The choice of the Greater Lansing geographic area minimized both the amount of time needed to gather the information and the amount of disturbance of usual business office activities.

B. Business Activity Limitations

1. It was hypothesized that the factors affecting demand for telephone communication products

and services would vary across different classes of business. This forced the use of different questionnaires for each separate class of business. Inclusion of all types of business customers in the study would have necessitated the structuring and printing of a large number of different questionnaires. This was impossible because of the time and financial constraints associated with the research design.

2. Usage data on certain classes of businesses could not be released by Michigan Bell even with management or owner consent. This was particularly true for such institutions as hotels, motels, hospitals and certain other service organizations. For these businesses, telephone usage by individuals not employed by the firm itself made all usage information confidential.

3. Because firms such as service stations, shoe repair shops, barber shops, and many eating establishments are very small, they exhibit

demand characteristics similar to residential customers. Firms in these business classes may differ from residential users in local phone usage, but they exhibit little variation in their demand for equipment and toll usage. This makes the problem of forecasting toll and equipment demand for these types of establishments trivial.

4. Some establishments of the size and scope of the Oldsmobile Division of General Motors and Michigan State University were located in the survey area. These firms are so complex in their communication needs and behavior, however, that they are not typical of the general class of firms investigated in this study. The values that would be obtained from firms of this nature for most of the classificatory variables listed in Table 3.1 would be far beyond the range of values obtained for the other firms in the study. Thus, any analysis of firms of this size would have to be done on an individual

basis and would be an exception to the general models being developed.

One of the objectives of the study was to determine the effects of certain independent variables on demand across different types of businesses as well as within certain industry segments. Because of this objective and due to the limitations discussed above, five different classes of commercial customers from the Greater Lansing area were selected for analysis. The three main criteria used for selecting these five segments were:

1. There should be at least one category which is homogeneous with respect to the classificatory variables used to define member firms. There should also be one category whose member firms are heterogeneous with respect to these classificatory factors.
2. There should be a wide variance in the demand for telephone communications products and services between the large and small business establishments in each category.
3. There should be a sufficient number of firms in each category to assure an adequate sample response for analysis.

Using the preceding criteria and following a study of the frequency and size of various types of firms in the Greater Lansing area, five business segments were selected for analysis. Table 3.4 lists these segments and indicates the types of firms (by SIC) included in each segment as well as the approximate number of establishments of each type located in the Greater Lansing area. Categories (1) and (2) are service institutions and firms in these groups are quite homogeneous with respect to most of the classificatory variables used in the analysis. Categories (3), (4) and (5) are broad groupings and as such are comprised of firms reflecting extreme heterogeneity in their classificatory characteristics.

To determine the variance in demand and usage behavior for each of the selected categories, a pilot study was run where two or three small and two or three large firms were chosen from each classification. Where possible, the net worth rating given in the Dunn and Bradstreet Reference Book was used as a proxy measure of firm size. When this was not possible, as in the case of the dry cleaning and realtor firms, individual judgment based on experience and knowledge of the area was used to select

TABLE 3.4

BUSINESS SEGMENTS SELECTED FOR ANALYSIS--BY SIC AND NUMBER OF FIRMS[1]

Basic Classification	SIC Classes Included	Approximate Number of Firms in Each Basic Classification
1. Real Estate Establishments	65,66	175[2]
2. Dry Cleaning Establishments	721	70[3]
3. Retailers	52,53,55 (except 554) 56,57,59 (except 591)	480[4]
4. Wholesalers	501-509	444[5]
5. Manufacturers	19-39	235[6]

[1]The above categories are not mutually exclusive. For example, a firm engaged in both retailing and wholesaling would be included in both categories.

[2]Michigan Bell Telephone Directory for Lansing Area.

[3]Ibid.

[4]Manufacturer segments: U.S. Bureau of the Census, Census of Business, 1963, Vol. II, Retail Trade-Area Statistics, Part 2, U.S. Government Printing Office, Washington, D.C., 1966. Figure represents Lansing Metropolitan Area only.

[5]U.S. Bureau of the Census, Census of Business, 1963, Vol. 5, Wholesale Trade-Area Statistics, U.S. Government Printing Office, Washington, D.C., 1966. Figure represents Lansing Metropolitan Area only.

[6]U.S. Bureau of the Census, Census of Manufacturers, 1963, Vol. III, Area Statistics, U.S. Government Printing Office, Washington, D.C., 1966. Figure represents Ingham County.

the pilot firms. Usage and demand data was then obtained for each of the selected firms from Michigan Bell records. Table 3.5 illustrates selected demand and usage characteristics for these firms and shows that a substantial variance does exist in demand characteristics among firms in each of the five categories.

Next, a comprehensive listing was developed of all firms in the Greater Lansing Area classified in one or more of the five segments. Compiling a comprehensive list of these firms created a difficult problem, since no one source provided a complete record of businesses classified in this manner. The State of Michigan maintains a file on all businesses located within the State for tax purposes, but this list is arranged alphabetically and not by class or location of business. Michigan Bell also maintains a listing of all of its commercial customers, and codes each firm according to a specific classification system. But no feasible way could be found to isolate only those firms in particular classes that were located in the Greater Lansing area. Various trade publications and the Chamber of Commerce provided listings which were incomplete and thus of limited value except for cross-reference purposes.

TABLE 3.5

PILOT STUDY RESULTS SHOWING VARIANCE IN FIRM USAGE CHARACTERISTICS FOR FIVE BUSINESS SEGMENTS

		Usage Data						
Business Segment	SIC Code (3 digit)	Local Service Billing ($)*	Directory Adver-tising ($)	Long Distance Intra-State ($)	Billing Inter-State ($)	Lines or Trunks	Tele-phone loca-tions	PBX yes-no
Cleaners								
A	721	53.00	116.75	2.15	0.00	4	5	No
B	721	54.85	7.70	9.30	12.00	2	6	No
C	721	15.20	151.90	0.00	2.85	1	3	No
D	721	11.00	21.50	0.00	0.00	1	1	No
E	721	12.35	14.50	.60	0.00	1	2	No
Realtors								
A	65	93.90	146.00	22.80	5.75	4	10	No
B	65	82.45	146.00	14.75	1.75	2	7	No
C	65	140.30	89.00	28.65	36.35	5	12	No
D	65	26.55	5.90	0.00	0.00	2	4	No
E	65	24.70	0.00	1.55	1.30	2	4	No
Wholesalers								
A	508	131.25	10.20	136.95	214.30	4	10	Yes
B	506	151.75	7.75	191.05	69.80	5	14	No
C	509	348.55	37.00	1105.75	373.70	6	21	No
D	501	63.05	0.00	15.55	23.50	3	4	No
E	508	15.65	10.00	5.15	10.10	1	4	No

TABLE 3.5 (Continued)

		Usage Data						
Business Segment	SIC Code (3 digit)	Local Service Billing ($)*	Directory Adver-tising ($)	Long Distance Intra-State ($)	Billing Inter-State ($)	Lines of Trunks	Tele-phone loca-tions	PBX yes-no
Manufacturers								
A	353	811.85	9.50	449.85	1387.39	10	65	Yes
B	354	917.75	43.00	890.45	891.70	10	63	Yes
C	339	827.00	10.00	510.80	585.10	7	58	Yes
D	239	25.80	77.90	4.00	0.00	2	2	No
E	229	54.75	36.55	27.30	83.70	2	5	No
Retailers								
A	531	957.25	64.40	16.85	61.80	13	107	Yes
B	571	142.15	81.20	45.70	9.80	4	12	Yes
C	531	2839.25	309.60	626.75	569.30	45	273	Yes
D	553	19.25	48.00	7.60	4.45	1	3	No
E	525	26.65	7.25	5.25	5.00	2	3	No

*All data given as of February, 1968, or for the month of February, 1968.

The Dunn and Bradstreet Reference Book[1] lists firms by city and classifies each establishment by the SIC method. This reference was used as the major source for developing a list of manufacturers, wholesalers, and retailers. The manufacturer listing was supplemented by The Directory of Michigan Manufacturers,[2] and the Lansing Chamber of Commerce data was used to supplement the retailer list. However, no source could be located that listed wholesalers by geographical area other than the Dunn and Bradstreet reference.

The Dunn and Bradstreet Reference Book does not, however, contain a listing of realtors and dry cleaners. The yellow pages of the telephone directory, which includes thorough listings of firms in these two categories, was used exclusively as a source to define the population of realtors and dry cleaners in the Greater Lansing area.

Since firm size was hypothesized to be the major factor affecting firm demand for telephone communications equipment and service, it was necessary to stratify the

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[1] Dunn and Bradstreet Reference Book, 1968, New York: Dunn and Bradstreet, Inc.

[2] The Directory of Michigan Manufacturers, 1968, Detroit: Michigan Manufacturers and Financial Record, Manufacturer Publishing Company.

firms in each segment according to a "size" variable. There are two basic problems when stratifying firms by size: first, to specify a relevant size variable (or variables) for each category, and second, to obtain data on these variables for each firm in the population. No source of information or data on the usual size variables such as gross sales, or number of employees, could be located. The net worth code given in Dunn and Bradstreet, therefore, was used as a gross estimate of the relative measure of firm size for the manufacturer, wholesaler, and retailer segments.

The sample for the manufacturer, retailer, and wholesaler segments was then chosen according to the following criteria:

1. Since there were relatively few firms large enough to be classified as either "A," "B," or "C," all firms receiving these Dunn and Bradstreet ratings were included in the sample.
2. A random sample was taken of those firms either receiving a rating below "C" or no rating.

Table 3.6 indicates the number of firms in each rating classification that were included in the manufacturer,

TABLE 3.6

NUMBER OF ESTABLISHMENTS INCLUDED IN MANUFACTURER, WHOLESALER, AND RETAILER SAMPLES BY FIRM SIZE*

Business Segment	D & B Net Worth Rating A	B	C	D	E	Below E or No Rating Given	Total Sample Size
Manufacturer	20	12	18	9	13	34	106
Wholesaler	15	18	26	16	13	20	108
Retailer	5	15	25	8	4	8	65

*The proxy variable used to indicate firm size is the Dunn and Bradstreet net worth code. The net worth assigned to each letter is as follows: A: $500,000; B: $200,000-$500,000; C: $75,000-$200,000; D: $35,000-$75,000; E: $20,000-$35,000.

wholesaler and retailer samples.

Stratification of realtors and dry cleaners by size was even more difficult. The only adequate listing of these establishments is in the Yellow Pages. A number of firms do, however, purchase blocks of advertising space in the Yellow Pages in addition to simply having their names listed. These firms are usually assumed to be among the larger realtors and dry cleaner establishments. Therefore,

the total population of businesses in these two segments that purchased separate advertising space were included in the sample. A random sample was then taken of those remaining firms whose names were listed under the general realtor and dry cleaner headings in the yellow pages. Table 3.7 indicates the number of establishments of each type that were included in the realtor and dry cleaner samples.

Upon completion of the sample for each of the five business segments, addresses of the selected firms and, when available, the names of owners or top officers in each firm were obtained from the Polk City Directory for Lansing. In those few cases where the Polk Directory did not list this information, the Lansing Telephone Directory was used to secure firm addresses.

Questionnaire Administration

Five different questionnaires were prepared, one for each of the selected business segments. (See previous section dealing with "Questionnaire Construction"). Each questionnaire was coded and accompanied by a permission request form and cover letter stating the purpose of the research and assuring the respondents of the confidential

TABLE 3.7

NUMBER OF ESTABLISHMENTS INCLUDED IN THE REALTOR AND DRY CLEANER SAMPLES BY FIRM SIZE*

Business Segment	Amount of Space Used in Yellow Page Advertising (proportion of paper used) 1/2	1/4	1/8-1/16	1/16
Realtors	4	8	16	12
Dry Cleaners	1	4	9	11

*The proxy variable used to indicate firm size for these segments was the amount of advertising space purchased in the yellow pages of the telephone directory.

nature of their replies.

A total of 336 questionnaires were mailed within a one-week period. After approximately three weeks, duplicate questionnaires, permission request forms, and cover letters were mailed under a second cover letter to those individuals not responding to the original mailing. Following a second three week period, personal phone calls were made to those subjects who had still not responded. A third set of materials were then mailed to those subjects who stated a willingness to complete the questionnaire in the telephone conversation. Table 3.8 lists the number of questionnaires sent to each segment during each of the three periods and the response rate following each mailing.

Statistical Techniques

The problem of segmenting markets and forecasting demand are, in many cases, complementary. This is true since many times a segmentation strategy is based upon the relative amounts of a product or service demanded by certain types or classes of customers.[1] Even when market segmentation is based upon some factor or factors other than usage rates, the strategy may still be used as an aid to forecasting demand. Thus, whenever a firm attempts to forecast the demand for a particular product, market segmentation plays a fundamental role in the development of demand estimates. In fact, except for those industries in which economic indicators or past sales are used to

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[1]For examples of this type of segmentation, see "Some Practical Applications of 'Heavy Half' Theory," *Proceedings, of the 10th Annual Conference of the Advertising Research Foundation* (October, 1964) and Dik Warren Twedt, "How Important to Marketing Strategy is the 'Heavy User'?" *Journal of Marketing* (January, 1961), pp. 71-72.

forecast demand, market segmentation is a basic prerequisite for accurate demand estimation.

Based on this rationale, the first step in developing a predictive model for telephone products and services was to identify various segments of the commercial market exhibiting different usage or purchase rates. Because a large number of independent factors were examined, search procedures were required to identify the most important characteristics and to establish whether or not significant relationships existed among specific variables.

Cross-classification analysis was one of the methods used to describe the degree of association between specific sets of variables. A principal advantage of this technique is that it allows the researcher to "make relatively few assumptions, prior to the analysis, as to the nature of the relationships being studied."[1] For example, the assumption that a linear relationship exists between variables is not necessary when using cross-classification analysis. It is required when utilizing many of the other multivariate techniques.

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[1]Ronald E. Frank and Paul E. Green, _op_. _cit_., p. 55.

TABLE 3.8

QUESTIONNAIRE MAILING AND RESPONSE INFORMATION

Business Segment	First Mailing			Second Mailing			Final Mailing (following telephone contact)			Totals	
		Returned			Returned			Returned		Returned	
	Mailed*	Total**	Net***	Mailed	Total	Net	Mailed	Total	Net	Total	Net
Manufacturers	101	30	21	71	17	13	24	21	17	68	51
Wholesalers	105	36	24	69	21	17	28	24	21	81	62
Retailers	65	28	17	37	16	12	17	14	13	58	42
Realtors	40	15	11	25	9	7	10	9	5	33	23
Dry Cleaners	25	9	5	16	6	4	5	3	2	18	11
Totals	336	118	78	218	69	53	84	71	57	258	189

Total Response Rate: $\frac{258}{336} = 77\%$ Usable Response Rate: $\frac{189}{336} = 56.2\%$

*Adjusted for Post Office returns
**Includes all questionnaires returned
***Includes only usable questionnaires

Another technique used to summarize or reduce the large number of independent factors to a lesser number was factor analysis. In addition to reducing the redundancy in the original set of measurements, factor analysis may be used to:[1]

1. provide a useful way to segment a population into distinct categories based on specific characteristics.
2. assist the researcher in extracting certain variables from a large original set that may then be used as independent factors in further analysis.
3. create a smaller subset of variables that can replace the original set of factors with little or no loss of information.

Analysis of variance techniques were also used to isolate particular factors that appeared to influence the behavior of the dependent variables. Since conventional analysis of variance is unsuitable in those cases where the dependent variable of interest is either an attribute or one which "does not or cannot be made to conform to the

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[1] _Ibid._, p. 76.

shape of the normal distribution within each classification cell established by the factor variables,"[1] the use of these techniques was somewhat limited.

Following the application of various search techniques to determine whether or not relationships actually existed among variables, multiple regression and multiple discriminant analysis were used to specify and describe the nature of these relationships. These techniques provided the basic models for the predictive equations. Multiple regression was the primary technique used but the categorical nature of certain dependent variables required the use of multiple discriminant analysis.

A fundamental problem should be stated at this point. Studies in the consumer area have shown that the use of socio-economic factors in multiple regression or multiple discriminant analysis models has resulted in a low proportion of explained variance when attempting to predict individual family purchase patterns or usage rates. However, as Bass _et al_. state, "The inability of

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[1]William S. Peters and George W. Summers, _Statistical Analysis for Business Decisions_ (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968), p. 298.

socioeconomic variables to explain a substantial part of the variance of usage rates of persons does not necessarily imply that there are not substantial differences in the mean usage rates for different socio-economic market segments."[1] This may also be true when looking at individual firm demand for telephone products and services. Therefore, cross-classification analysis was used to establish conditional probability models of each segment's demand for different quantities of telephone offerings. The development of these models was based on the measurement of certain key independent factors. Thus, in addition to focusing on individual firm demand, the differences in mean usage rates for different classes of business firms were also examined.

Summary

Since knowledge of the basic variables that affect industrial demand behavior for telephone offerings is limited, an exploratory type of investigation--where a large number of independent factors were hypothesized to

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[1]Frank M. Bass, Douglas J. Tigert and Ronald T. Lonsdale, "Market Segmentation: Group Versus Individual Behavior," Journal of Marketing Research (August, 1968), pp. 269-270.

influence demand--was necessary. To obtain information on these factors, a mail questionnaire was developed. The questionnaire was administered to selected firms in five categories: manufacturers, wholesalers, retailers, realtors and dry cleaners. Telephone communication data on individual firm purchase and usage behavior were collected from Michigan Bell records.

Because of the large number of independent or predictive factors, statistical search procedures such as cross-classification analysis, factor analysis and analysis of variance were used to determine if significant relationships actually existed between and among variables. Multiple regression, multiple discriminant and conditional probability models were then constructed to specify more precisely the relationship among variables and establish demand equations.

CHAPTER IV

DETERMINATION OF THE FUNDAMENTAL VARIABLES AFFECTING DEMAND

The purpose of this chapter is to examine the total group of independent variables and isolate those factors which contribute most to the explanation of firm demand variances. These variables will then form the basis for developing the predictive demand equations presented in Chapter V.

General Characteristics of Firms

To better understand the nature of the firms studied and the scope and significance of the demand equations developed in Chapter V, some of the more important characteristics of the firms surveyed in each of the five business segments are presented in Tables 4.1 - 4.3 and discussed in the following paragraphs.

In Chapter III, a number of proxy variables indicating firm size were used to stratify the samples for each business class. The selection of the proxy variables was based primarily on their availability in secondary source material. Tables 4.1 - 4.3 show data obtained from the questionnaires on size factors that are more traditionally used to indicate firm size. These tables indicate that the proxy variables initially used to stratify the samples did result in a satisfactory distribution of firms over the more traditional size variables.

Table 4.1 gives employment figures for firms in each business segment. It also indicates the mean number of employees used by firms in each category as well as the standard deviation of employment and the coefficient of variations for each business class. It should be noted that the realtor and dry cleaner classes are relatively more homogeneous with respect to this variable than the manufacturer, wholesaler, and retailer segments. This is indicated by a coefficient of variation of 90 for the realtor segment, 75 for the dry cleaner segment, 143 for the manufacturer segment, 202 for the wholesaler segment, and 270 for the retailer segment. Also, based on employment data, firms in the manufacturer segment had the largest mean size (77.3 employees), and this segment had by far the largest percentage of firms employing over 40

TABLE 4.1

SIZE DISTRIBUTION OF FIRMS - NUMBER OF EMPLOYEES
BY BUSINESS SEGMENT

Business	No.	Number of Employees				Summary Statistics		
Segment	Firms	0-20	21-40	41-100	100	$\bar{x}$	s	V*
Manufacturer	47	20	5	8	14	77.3	110.0	143
Wholesaler	62	39	14	5	3	29.1	58.9	202
Retailer	42	25	8	5	4	49.5	133.6	270
Realtor	22	20	2	0	0	9.0	8.2	90
Dry Cleaner	9	8	1	0	0	7.6	5.7	75
TOTAL	182	112	30	18	20	42.6	63.4	148

*Coefficient of Variation

persons (47%).

Table 4.2 shows the distribution of firms in each business segment according to gross revenue earned in 1967. As was the case for total number of employees, the coefficient of variation for the gross revenue factor indicates that the realtor and dry cleaner segments are more homogeneous than the manufacturer, wholesaler, or retailer segments. The gross sales summary statistics do vary somewhat from those of Table 4.1, however. For example, based on the gross sales size variable, firms in the wholesaler segment have a larger mean size than manufacturing respondents.

Table 4.3 presents summarized data on a number of other classificatory variables that are used to categorize firms in the five business segments. Although frequency tables are not given, these summary statistics should help the reader understand the nature of the specific businesses selected for study.[1] Of particular interest are the variables related to geographical sales patterns and the geographical location of suppliers. These variables are

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[1]A random sampling of non-respondents was conducted through brief telephone interviews to determine the characteristics of firms not participating.

TABLE 4.2

SIZE DISTRIBUTION OF FIRMS - 1967 GROSS REVENUE
BY BUSINESS SEGMENT

Business	No.	Gross Revenue ($000's)				Summary Statistics		
Segment	Firms	0-400	401-800	801-1200	1200	$\overline{x}$	s	V*
Manufacturer	47	16	4	8	19	3187	7492	235
Wholesaler	62	19	9	9	24	3717	12058	325
Retailer	42	17	10	6	9	1864	4079	219
Realtor	22	18	3	1	00	267	306	115
Dry Cleaner	9	9	0	0	0	52	16	31
TOTAL	182	79	26	24	52	2540	4732	186

*Coefficient of Variation

hypothesized to correlate strongly with a number of demand factors in the manufacturer, wholesaler, and retailer segments.

Some General Characteristics of Firm Demand

The firms studied in each segment varied greatly in their telephone communication usage and demand behavior. This was particularly true for manufacturing, retailing, and wholesaling establishments. Before the relationships between independent variables and demand are developed, some general findings will be presented concerning the average usage and demand characteristics of each business segment.

Telephone usage in this study is separated into three components--monthly intrastate, monthly interstate, and total monthly toll billings. As mentioned previously, a more detailed breakdown was not possible since this would have required a monitoring of all calls made by a firm during a specified period of time. Table 4.4 presents the average dollar amount of intrastate and interstate toll usage for business firms in each segment for the month of February, 1968. This table shows that wholesalers had the highest mean intrastate toll usage while

TABLE 4.3

SELECTED CHARACTERISTICS OF FIRMS SAMPLED - BY BUSINESS SEGMENT

	Business Segment									
	Manufacturer		Wholesaler		Retailer		Realtor		Dry Cleaner	
Characteristic	$\overline{x}$	s	$\overline{x}$	s	$\overline{x}$	s	$\overline{x}$	s	$\overline{x}$	s
No. years in facility	16.2	12.8	17.2	14.2	23.0	21.3	9.3	11.5	10.9	9.1
Sq. feet of floor space (000's)	36.1	37.0	19.5	28.1	22.9	35.2	--	--	2.3	.4
No. offices	4.6	5.0	4.5	4.2	4.3	5.5	5.0	4.4	1.0	0.5
No. salaried employees	12.8	13.9	9.6	16.3	12.0	15.1	--	--	--	--
No. suppliers	74.6	71.1	91.2	113.2	543	2143	--	--	--	--
No. salesmen in field	7.1	12.7	4.4	5.3	--	--	8.1	6.7	--	--
% sales in local calling area	42.8	38.5	52.7	36.4	88.1	18.2	--	--	--	--
% sales in Michigan outside Lansing	28.6	27.9	41.8	34.8	9.3	16.9	--	--	--	--
% suppliers in local calling area	29.8	26.9	10.4	20.9	17.4	28.9	--	--	--	--
% suppliers in Michigan outside Lansing	39.2	23.8	21.3	24.2	21.8	26.3	--	--	--	--

*NOTE: Variable is not applicable to those segments where blanks exist.

manufacturers had the highest mean interstate toll usage.

Ideally, toll data for all firms should have been collected for each month of the year to account for differences caused by seasonal influences. The difficulty in gathering the data and the amount of time necessary to complete such an effort made this task impossible. Theoretically, this means that any predictive model for toll usage developed is only valid for the month in which the data were gathered.[1] This restraint does not apply to the predictive models developed for equipment and services since the demand for these offerings is not normally seasonal.

The demand for equipment and services can be represented by four summarized variables:

a. The total monthly dollar value of equipment billings

b. The number of lines or trunks used

c. The number of telephone locations a firm maintains

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[1]However, usage data on all firms collected for a second month and a sampling of usage data for a third month showed close similarity with the first month's data. In those few cases where a radical difference did exist in the monthly toll figures, an average of the intrastate and interstate usage figures was used.

TABLE 4.4

MEAN INTRASTATE AND INTERSTATE TOLL BILLINGS
FOR FEBRUARY, 1968 - BY BUSINESS SEGMENT

Business Segment	Amount of Toll Billings ($)			
	Intrastate		Interstate	
	$\bar{x}$	s	$\bar{x}$	s
Manufacturer	$111.02	$147.05	$153.15	$267.26
Wholesaler	165.30	767.23	106.37	223.33
Retailer	61.36	98.89	47.81	116.30
Realtor	27.45	47.01	15.91	17.42
Dry Cleaner	2.11	1.54	7.89	8.72

d. The amount of Yellow Page Advertising a firm utilizes

Table 4.5 summarizes the amount of each of these offerings used by firms in each business segment. In analyzing Table 4.5, it is readily apparent that the mean amount of money expended on Yellow Page Advertising is greatest in the retailer segment. An average of $85.19/month is spent by each retailer. This result is expected since the retailer and realtor (who ranks second in expenditures for Yellow Page Advertising) deal directly with the consumer

TABLE 4.5

AVERAGE EQUIPMENT AND SERVICE UTILIZATION
FOR FEBRUARY, 1968 - BY BUSINESS SEGMENT

Business Segment	Telephone Offerings Demanded: Mo. Advertising Billing ($) $\bar{x}$	Mo. Advertising Billing ($) s	Mo. Equipment Billing ($) $\bar{x}$	Mo. Equipment Billing ($) s	Number of Lines Used $\bar{x}$	Number of Lines Used s	No. Telephone Locs. Maintained $\bar{x}$	No. Telephone Locs. Maintained s
Manufacturers	$18.63	$26.63	$161.74	$183.85	3.71	2.01	11.21	10.36
Wholesalers	30.10	35.97	181.98	383.93	3.72	3.24	14.48	35.44
Retailers	85.19	77.52	231.52	466.19	5.05	7.39	18.50	42.74
Realtors	58.32	44.35	147.14	178.16	4.00	2.62	9.91	10.98
Dry Cleaners	22.44	22.38	17.00	13.15	1.33	0.71	1.78	1.09

and would benefit most by maximum exposure in this medium.

Figures in Table 4.5 show that firms in the retailer group also have a higher average expenditure for equipment and a larger mean number of lines and telephone locations than firms in the other segments. More interesting and informative comparisons between segments might be made, however, by looking at several ratios. Table 1 in Appendix I presents five ratios relating the dependent variables "number of lines" (NT) and "number of locations" (NL) to each other and to the independent variables "number of employees" (NE) and "number of salaried employees" (NS). One would hypothesize that the greater the value a firm places on a caller being able to reach his number on the first call without receiving a busy signal, the lower the ratios NL/NT, NE/NL, NE/NT, NS/NT, and NS/NT should be. In other words, these ratios should be lowest for those segments or firms where there is a high probability that a caller will try a competitor rather than continue to call a busy number. This is demonstrated most clearly in the realtor segment, where the ratios of NL/NT, NE/NL and NE/NT are substantially below those obtained for the manufacturer, wholesaler and retailer segments. It is also interesting to note that the manufacturer segment has a significantly lower number of lines and locations/employee than either the wholesaler or retailer segment. All three segments, however, have approximately one phone for every salaried employee.

Data were also obtained on various other types of equipment and services used by individual firms. This information is summarized in Table 4.6. As indicated in this table, the demand for these product and service offerings was not great enough to allow a regression or demand equation to be developed. In other words, the number of firms sampled in any one segment that used such offerings as WATS was so small that it prevented any general hypotheses or conclusions from being drawn. However, some general findings and implications related to these additional dependent variables are discussed in the following paragraphs.

A total of nine responding firms were found to subscribe to some type of WATS service. This included one manufacturer, and eight wholesalers. No retailers responding to the questionnaire used Wide Area Telephone Service. If these findings are representative of all similar type and

TABLE 4.6

DEMAND AND USAGE OF OTHER EQUIPMENT AND SERVICES
FOR FEBRUARY, 1968 - BY BUSINESS SEGMENT

	Type of Equipment or Service		
Business Segment	Firms Using WATS	Firms Using PBX	Firms Using CALL DIRECTIONS
Manufacturer	1	12	5
Wholesaler	8	9	7
Retailer	0	6	6
Realtor	0	2	5
Dry Cleaner	0	0	0

size firms, it is difficult to hypothesize why a higher proportion of wholesalers use WATS than do manufacturers. In fact, no differentiating features were found between those firms using WATS and all other wholesalers and manufacturers.

Data were also gathered on the number of firms using PBX's (switchboards) and the specific types of switchboards used. (line and station capacity) Twelve manufacturers, nine wholesalers, six retailers, and two realtors sampled were found to have some type of switchboard equipment. In percentage terms, this means approximately 26% of the manufacturers, 15% of the wholesalers, 14% of the retailers, and 10% of the realtors sampled use PBX's. As would be expected, the firms in each segment that use switchboards are substantially larger (based on number of employees or gross sales) than non-users. For example, manufacturing firms using switchboards have an average of 160 employees while non-switchboard manufacturers have an average of 62 employees. As was the case with WATS usage, however, there were not enough firms using switchboards in any one segment to accurately develop equations for predictive purposes.[1]

One other type of equipment usage examined was the demand for Call Directors. Here, as with WATS usage, only a very small subset of those sampled used call director equipment, and no meaningful relationships could be derived.

Attitudinal Characteristics of Responding Firms

The importance that management places on various aspects of their telephone communications activities was hypothesized to influence both the amount of equipment and

[1]A discriminant analysis was run to differentiate between users and non-users of WATS and switchboard equipment, but no significant relationships could be found other than those related to the size variables mentioned above.

usage demanded. The survey included a number of questions which required respondents to rank various activities for which they used telephone communications. Rankings were based on the amount of time the customer spent on each activity and the importance which he felt the telephone played in each communication activity. Response means and statistics related to these results are presented in Appendix II.

Several findings of interest are evident in the tables presented in Appendix II. First, the majority of firms in all segments ranked the activity "communicating with customers" as being the most time consuming. However, firms dealing directly with the consumer (i.e., Retailers, Realtors, and Dry Cleaners) ranked themselves as spending a larger portion of their telephone usage time communicating with customers than did firms in the manufacturer and wholesaler segments.

Second, all segments other than realtors rated communicating with suppliers as the most time consuming toll telephone communications activity. Realtors as a group ranked communicating with salesmen or brokers as using up the most toll usage time.

A respondent's ranking of the time spent communicating with various groups may differ from a ranking which specifies the importance of telephone communications to each of these areas. In other words, even though a customer states that the majority of his telephone time is spent communicating with customers, he also might rate telephone usage as more important to some other communication activity.

The tables in Appendix II show that for the majority of cases, the relative importance which firms attached to particular telephone communications activities was strongly related to the perceived amount of time spent on those activities. There were, however, several exceptions that are illustrated in the summarized data presented in Tables 4.7 and 4.8. These tables illustrate the difference between the mean "importance" and mean "time" rankings for each segment and each activity. They show that in a number of cases there were significant differences between these two rankings. For example, although both manufacturers and wholesalers ranked "communicating with suppliers" as the most time consuming toll telephone communications activity, firms in both segments ranked "communicating with

TABLE 4.7

COMPARISON OF MEAN TIME AND IMPORTANCE RANKINGS
OF LOCAL TELEPHONE USAGE - BY BUSINESS SEGMENT

	Mean Time and Importance Rankings - By Segment														
	Manufacturer			Wholesaler			Retailer			Realtors			Dry Cleaner		
	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.
Communicating with:															
Customers	2.3**	1.8	.05	2.1	1.5	.05	1.6	1.1	.05	1.2	1.3	n.s.	1.1	1.0	n.s.
Suppliers	2.7	2.2	n.s.*	2.8	2.3	n.s.	2.7	2.4	n.s.	5.0	5.6	n.s.	2.1	2.7	n.s.
Other Depts.	3.2	3.8	n.s.	3.4	4.3	.05	2.8	3.0	n.s.	3.7	4.7	.05	*	*	--
Salesmen	4.4	3.6	.05	3.6	3.2	n.s.	3.4	4.2	n.s.	2.6	2.3	n.s.	*	*	--
Branch Facilities	3.5	3.4	n.s.	3.9	3.9	n.s.	3.8	3.8	n.s.	4.4	3.3	.05	3.3	3.2	n.s.

*n.s.: Difference between mean time and mean importance ranking was not significant based on a t-test using = .05 as the criterion.

**The lower the value, the more time consuming or more important is the communications activity.

TABLE 4.8

COMPARISON OF MEAN TIME AND IMPORTANCE RANKINGS
OF TOLL TELEPHONE USAGE - BY BUSINESS SEGMENT

	Mean Time and Importance Rankings - By Segment														
	Manufacturer			Wholesaler			Retailer			Realtors			Dry Cleaner		
Activity	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.	Mean Time	Mean Imp.	Sig.
Communicating with:															
Customers	2.3**	1.5	.05	2.6	1.6	.05	2.2	2.5	n.s.	2.0	1.3	.05	1.9	3.1	.05
Suppliers	2.0	2.5	n.s.*	2.0	2.4	n.s.	1.9	1.6	n.s.	4.5	4.9	n.s.	1.2	3.5	.01
Salesmen	3.6	3.4	n.s.	3.2	3.5	n.s.	3.6	3.8	n.s.	1.4	1.1	n.s.	*	*	--
Branch Facilities	2.6	2.8	n.s.	3.1	3.3	n.s.	3.4	3.2	n.s.	4.1	2.4	.01	*	*	--

*n.s.: Difference between mean time and mean importance ranking was not significant based on a t-test using .05 as the criterion.

**The lower the number, the more time consuming or more important is the communications activity.

customers" as the most important toll activity.

One other aspect of the attitudinal portion of the study should be mentioned at this point. This deals with the portion of the questionnaire that asked respondents to compare their demand for equipment and usage with what they perceived to be demanded by other firms of similar type and size. Table 4.9 summarizes this information by indicating the per cent of firms that perceived their demand for various offerings to be below, the same as, or above that of similar size and type establishments. A finer breakdown of this data is presented in Appendix III, where the data is tabulated by business segments.[1] Several general findings related to the information presented in Appendix III are reviewed in the following paragraphs.

First, the large majority of firms perceive their local telephone usage to be average. Very few firms in any segment perceive their usage of the telephone for local communication to be "below average." However, with respect to toll usage, approximately the same number of firms

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[1]Although data were collected on a five point scale (far below average, below average, average, above average, far above average), only three summary classifications are used in the tables.

TABLE 4.9

PERCEIVED TELEPHONE USAGE RELATIVE TO FIRMS OF A SIMILAR TYPE AND SIZE

Activity	Number of Firms	Perceived Usage: % Firms Perceiving Usage <Similar Firms	% Firms Perceiving Usage = Similar Firms	% Firms Perceiving Usage >Similar Firms
Local Usage	183	6%	64%	30%
Toll Usage	183	13	47	40
Total Equipment Used	181	13	57	30
Time Used in Supplier Communication	181	11	58	31
Time Used in Customer Communication	182	9	53	38
Yellow Page Advertising Used	182	26	53	21

perceive their usage to be both above and equal to that of comparable type and size firms. The fact that toll usage is a variable cost whereas local usage is typically a minor fixed cost may help to explain these differences. All firms can use the telephone for local usage as much as they desire without additional cost. Therefore, it is probably true that most firms of similar type and size would perceive less variance in local usage than in toll usage.

Second, the data presented in Table 4.9 suggest that the majority of firms perceive their use of Yellow Page Advertising to be equal to that of comparable firms. This consistency of response probably derives from two sources. First, the number of alternatives a firm faces here is less than would be the case in the other demand categories. Only a limited number of size options are available to a firm for Yellow Page Advertising space. Second, and more important, most firms are probably quite aware of the types and sizes of Yellow Page ads their competitors carry. In many cases, they will try to maintain a similar amount of advertising space.

The data presented in Appendix III, however, indicate some differences in these perceptions across business segments. The manufacturer and wholesaler segments both have a larger percentage of respondents that perceive their use of Yellow Page Advertising to be below average than either of the other three segments. This might be explained by our earlier reasoning that manufacturers and wholesalers are not as concerned and do not utilize the Yellow Page services as heavily as do firms that deal directly with the consumer. If this is true, then it is also likely that firms in the retailer, realtor, and dry cleaner segments will try to maintain ads of similar or larger size than competitors. As Appendix III shows, these firms do perceive their usage to be either equal to or above that of similar type and size firms.

The response patterns associated with the perceived demand and use of equipment are very similar across segments. The majority of firms perceive their use of telephone equipment to be "average" with a large percentage of the remaining firms placing themselves in the "above average" category.

The final two activities listed in Table 4.9 are the amount of time perceived to be used in communicating with both customers and suppliers relative to usage by similar type and size firms. These findings show the large majority of firms in all segments in the "average" or "above average" categories. The realtor segment, in fact, had a majority of firms (61%) view themselves as above average in their use of the phone to contact customers. No firms in this segment perceived their use to be below average.

The fact that such a large percentage of firms view their demand for various telephone offerings and their usage of these offerings for various activities as either average or above average has certain implications for the supplying utility. Assuming that the best potential customers for a product will be those that perceive their usage to be below average, the large majority of firms included in this study can be termed "poor prospective buyers." This may not be the case, however, if the firm which perceives its demand or usage to be average or above average is actually "below average" and can be convinced of this fact. This implies that a major function of the salesmen in these situations is to relate perceived demand to actual demand and adjust his sales approach accordingly.

The relevance of the relationship between perceived demand and actual demand as well as the potential importance of the other attitudinal data on the demand variables requires further research. Such research would hopefully lead to a better understanding of the perceived demand and actual demand relationships and a system whereby priorities could be assigned to customers based upon their potential demand for additional telephone offerings.

Relationships Between Criterion Variables

Prior to examining in detail the interrelationships among and importance of the explanatory variables, it should be helpful to review some of the interdependencies existing in the dependent or demand variables. A simple correlation matrix in which the seven major demand variables are included for each business segment is presented in Table 4.10. Several basic points can be summarized from the information presented in this table.

First, the amount of Yellow Page Advertising that manufacturing and wholesaling firms use is not significantly correlated with any other demand characteristic. This is not true for the retailer, realtor, and dry cleaner segments, however, where significant correlations exist between the advertising criterion and a number of the other dependent variables. As was hypothesized earlier, this is probably due to the fact that Yellow Page Advertising is a more effective tool for firms dealing directly with the consumer. These firms, therefore, tend to show a much greater variance in demand for this offering than do

TABLE 4.10

CORRELATION MATRIX OF CRITERION VARIABLES - BY BUSINESS SEGMENT

Criterion Variable	(1) M	(1) W	(1) R	(1) r	(1) C	(2) M	(2) W	(2) R	(2) r	(2) C	(3) M	(3) W	(3) R	(3) r	(3) C	(4) M	(4) W	(4) R	(4) r	(4) C	(5) M	(5) W	(5) R	(5) r	(5) C	(6) M	(6) W	(6) R	(6) r	(6) C	(7) M	(7) W	(7) R	(7) r	(7) C
Advertising $**	1.0	1.0	1.0	1.0	1.0																														
Total Toll Billings**	-.16	.06	.55	.21	-.01	1.0	1.0	1.0	1.0	1.0																									
Intrastate Toll Billings**	-.15	.10	.62	*	*	.85	.98	.91	*	*	1.0	1.0	1.0	1.0	1.0																				
Interstate Toll Billings**	-.15	-.06	.42	*	*	.96	.80	.94	*	*	.66	.68	.70	*	*	1.0	1.0	1.0	*	*															
Equipment $**	-.05	.06	.68	.32	.31	.67	.96	.75	.87	.01	.59	.96	.66	*	*	.64	.73	.71	*	*	1.0	1.0	1.0	1.0	1.0										
Number of Lines	-.02	.08	.62	.47	.25	.70	.90	.73	.79	-.06	.68	.88	.63	*	*	.63	.73	.71	*	*	.91	.96	.98	.96	.98	1.0	1.0	1.0	1.0	1.0					
Number of Telephone Locations	-.11	.07	.66	.25	.44	.74	.97	.74	.85	.11	.67	.97	.63	*	*	.69	.73	.73	*	*	.89	.99	.99	.97	.96	.63	.93	.97	.95	.92	1.0	1.0	1.0	1.0	1.0

*Insufficient data available to calculate meaningful correlation coefficients.

**Monthly figures.

wholesalers and manufacturers. For example, although a large manufacturer will utilize a greater amount of telephone equipment and more toll time than a small manufacturer, the larger firm will probably not find it advantageous to carry more Yellow Page space than the smaller establishment. On the other hand, the use of Yellow Page space in the retailer, realtor, and dry cleaner segments very likely would increase along with the demand for toll usage and telephone equipment as the firm's size increased. The importance of the size variable on the demand for various telephone offerings will be discussed more extensively in the latter part of this chapter and in Chapter V.

Second, the total amount of toll time used by firms in each segment is correlated significantly with the amount of equipment a firm uses. Toll usage is correlated most highly with the number of telephone locations that a firm maintains. This is especially true for the wholesaler segment where a correlation coefficient of .97 exists between total toll billings and the number of telephone locations maintained. These findings are similar to those arrived at in Michigan Bell's study of the consumer market[1] where a direct relationship was found between the demand for equipment and the amount of toll time a residential customer used.

Third, since telephone lines and telephone locations constitute the major equipment demanded by firms in this study, the total amount of equipment dollars spent is strongly correlated with these two offerings. If only the ten largest firms (using number of employees as the size indicator) in the wholesaler, manufacturer, and retailer segments are considered, the correlations between equipment dollars spent and the number of telephone lines and telephone locations drops significantly. This reflects a greater variance in demand by large firms for the additional types of vertical equipment offerings that were mentioned previously in this chapter.

Finally, in all but the wholesaler segment the number of telephone locations a firm maintains is highly correlated with the number of telephone lines it uses. The poor correlation in the wholesaler segment is also reflected by the large variance in the number of telephone locations

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[1] Profile of the Michigan Bell Consumer, op. cit., p. 42.

maintained by wholesaling firms (see Table 4.5). Although firms in the wholesaler segment did not vary substantially in their demand for telephone lines, they exhibited a high degree of variance in the number of telephone locations maintained. The factors causing the variation in these and other demand variables will be the major topic of discussion in the remainder of this chapter and in Chapter V.

Simple Correlations Between Independent and Criterion Variables

Tables 4.11 - 4.15 present product-moment R's for the classificatory and attitudinal variables that are significantly correlated with specific criterion demand variables.[1] These correlation matrices are presented by business segment. Table 4.16 summarizes this information by presenting the total number of independent variables that were hypothesized to affect specific demand criteria and the number that were found to have significant associations. This table indicates that, with the exception of

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[1]The tables are abbreviated to only indicate relationships that were significant at the .01, .05, and .10 levels because of the large number of independent variables that were originally hypothesized to affect demand.

the Yellow Page Advertising criterion variable in the manufacturer segment, between 11 and 22 explanatory factors are correlated significantly with all dependent variables in the manufacturer, wholesaler, and retailer segments.

Manufacturer Segment Associations

Table 4.11 indicates that only three of the 44 variables in the manufacturer segment that were hypothesized to affect Yellow Page Advertising usage are correlated significantly with the criterion variable. Of these three, only the variable "% sales in the Lansing Area" is significant at the .05 level. This means that of the total array of explanatory variables tested, the manufacturer's Yellow Page Advertising usage is influenced most by the percentage of total sales occurring in the local calling area.

For the interstate toll criterion, the explanatory variable that has the highest coefficient of correlation is "Gross sales outside of Michigan." Since the interstate toll component of the total toll variable is greater than the intrastate toll component, the explanatory variable related to out-of-state sales also carries a high coefficient of correlation with the total toll criterion. Several "size" variables, particularly the "number of offices" and

TABLE 4.11

SIMPLE CORRELATION MATRIX FOR SELECTED EXPLANATORY AND CRITERION VARIABLES - MANUFACTURER SEGMENT

Explanatory Variables	Criterion Variables						
	Advertising $	Total Toll $	Intrastate Toll $	Interstate Toll $	Equipment $	Telephone Lines	Telephone Locations
Size Variables							
1. No. Buildings	n.s.	.30+	.51*	n.s.	.33+	.41*	.38*
2. Facility Sq. Footage	n.s.	.32+	.41*	.22•	.43*	.47*	.52*
3. No. Offices	n.s.	.64*	.46*	.67*	.67*	.70*	.60*
4. 1967 Gross Sales	n.s.	.28+	.24+	.26+	n.s.	.24+	n.s.
5. No. Employees	n.s.	.19•	.24+	n.s.	.32+	.33+	.38*
6. No. Salaried Employees	-.21•	.68*	.68*	.59*	.70*	.70*	.80*
7. No. Clerical Employees	n.s.	.35*	.44*	.26+	.30+	.40*	.42*
8. No. orders/month	n.s.	.27+	.52*	n.s.	.19•	.22•	.21•
9. Total Outlets	n.s.	.19•	n.s.	.21•	n.s.	n.s.	n.s.
10. No. Suppliers	n.s.	.31+	.32+	.27+	.43*	.45*	.50*
Geographic Variables							
11. % Sales in Lansing Area	.28+	-.51*	-.48*	-.47*	-.40*	-.43*	-.47*
12. % Suppliers in Lansing Area	n.s.	-.30+	-.28+	-.28+	n.s.	n.s.	-.23•
13. No. Outlets in Area "A"	n.s.	.28+	.20•	.29+	n.s.	n.s.	n.s.
14. No. Outlets in Area "B"	n.s.	.31+	.21•	.32+	n.s.	n.s.	n.s.
15. No. Suppliers Outside Lansing	n.s.	.37*	.35*	.34*	.44*	.43*	.52*
16. No. Suppliers outside Michigan	n.s.	.47*	.38*	.46*	.36*	.38*	.51*
17. Gross Sale Outside Lansing	n.s.	.30+	.25+	.29+	n.s.	.25+	n.s.
18. Gross Sale Outside Michigan	-.20•	.80*	.57*	.83*	.47*	.44*	.48*
19. % Sales in Mich. Outside Lansing	n.s.	.19•	.45*	n.s.	n.s.	.30+	n.s.
20. Distance from Home Office	n.s.	n.s.	n.s.	.34*	.25+	.29+	.27+
21. No. Suppliers in Michigan	n.s.	n.s.	.22•	n.s.	.39*	.38*	.40*
Attitudinal Variables							
22. Perceived Time Spent on Local Communication with Customers	n.s.	.37*	.31+	.35*	.56*	.48*	.54*
23. Perceived Understandings of Offerings	n.s.	-.26+	n.s.	-.29+	-.26+	-.21•	-.30+

•Level of significance is equal to or less than .10.
+Level of significance is equal to or less than .05.
*Level of significance is equal to or less than .01.
n.s.The coefficient of correlation for the given variables is not significant at the .10 level.

the "number of salaried employees" a firm had, also are correlated quite strongly with all toll variables. It is interesting to note that the salaried employee variable has a much higher correlation with the total toll and interstate toll variables in this segment than the independent variable "number of employees." As will be seen later, however, the opposite relationship exists for the wholesaler and retailer segments. There are two related factors that might cause this variation. First, manufacturers in most cases employed a larger number of nonsalaried personnel than did the retailers or wholesalers. Second, the non-salaried personnel employed by the manufacturer appear to have a lesser influence on the demand for telephone usage and equipment than do the non-salaried personnel employed by firms in the retailer and wholesaler segments.

Finally, the demand for equipment in the manufacturer segment is correlated most highly with the "number of offices" and the "number of salaried employees" a firm maintains. The variable related to the perceived amount of time spent communicating with customers in the local calling area is also highly correlated with the equipment criteria variables. However, this attitudinal factor is not correlated significantly with any of the explanatory "size" variables.[1] This implies that a manufacturer's demand for telephone equipment is sensitive to his perceived local communications behavior as well as to the absolute size of the firm.

Wholesaler Segment

There are a larger number of explanatory factors significantly correlated with the advertising dollars criterion variable in this segment than in the manufacturer segment. But only two factors, the "number of years the firm has been in business" and the "number of orders/month" are significant at the .05 level. It is interesting to note that this is the only case in which a variable concerning the length of time a firm has been in business is correlated significantly with a demand variable.

All other criterion variables are highly correlated with a number of "size" factors and with the geographic variable "gross sales outside of Lansing." The explanatory

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[1]Although collinearity is not a problem in this case, many of the independent variables included in Tables 4.11 - 4.15 will be dropped from consideration later in the analysis since they are strongly collinear with other variables.

factor "gross sales outside of Michigan" was correlated more highly with the criterion variables in the manufacturer segment than was the factor "gross sales outside of Lansing." The in-state component of sales, however, has more affect on the criterion factors in the wholesaler segment. The difference in the effects of these two geographic variables is greater than might be expected by looking only at the average percentage of total sales occurring in outstate Michigan for these two segments.[1] As will be discussed later, however, a number of other factors weigh heavily on the demand behavior of wholesalers and manufacturers.

Another factor that affects the criterion variables differently in the manufacturer and wholesaler segments is the perceived importance of the telephone in dealing with customers and suppliers. The perceived amount of time spent communicating with customers is correlated significantly with all criterion variables except Yellow

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[1]As indicated in Table 4.3, the manufacturer segment had an average of 29% of their total sales in Michigan outside of Lansing, while the wholesaler percentage was 42%. These percentages reflect the fact that firms in this study are near the center of the State of Michigan. A location nearer the border of the state might have caused a much greater increase in out-of-state sales, particularly for wholesale establishments.

TABLE 4.12

SIMPLE CORRELATION MATRIX FOR SELECTED EXPLANATORY AND CRITERION VARIABLES - WHOLESALER SEGMENT

Explanatory Variables	Criterion Variables: Advertising $	Total Toll $	Intrastate Toll $	Interstate Toll $	Equipment $	Telephone Lines	Telephone Locations
Size Variables							
1. No. Buildings	.19°	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
2. Facility Sq. Footage	n.s.	.26+	.25+	.25+	.39*	.41*	.42*
3. No. Offices	-.18°	.43*	.36*	.55*	.56*	.61*	.49*
4. 1967 Gross Sales	n.s.	.95*	.94*	.75*	.94*	.90*	.95*
5. No. Employees	n.s.	.89*	.88*	.68*	.95*	.89*	.96*
6. No. Salaried Employees	n.s.	.67*	.62*	.66*	.73*	.74*	.75*
7. No. Clerical Employees	n.s.	.84*	.82*	.69*	.88*	.86*	.90*
8. No. Orders/Month	.25+	n.s.	n.s.	n.s.	n.s.	.22+	n.s.
9. No. Outlets in Michigan	-.18	n.s.	.36*	n.s.	n.s.	n.s.	n.s.
10. Total No. Outlets	n.s.	n.s.	n.s.	.38*	n.s.	n.s.	n.s.
11. No. Suppliers	n.s.	n.s.	n.s.	n.s.	n.s.	.21°	n.s.
12. No. Years in Operation	.25+	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Geographic Variables							
13. % Sales in Lansing Area	.21°	-.28+	-.21°	-.46*	-.25+	-.24+	-.24+
14. No. Outlets in Area "A:	-.19°	n.s.	n.s.	.17°	n.s.	n.s.	n.s.
15. No. Suppliers Outside Lansing	n.s.	n.s.	n.s.	n.s.	n.s.	.21°	n.s.
16. No. Suppliers Outside Michigan	n.s.	n.s.	n.s.	n.s.	n.s.	.21°	n.s.
17. Gross Sale Outside of Lansing	n.s.	.96*	.94*	.76*	.94*	.88*	.95*
18. Gross Sale Outside of Michigan	n.s.	.17°	n.s.	.33*	n.s.	.18°	n.s.
19. % Sales in Mich. Outside Lansing	n.s.	.26+	.24+	.26+	.23+	.21°	.22+
20. Distance from Home Office	-.10°	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Attitudinal Variables							
21. Perceived Time Spent on Local Communication with Customers	.17°	n.s.	n.s.	-.17°	n.s.	n.s.	n.s.
22. Perceived Understanding of Offerings	.23+	n.s.	n.s.	-.21°	n.s.	n.s.	n.s.
23. Perceived Importance of Telephone in Communicating with Suppliers	n.s.	.23+	.23+	.18°	.26+	.26+	.27+
24. Perceived time Spent on Local Communication with Suppliers	n.s.	-.19°	.22+	n.s.	-.21°	-.18°	-.20°

°Level of significance is equal to or less than .10.
+Level of significance is equal to or less than .05.
*Level of significance is equal to or less than .01.
n.s.The coefficient of correlation for the given variables is not significant at the .10 level.

Page Advertising in the manufacturer segment. Yet the perceived amount of time spent, and the importance of communicating with suppliers are not correlated highly with the demand criteria. The opposite situation is true in the wholesaler segment in which the factors dealing with supplier communications behavior are more highly correlated with the criterion variables than are those factors associated with customer communication. This implies that the customer aspect of a manufacturer's communication behavior has greater impact on the demand for selected telephone offerings than does the supplier component. In the wholesaler segment the effects of these two components are reversed.

Retailer Segment

Table 4.13 indicates that only the retailer segment has a large number of explanatory variables correlated with the advertising criterion at the .05 and .01 levels of significance. The majority of these explanatory factors can be categorized as "size" variables. The correlation coefficients indicate a positive relationship between the size of retail institutions and the demand for Yellow Page Advertising space.

TABLE 4.13

SIMPLE CORRELATION MATRIX FOR SELECTED EXPLANATORY AND CRITERION VARIABLES - RETAILER SEGMENT

Explanatory Variables	Criterion Variables						
	Advertising $	Total Toll $	Intrastate Toll $	Interstate Toll $	Equipment $	Telephone Lines	Telephone Locations
Size Variables							
1. No. Buildings	.22°	n.s.	n.s.	n.s.	.28+	.27+	.23°
2. Facility Sq.Footage	.66*	.60*	.51*	.60*	.91*	.89*	.90*
3. No. Offices	.62*	.58*	.65*	.44*	.76*	.74*	.69*
4. 1967 Gross Sales	.31+	.20°	.25°	n.s.	.42*	.35+	.34+
5. No. Employees	.64*	.75*	.63*	.75*	.97*	.94*	.97*
6. Salaried Employees	.62*	.48*	.50*	.40*	.74*	.68*	.67*
7. Sales Clerks	.61*	.76*	.63*	.76*	.94*	.90*	.94*
8. No. Suppliers	.42*	.53*	.40*	.57*	.82*	.85*	.88*
Geographic Variables							
9. % Sales in Lansing Area	n.s.	-.31+	-.45*	n.s.	n.s.	n.s.	n.s.
10. No. Suppliers Outside Lansing	.42*	.54*	.40*	.57*	.82*	.86*	.88*
11. No. Suppliers Outside Michigan	.44*	.56*	.43*	.60*	n.s.	n.s.	.90*
12. % Sales in Mich. Outside Lansing	n.s.	.27+	.47*	n.s.	n.s.	n.s.	n.s.
13. No. Suppliers in Michigan	n.s.	n.s.	n.s.	n.s.	.33+	.41*	.40*
14. % Suppliers in Lansing	.21°	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
15. No. Outlets in Michigan Outside Lansing	n.s.	n.s.	.23°	n.s.	n.s.	n.s.	n.s.
Attitudinal Variables							
16. Perceived Time Spent on Local Communication with Customers	n.s.	n.s.	n.s.	n.s.	.36*	.37*	.35+
17. Perceived Understanding of Offerings	n.s.	n.s.	n.s.	.22°	n.s.	n.s.	n.s.
18. Perceived Importance of Local Telephone Communications with Suppliers	.30+	n.s.	n.s.	n.s.	.30+	.28+	.31+
19. Perceived Importance of Telephone in Attracting New Customers	-.22°	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

°Level of significance is equal to or less than .10.
+Level of significance is equal to or less than .05.
*Level of significance is equal to or less than .01.
n.s.The coefficient of correlation for the given variables is not significant at the .10 level.

The remainder of the dependent or criterion variables are also correlated most significantly with "size" variables. This is most obvious for the dependent variable "interstate toll dollars" where seven of the ten explanatory variables significantly correlated with the criterion can be categorized as size factors. Also, the low mean monthly dollar amount spent on interstate calls by firms in the retailer segment ($47.00) as compared to the amount spent on interstate calls by firms in the manufacturer and wholesaler segments (see Table 4.5) suggests that fewer factors cause a variance in interstate toll usage for the retailer than is the case for the manufacturer or wholesaler. For example, since retailers have less geographical variation in sales than do manufacturers or wholesalers, any variables associated with geographic sales patterns have little, if any, effect on the retailers' toll usage.

Finally, a significant positive correlation does exist between the amount of time a retailer perceives himself to use in communicating with customers and the amount of telephone equipment he rents. In other words, the higher the retailer's ranking of the amount of time spent communicating with customers, the greater his demand for telephone equipment.

Realtor and Dry Cleaner Segments

Simple correlation matrices for the realtor and dry cleaner segments are presented in Tables 4.14 and 4.15. For these segments, a maximum of three explanatory variables are correlated significantly with any one criterion variable. For the dry cleaner segment, no independent variable was correlated significantly with either the amount of Yellow Page Advertising used or the amount of toll usage demanded. The relatively small sample sizes obtained for these two segments and the relative homogeneity of firms in the realtor and dry cleaner categories undoubtedly contribute to the lack of significantly correlated factors.

Some General Comments and Comparisons on the Correlation Matrices

Since the majority of the explanatory factors are associated in some way with the size of the firms, these factors are, in general, positively correlated with the demand variables. There are, however, several interesting exceptions. For the manufacturer, wholesaler, and retailer segments, the independent variable "per cent of sales in the Greater Lansing Area" is negatively correlated with the

TABLE 4.14

SIMPLE CORRELATION MATRIX FOR SELECTED EXPLANATORY AND CRITERION VARIABLES - REALTOR SEGMENT

Explanatory Variables	Criterion Variables: Advertising $	Total Toll $	Intrastate Toll $	Interstate Toll $	Equipment $	Telephone Lines	Telephone Locations
1. No. Offices	.43+	.79*	.42+	.86*	.89*	.86*	.88*
2. 1967 Gross Sales	n.s.	.42+	.29°	.48+	.54*	.50*	.52*
3. No. Employees	n.s.	.81*	.67*	.75*	.77*	.67*	.75*

°Level of significance is equal to or less than .10.
+Level of significance is equal to or less than .05.
*Level of significance is equal to or less than .01.
n.s.The coefficient of correlation for the given variables was not significant at the .10 level.

TABLE 4.15

SIMPLE CORRELATION MATRIX FOR SELECTED EXPLANATORY AND CRITERION VARIABLES - DRY CLEANER SEGMENT

Explanatory Variables	Criterion Variables						
	Advertising $	Total Toll $	Intrastate Toll $	Interstate Toll $	Equipment $	Telephone Lines	Telephone Locations
1. No. Offices	n.s.	n.s.	n.s.	n.s.	.76*	.71*	.69*
2. No. Employees	n.s.	n.s.	n.s.	n.s.	.79*	.79*	.65+
3. No. Years in Operation	n.s.	n.s.	n.s.	n.s.	.40°	n.s.	.44°

°Level of significance is equal to or greater than .10.
+Level of significance is equal to or greater than .05.
*Level of significance is equal to or greater than .10.
n.s.The coefficient of correlation for the given variables was not significant at the .10 level.

amount of toll usage - both inter and intrastate.[1] This verifies the hypothesis that as the per cent of total sales occurring in the local calling area increases, toll usage declines. Surprisingly, this same inverse relationship exists between the variable "per cent of sales in the Greater Lansing Area" and the criterion variables "equipment dollars," "number of lines," and "number of telephone location," but only for the manufacturer and wholesaler segments. Thus, a manufacturer or wholesaler selling primarily in the local calling area not only has lower toll billings than a firm selling primarily out of state, but also demands a lesser amount of telephone equipment. As was mentioned, this was not the case for the retailer segment. Here the demand for equipment was correlated positively with the per cent of sales occurring in the local calling area.[2]

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[1]The variable "per cent of sales in the Greater Lansing Area" has no meaning for the realtor and dry cleaner segments since nearly all firms sampled in these two segments had no sales outside of this area. Also, although no significant correlation is indicated between "per cent of sales in the Greater Lansing Area" and the interstate component of toll billings in the retailer segment, the correlation was positive and was significant at the .15 level.

[2]The correlations between "per cent of sales in the Greater Lansing area" and the demand for equipment in the retailer segment were not significant at the .10 level and are not shown in Table 4.13. However, the correlation coefficients were positive and were significant at the .20 level.

The findings presented thus far in the chapter suggest several basic conclusions regarding the effect of geographic sales patterns on the demand for telephone offerings in the retailer, manufacturer and wholesaler segments.[1]

First, toll billings for a manufacturer or wholesaler are a positive linear function of the amount of sales taking place outside the local calling area. Since a very small portion of a retailer's total sales are made outside of his local calling area, geographic sales variation has an insignificant effect on the retailer's toll billings.

Second, the amount of equipment, particularly the number of telephone lines and the number of telephone locations a manufacturer or wholesaler utilizes, is also a positive, linear function of the amount of sales occurring outside the local calling area. However, as was the case with toll usage, the retailer's demand for equipment does not appear to be affected by geographical sales variation and, in fact, seems to be related only weakly to sales in

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[1]The tentative conclusions derived here only apply to firms of the type and size studied in this paper. However, these findings provide a basis for develping a broader research design and testing more general hypotheses.

general.

A linear, positive relationship also exists between the number of suppliers a manufacturer and retailer have outside the local calling area and the firm's demand for various telephone offerings. This same relationship does not exist for firms in the wholesaler segment, however, as indicated by Table 4.12. In fact, for firms in the wholesaler segment, there is little or no correlation between either the absolute number of suppliers, or the location of suppliers, and most criterion factors. It is difficult to draw any cause-effect implications from these correlations. For example, it is hard to understand why supplier factors should influence demand in the retailer and manufacturer segment but have little effect on demand in the wholesaler segment. A possible explanation for this difference might be that, although wholesalers view the use of the telephone in contacting suppliers as quite important, the majority of communication with suppliers is performed either through face-to-face contacts with salesmen or through written correspondence.

One other correlation result that should be mentioned here exists between the independent variable "understanding"

TABLE 4.16

NUMBER OF INDEPENDENT VARIABLES SIGNIFICANTLY CORRELATED WITH SELECTED CRITERION VARIABLES - BY BUSINESS SEGMENT

	Business Segment									
	Manufacturer		Wholesaler		Retailer		Realtor		Dry Cleaner	
Criterion Variable	No. Vari-ables tested	No. found to be sig.*	No. Vari-ables tested	No. found to be sig.*	No. Vari-ables tested	No. found to be sig.*	No. Vari-ables tested	No. found to be sig.*	No. Vari-ables tested	No. found to be sig.*
Advertising $	45	3	44	10	38	13	10	1	12	0
Total Toll $	45	21	44	12	38	11	10	3	12	0
Intrastate Toll $	45	20	44	12	38	12	10	3	12	0
Interstate Toll $	45	18	44	15	38	10	10	3	12	0
Equipment $	45	16	44	11	38	12	10	3	12	3
Telephone Lines	49	19	44	16	38	12	10	3	12	2
Telephone Locations	45	17	44	11	38	13	10	3	12	3

*Includes all independent variables which were found to be significantly correlated with the criterion variables at the .10 level or above.

and the different criterion variables. "Understanding" is used here to denote the customers' perceived understanding of the kinds of equipment and services offered by Michigan Bell. The customer responded on a scale from one to five, "1" meaning he felt his understanding of telephone offerings was excellent and "5" meaning the customer felt he had a very poor understanding of the telephone products and services available. No measure was made of the respondents actual understanding of the alternatives available but only his perceived understanding or knowledge. Nevertheless, it is interesting to note that a negative correlation exists between the variable "understanding" and nearly all criterion variables for all segments. In other words, the demand for and usage of telephone offerings varies directly with managements' perceived understanding or knowledge of telephone offerings available.[1] If managements' actual understanding coincides with their perceived understanding, then it might be inferred that a firm's demand for various

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[1]To determine whether some of the variation in the variable "understanding" was perhaps due to some other independent variable, all intercorrelations were examined. No significant correlations between "understanding" and any other independent factors were found at the .05 level. Certain "size" variables, however, were found to be significantly associated with the perceived understanding factor at the .10 level.

offerings might increase if it were made more aware of the total array of telephone offerings available to them.

The correlation matrices illustrated and discussed in the preceding pages indicate that many of the criterion variables under study are correlated significantly with a large number of explanatory factors. However, as Farley pointed out in his study dealing with brand loyalty,[1] even excellent marginal relationships can often cause problems for multivariate analysis. This is true because the independent variables used in the analysis are often highly correlated with one another. Thus, significant multiple correlation coefficients should be produced if all of the independent variables shown to be significant in Tables 4.12 - 4.16 are used in a regression analysis. Few of the regression coefficients, however, may be found to be significant.

Actual regressions carried out for the manufacturer, wholesaler, and retailer segments using all of the independent variables found a maximum of five independent variable coefficients significant at the .05 level for any one

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[1]John U. Farley, "Why Does 'Brand Loyalty' Vary Over Products?," Journal of Marketing Research (November, 1964), p. 11.

equation. The signs of these coefficients also failed to show any reasonable pattern, and multicollinearity was suspected. Factor analysis was used to identify those variables which contributed most to explaining the variance in the criterion variables. Factor analysis was used because the relationship between the total set of significant variables can be observed simultaneously without encountering the problems of multicollinearity that are present in the data. This meant that a relatively "clean" subset of independent variables could be identified and the predictive power and hypothesis testing ability of multiple regression more accurately utilized.[1]

Sources of Variation in Demand Variables - Factor Analysis

A number of factoring procedures have been used as preliminary data-reduction techniques in multiple regression problems. One method often used by researchers is to summarize a large number of independent factors into a few "factors" such that only a small amount of information included in the large set of original variables is lost.

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[1]William F. Massy, "Applying Factor Analysis to a Specific Marketing Problem." Toward Scientific Marketing, 1963, American Marketing Association, pp. 295-296.

Only the independent variables are used to construct the factor scores. The factor scores themselves are then estimated using regression equations, and these estimated factor scores are used to predict values of the criteria or demand variables.[1] Although this technique may provide the user with optimal results, the use of the factor scores in the regressions may cause problems of interpretability. This problem may be particularly acute when it is necessary or beneficial for the user to interpret directly the effects of various explanatory variables on the criterion. In these instances, it may be beneficial to simply isolate the key explanatory factors, use these in the predictive equations, and sacrifice the additional information supplied by the remaining independent variables.

An alternative which satisfies the criterion just mentioned is to use factor analysis to isolate the actual independent variables which account for the major share of information included in the original larger set of data. This approach was used by Twedt in his study of the variables

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[1]For an example of this methodoloty, see: Farley, op. cit., pp. 11-12.

affecting advertising readership.[1] Although some predictive accuracy is sacrificed, this technique does allow the user to more easily interpret the effects of key explanatory variables.

Based on this latter methodology, factor analysis was performed on each criterion variable and the explanatory variables which were correlated with each criterion factor at the .20 level of significance.[2] The principal components extraction routine was used in the analysis with an eigen value of one used as the limiting criteria. This meant that only factors including variables which added five per cent or more to the cumulative proportion of variance were included in the principal components model. The factor loadings were then rotated using the varimax criterion. The varimax method has the greatest simplicity since the factor loadings are made to approach either zero or

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[1]Dik Warren Twedt, "A Multiple Factor Analysis of Advertising Readership," Journal of Applied Psychology, Vol. XXXIII, No. 3 (June, 1952), pp. 207-215. Also for an example and comparison of the use of both of the previously mentioned Factor Analysis techniques on the same set of data, see Farley, op. cit.

[2]Factor analysis was not carried out for the independent variables correlated with the advertising criterion in the manufacturer segment or for any variables in the realtor and dry cleaner segments. There were too few explanatory factors correlated significantly with the dependent variables in these instances.

one.[1] Variables exhibiting the largest absolute loadings and that appeared to be both factorially pure and offer the best chance for prediction purposes were chosen from the rotated principal components for each criterion variable.[2]

Tables showing the factor loadings of each independent variable for all relevant criterion variables are given in Appendix IV for each business segment. For explanatory purposes, Table IV-I, which indicates the independent variable loadings on the total toll criterion variable for the manufacturer segment, is reproduced as Table 4.17. The underlined values in the table represent those variables which had their highest loadings on each of the five factors. The squared factor loadings give the percentage of variance for each variable that may be predicted by a given factor. Since the dependent variable is listed first in each table, the loadings given in the first row in each table when

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[1]For a complete discussion of this methodology, see Harry Harman, Modern Factor Analysis (Chicago: University of Chicago Press, 1960), pp. 301-308.

[2]It should be pointed out at this time that in addition to multicollinearity checks, analysis was also made of a large number of dependent-independent variable relationships to determine whether any nonlinearities existed. Since no nonlinearities were observed, the data were used in constructing only linear regression models.

squared indicate the percentage of variance in the criterion variable that can be explained by each factor. For example, in Table 4.17 the total toll criterion variable has a loading of -.798 on Factor 1; therefore $(-.798)^2 = .64$, or 64% of the variance in manufacturer toll usage can be explained or predicted from Factor 1. As is also indicated by the last figure in Row 1 of Table 4.17, .858 or approximately 86% of the variance in manufacturer toll usage can be explained by all five factors. It should also be noted, however, that the first two factors alone account for approximately 74% of the variance in the dependent variable. A review of the tables in Appendix IV shows that in nearly all situations one or two factors account for the majority of variance in the criterion variable.

Since the factor extraction was stopped at the fifth factor, and because of the diverse nature and large number of explanatory variables, not all of the loadings show any pattern. For example, Factors 1 and 2 in Table 4.17 are loaded heavily on a heterogeneous grouping of variables. However, Factor 3 loads heavily on variables associated with the firm's relationship with its suppliers; Factor 4 is loaded most heavily on variables associated with the

TABLE 4.17

ROTATED FACTOR LOADINGS FOR TOTAL TOLL AND ASSOCIATED EXPLANATORY VARIABLES - MANUFACTURER SEGMENT

Variable	Loading					Communality
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
Total toll	-.798	.303	.262	.230	-.084	.858
Grossale 2*	-.813	-.012	.073	.361	-.021	
Numoffices	-.672	-.049	.157	-.074	-.266	
Underst	.606	-.007	.306	.245	.252	
PctsaleL	.595	.048	-.345	.200	.194	
Numsalem	-.483	.330	.460	-.157	-.364	
Tloccust	-.442	.100	.281	-.209	-.377	
Numordmo	-.172	.698	.019	-.016	.009	
Numbuild	.006	.697	.499	-.194	-.018	
Disthome	.097	.410	.010	.203	-.207	
Numsuppl	-.146	-.056	.917	.056	-.179	
Numsupp	-.067	-.064	.826	-.039	-.148	
Numsupp2	-.219	-.029	.791	.179	-.173	
Sqfeet	-.112	.256	.618			
PctsuppL	.387	-.079	-.391	-.172	.157	
NumoutB	-.127	.043	.093	.929	.045	
NumoutA	-.086	.049	.133	.921	.029	
Pctsupm	-.158	-.355	.228	-.510	-.083	
Grossale	-.200	-.025	.051	.135	-.922	
Grossale1	-.227	-.034	.033	.151	-.905	
Numempl	-.092	-.010	.323	-.137	-.870	
Numclrem	-.190	.202	.253	-.082	-.860	
PctsaleM	-.058	.349	.235	-.243	-.499	

*For an explanation of abbreviated variables, see Appendix IV.

location and number of branch facilities; the fifth factor is most heavily loaded on the amount of sales of the firm and the number of employees of various types employed by the firm.

The factor loading matrices for the remaining criterion variables in the manufacturer segment show the same general pattern as those in Table 4.17 (see Tables IV.2 - IV.6 in Appendix IV). The number of independent variables used in each case differ, and the factors themselves vary somewhat in their contribution to explaining the variance in the criterion variables. However, the explanatory variables do group themselves in nearly the same manner for each variable.

Tables IV.7 - IV.12 in Appendix IV indicate that for the wholesaler criterion variables, extraction was stopped at either the second or third factors. A possible explanation for the low number of factors in this case is that fewer explanatory variables were correlated significantly with the criterion variables in the wholesaler segment than was the case in the manufacturer segment. For both the two and three factor cases, the factor that accounts for the greatest amount of variance is the factor heavily weighted on firm size variables. (i.e., number of employees, gross sales, and physical size of the facility.) In the three factor cases, factor two is loaded heavily on variables associated with the perceived importance of suppliers to the firm's communication behavior, while factor three loads heavily on geographic sales variables. When extraction was stopped at only two factors, the variables associated with supplier importance were included in the factor emphasizing size variables, while the second factor is weighted heavily on geographic sales variables.

Finally, Tables IV.13 - IV.19 in Appendix IV present the rotated factor loading matrices for the various explanatory and criterion variables in the retailer segment. A factor analysis was run on the criterion variable "Yellow Page Advertising dollars" and the associated explanatory factors for the retailer segment only because of the large number of explanatory variables that were correlated significantly with the criterion in this segment.

As was the case for the manufacturer segment, extraction was stopped in each model at the fifth factor, although the first two factors in each case account for the largest proportion of variance in the dependent variable. However, unlike the manufacturer and wholesaler factor models, few of the factor loadings in this segment show any logical relationships or pattern.

For the manufacturer, wholesaler, and retailer segments, the rotated factor models were used to select the initial variables used in the regression models. For this purpose, the variables with the largest absolute loadings on each factor and which seemed to be factorially purest were found in the rotated factor loading models. The independent variables selected in this manner for the manufacturer, wholesaler and retailer segments are shown in Table 4.18. As indicated in this table, the explanatory variables that were chosen from the factor models differ substantially for each criterion variable across the three segments. Total yearly gross sales and the per cent of sales occurring in the local calling area are the two explanatory variables occurring most frequently. However, they are only found in two business segments and thus cannot be assumed to be good predictors across the total population of firms.

There are, however, certain variables that tend to be used consistently within certain segments for all

TABLE 4.18

EXPLANATORY VARIABLES HAVING HIGHEST LOADING ON
EACH FACTOR IN THE ROTATED FACTOR LOADING MODELS
BY DEPENDENT VARIABLE AND BUSINESS SEGMENT

Independent	Dependent Variable by Business Segments*																				
	Advertising $			Total Toll $			Intrastate Toll $			Interstate Toll $			Equipment $			Telephone Lines			Telephone Locations		
Variable	M**	W**	R	M	W	R	M	W	R	M	W	R	M	W	R	M	W	R	M	W	R
Numbuild***			X			X			X			X	X		X			X			X
Numoff			X			X			X			X	X		X	X		X	X		
Sqfeet															X			X		X	X
Numempl			X											X							
Numsalem													X						X		X
Numclrem												X				X					
Numclerks						X			X						X			X			X
Grossale				X	X		X	X		X	X		X				X		X	X	
Grossale2				X			X			X											
Numordmo				X			X			X						X			X		
Numsuppl													X			X			X		
Numsuppl1				X			X														
Numsuppl2										X											
PctsaleL			X		X	X			X		X	X		X	X		X	X			X
PctsaleM								X	X											X	
NumoutA							X														
NumoutB				X						X											
NumoutO											X										
Imsupp					X			X													
Tlocsupp			X			X						X									

*M = Manufacturer Segment; W = Wholesaler Segment; R = Retailer Segment

**Factor analysis was not carried out for the advertising criterion in these segments because of the small number of significantly correlated independent variables.

***For an explanation of abbreviated variables, see Appendix IV.

criterion variables. For example, the number of buildings and number of offices a firm maintains are found to carry high weights across all criterion variables in the retailer segment. Yet, these variables load highest on only two factors for criterion variables in the wholesaler and manufacturer segments.

In general, the summary group of explanatory variables derived from the factor analysis looks quite reasonable. In nearly all cases, the explanatory variable that carried the highest simple correlation with each criterion variable is included. Also, the method used to select the summary group of explanatory variables appears to have minimized the degree of collinearity or correlation among independent variables. Whether this procedure has also led to the best choice of predictive variables will be determined in Chapter V. The results of the regressions using the variables derived from the factor analysis will be compared with those using other selection criteria.

Summary

A detailed description of many of the characteristics of responding firms was presented. Special emphasis was given to the way in which the structural or classificatory variables and specific attitudinal responses differed across the five business segments.

Simple correlations between statistically significant explanatory and criterion variables were then derived. In many cases, a large number of explanatory factors were significantly correlated with the dependent variables. For these situations, factor analysis was used to identify the independent variables that best summarized the information included in the larger set of collinear variables.

Based upon the results generated from the factor analysis, variables were chosen that had high factor loadings and which seemed to be factorially pure. By this procedure a group of explanatory variables that appeared to be minimally collinear were developed for each criterion variable. These explanatory variables will serve as initial inputs to the regression models that are developed in the following chapter.

CHAPTER V

DEMAND MODELS

In Chapter IV, a large number of factors were determined to be highly correlated with a firm's demand for telephone offerings. The purpose of this chapter is twofold: first, to examine in detail the variation in factor effects across firms of similar types and different business segments; second, to develop predictive models from these factors that can be used to forecast the demand behavior of firms for specific telephone communication offerings.

Sources of Demand Variation - Regression Models

One of the basic problems inherent in the use of regression models is selecting what might be called the "best" regression equation from all possible alternatives. This difficulty arises for two primary reasons. First, there seems to be no universally used criterion or standard for rating one regression equation better than another. Second, there are a number of judgmental or qualitative decisions that often have to be made regarding the inclusion or deletion of certain explanatory variables in regression models. In some cases, the criterion used to select the "best" set of explanatory variables may conflict with the criterion used to select the best regression equation. For example, in referring to the selection of variables to be included in a regression equation, Draper and Smith state:

> 1. To make the equation useful for predictive purposes we should want our model to include as many x's (independent variables) as possible so that reliable fitted values can be determined.
>
> 2. Because of the costs involved in obtaining information on a large number of x's and subsequently monitoring them, we should like the equation to include as few x's as possible.[1]

One regression equation may satisfy a specific prediction criterion better than any other; however, certain qualitative or quantitative constraints on the independent variables may lead to the selection of a model which is less than optimum in satisfying the predictability criterion.

There is no one criterion available for selecting the proper regression model; yet, there are a number of

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[1]Norman Draper and Harry Smith, Applied Regression Analysis (New York: John Wiley and Sons, Inc., 1966), p. 163.

procedures available to assist the researcher in selecting the "best" regression equation.[1] One of the most commonly used techniques is the stepwise regression method in which variables are added or "stepped" into the regression until some "satisfactory" model is achieved. Often the co-efficient of determination (R^2), which relates the proportion of variation in the dependent variable that is associated with variation in the independent or explanatory variables, is used as the primary judgment criteria. In other cases, predictor or independent variables are either added or deleted from the equation and a partial F criterion used to test their individual contributions to the model. Based on some preselected significance criterion, only variables that provide a significant contribution are then retained in the final model.

Another statistic sometimes used by researchers to compare predicted with actual results is that developed by Theil.[2] This statistic, termed Theil's "U,"[3] has been used

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[1] Ibid., pp. 163-177.

[2] H. Theil, Economic Forecasts and Policy (Amsterdam: North-Holland Publishing Company, 1958), pp. 31-42.

[3] $$U = \frac{\sqrt{\frac{1}{n} (Pi - Ai)^2}}{\sqrt{\frac{1}{n} Pi^2} + \sqrt{\frac{1}{n} Ai^2}}$$

Where Pi = prediction and
Ai = the corresponding actual outcomes for each subject.

to evaluate the forecasting performance of regression models. As shown in footnote 3 (page 156), this inequality coefficient takes on values between 0 and 1. A 0 value indicates perfect forecasting and values approaching 1 indicate poor forecasting performance. This coefficient was calculated for a number of the forecasting models presented later in this chapter. The predicting equation selected based on this criteria was no different than when the R^2 statistic was used to choose a best regression model.

The problem that sometimes results when using these and other statistics as the sole evaluating criterion is that high correlations do not necessarily indicate good predictor equations. Therefore, although statistical criteria provide valuable information, a complete reliance on them as the only judgment mechanism may lead to the selection of regression models that do not provide optimum forecasting performance.

Attempts have been made to determine the criterion which can be used to select optimal prediction equations;[1] yet "it appears that there is no single general criterion,

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[1]For example, see "The Predictive Accuracy of Empirical Demand Analysis," op. cit., pp. 550-575.

TABLE 5.1

EXPLANATION OF INDEPENDENT VARIABLE SYMBOLS USED IN THE CHAPTER V TABLES

Symbol	Variable Description
X_{sf}	Square footage of customer facility
X_{o}	Number of offices
X_{c}	Number of clerks employed by Retailer
X_{sol}	Number of suppliers outside of Lansing x 100
$X_{\%sl}$	Percentage of sales in Lansing area
$X_{\%sm}$	Percentage of sales in Michigan outside Lansing
X_{s}	Number of suppliers
X_{som}	Number of suppliers outside of Michigan x 100
X_{ce}	Number of clerical employees
X_{se}	Number of salaried employees
X_{gom}	1967 Gross sales outside of Michigan x 100
X_{om}	Number of orders taken per month
X_{ne}	Total number of employees
X_{gol}	1967 Gross sales outside of Lansing x 100
X_{gs}	Total 1967 Gross sales
X_{oom}	Number of outlets outside of Michigan
X_{y}	Number of years in operation

the rule being rather that ad hoc tests of predictive performance grow out of the logic of the particular investigation."[1] In other words, any decision about a best regression model should depend on the primary objectives of the research. Where prediction is the main purpose of the model, the best way to arrive at an optimum regression equation is to use forecasting performance itself as the primary indicator of regression quality. Sensible judgment is still needed in the selection of independent variables (i.e., where two independent variables are highly correlated, the choice of one may rest primarily on ease of measurement). However, a "critical examination of the model through examination of residuals"[2] should accompany any selection procedure. Only in this way can various discrepancies in the model be uncovered and a "best" regression model developed.

Preliminary Regression Results

Initially, the independent variables obtained from the factor analysis models in Chapter IV[3] were used as the

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[1]Palda, _op_. _cit_., p. 287.

[2]Draper and Smith, _op_. _cit_., p. 172.

[3]For a list of these variables, see Chapter IV, p. 151.

explanatory variables in the regression equations. The R^2 values obtained by correlating these variables with the demand criteria are shown in Table 5.2. The high values obtained for the coefficient of determination, R^2, for many of the demand equations indicate that a large proportion of the variation in the dependent variables is associated with the variation in the explanatory variables. This is especially true for the demand equations in the wholesaler and retailer segments where over half of the regression equations have R^2 values greater than .90.

Three major areas should be considered, however, prior to assuming that high R^2 values are synonymous with good predictor equations. In particular, several factors should be investigated before it is assumed that the equations presented in Table 5.2 are the best possible regression models. First, the effect of deleting one or more independent variables from the regression models on certain predictive criterion should be examined. Second, the possibility that variables not included in the original explanatory variable set may improve the predictability and accuracy of the equations should be tested. Finally, the assumption that the relationships between predictor and

TABLE 5.2

COEFFICIENTS OF DETERMINATION FOR REGRESSIONS OF DEMAND CRITERIA ON THE EXPLANATORY VARIABLES[1] SELECTED FROM FACTOR MODELS[2] - BY BUSINESS SEGMENT

Demand Variable	Coefficient of Determination by Business Segment					
	Manufacturer		Wholesaler		Retailer	
	R^2	N[3]	R^2	N	R^2	N
Advertising Expenditure	--	--	--	--	.54	5
Total Toll Usage	.83	5	.92	3	.72	5
Intrastate Toll Usage	.65	5	.95	3	.71	5
Interstate Toll Usage	.70	5	.73	3	.61	5
Equipment Billings	.61	5	.98	2	.98	5
Number of Telephone Lines	.62	4	.84	2	.94	5
Number of Telephone Locations	.65	5	.92	3	.98	5

[1]For a list of the independent variables used in these regressions, see Chapter IV, Table 4.18.

[2]Factor Analysis was not used in the realtor or dry cleaner segments or for the advertising criterion in the manufacturer and wholesaler segments because of the low number of independent variables significantly correlated with the demand factor in these areas.

[3]N = number of independent variables used in the regression model.

criteria factors are best described by simple linear models should also be examined.

Variable Addition and Deletion

Assuming that the independent variables selected from the factor analysis models were the best set of predictor variables available, the first step taken to improve the regression results was to examine the effect of reducing the number of predictor variables used. In other words, the R^2 values presented in Table 5.2 were obtained from regressions using all of the variables selected from the factor models. Better prediction models might result, however, if fewer explanatory variables are used in the regression models.[1] A number of criteria were established to guide the deletion decision. First, I decided to obtain regressions on all combinations of the explanatory variables derived from the factor models.[2] Then, starting with one independent variable, an additional

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[1]"Better" is used here to mean models that sacrifice a certain amount of statistical precision for the sake of using fewer, more easily measureable explanatory variables.

[2]Since there were never more than five factors in the factor analysis models, and thus, no more than five independent variables, the "all combinations" approach was feasible at this point of the analysis.

variable was included in the model only when it met the following criteria:

1. Its introduction to the model (a) increased the value of the coefficient of multiple determination (R^2) by at least .05 and/or (b) decreased the value of the standard error of the estimate (Syc) by at least 10%. Although there is a relationship between Syc^2 and R^2, a substantial decrease in one does not necessarily imply a large change in the other. Therefore, both are included as judgment criteria. Also, an analysis of the residual mean square (Syc^2) as the number of independent variables in the regression is increased helps to determine a best cutoff point for the number of variables included in a regression. However, this procedure does not necessarily guarantee that the right set of explanatory variables has been chosen.[1]

2. If two independent variables were highly correlated and contributed an equal amount to explaining the variance in the dependent variable (as

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[1]For a more complete discussion of this point, see Draper and Smith, op. cit., pp. 165-167.

indicated by the increase in R^2 resulting from separately adding each variable to the model), the independent variable that was most easily measureable was included.

Based on the above criteria, regressions including all combinations of the factorially selected explanatory variables were run and best regression models chosen. Table 5.3 lists the variables included in these regression models and the amount of variance in the demand variables that is explained by the reduced set of explanatory factors.[1]

Comparing the results presented in Table 5.3 with those of Table 5.2, one sees that the regression equations of Table 5.3 generally have fewer explanatory variables than the basic models presented in Table 5.2. In few instances did a substantial decrease in the correlation coefficient, or a substantial increase in the standard error of the estimate, result when one independent variable was

[1]Note that equations are not presented for the advertising criterion in the manufacturer or wholesaler segment, or for any dependent variables in the realtor or dry cleaner segments. Factor analysis models were not used to generate the initial selection of independent variables in these cases. Regression models are developed for these dependent variables, however, and will be discussed later in this chapter.

TABLE 5.3

COEFFICIENT OF DETERMINATION FOR REGRESSIONS OF DEMAND CRITERIA ON A REDUCED SET OF EXPLANATORY VARIABLES[1] SELECTED FROM FACTOR MODELS[2] BY BUSINESS SEGMENT

Demand Variable	Business Segment					
	Manufacturer		Wholesaler		Retailer	
	R^2	Predictors	R^2	Predictors	R^2	Predictors
Advertising Expenditure	--	--	--	--	.51	$X_o, X_{ne}, X_{\%sl}$
Total Toll Usage	.78	X_{gom}, [3]X_{om}	.90	X_{gs}	.68	$X_c, X_{\%sl}$
Intrastate Toll Usage	.62	X_{om}, X_{sol}	.95	$X_{gs}, X_{\%sm}$	.66	$X_c, X_{\%sm}$
Interstate Toll Usage	.68	X_{om}, X_{gom}	.69	$X_{gs}, X_{\%sl}$	.58	X_{ce}
Equipment Billings	.57	X_o, X_{se}	.98	$X_{ne}, X_{\%sl}$	.98	X_{sf}, X_c, X_c
Number of Telephone Lines	.60	X_s, X_{om}	.81	X_{gs}	.89	X_o, X_c
Number of Telephone Locations	.64	X_{se}	.94	$X_{gs}, X_{\%sm}$	.94	X_c

[1]For a description of how this reduced set of explanatory variables was chosen, see pp. 163-4 of Chapter V.

[2]See Footnote 2, Table 5.2.

[3]See Table 5.1 for an explanation of these variable symbols.

deleted from the original regression models. In fact, in some instances, as many as four explanatory variables were deleted from regressions that originally included five independent variables, with little noticeable effect on the R^2 or Syc statistics. For example, when four of the five explanatory variables chosen from the factor models to explain the variation in manufacturer demand for telephone locations were dropped from the regression equation, the R^2 statistic fell from .65 to only .64. The standard error of the estimate increased by only 2%. Thus, even though many of the factor models developed in Chapter IV contained four, five, or six factors, only the variables that loaded highest on the two or three top loading factors contributed significantly to the regression models. Once the important variables had been included in a demand model, both the amount of variance explained (R^2) and the residual mean square (Syc^2) for the model tended to stabilize.

The regression coefficients for each of the demand equations summarized in Table 5.3 were also checked for significance. In all cases the coefficients are statistically significant at the .05 level. In fact, many of the coefficients are significant at the .01 and .001 levels. The coefficients also carry the expected signs, indicating that multicollinearity is not in direct evidence. This finding was further verified by a check of the Durban Watson statistic for each equation. This test indicated no serial correlation in any model at the .05 level of significance.

Contribution of Additional Explanatory Variables to the Demand Models

Using the predicting equations presented in Table 5.3 as a base, all other independent variables that were correlated significantly with the criteria variables were individually "stepped" into these basic models. The effect that the addition of each of these variables had on the predicting models was then determined by using the sequential F-test criterion[1] and the R^2 and standard error criterion discussed on page 156. This procedure led to the inclusion of additional predictor variables in the basic models of Table 5.3. In some instances, the remaining factor analysis based variables were replaced

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[1]For a discussion of the uses of this technique in regression analysis, see Draper and Smith, _op_. _cit_., pp. 71-72.

with a new set of predictor variables. The resulting final regression models based on these criteria are presented in Tables 5.4 - 5.8. Although much of the remainder of this chapter will concentrate on reviewing the details of these models for each business segment, several general points will be made first concerning the differences among the various demand models developed thus far.

First, there are only three cases in which the final predictive models are the same as those presented in Table 5.3; and there is only one case (the total toll model for the wholesaler segment) where none of the explanatory variables derived from the factor models were used in the final regression equations. This indicates that the factor analysis technique was a useful methodology for arriving at a basic set of explanatory variables. As mentioned previously, however, only the variables chosen from the two or three highest loading factors provide a significant amount of information to the demand models.

Second, the variables used to forecast the same demand factors vary substantially across the business segments. There were some instances in which a single independent variable had a significant effect on a demand criterion across the three major segments (i.e., the independent variable "number of offices" is included in the "line" and "location" demand models for each of the three major segments). However, the differences that exist in the demand equations indicate that the business segmentation strategy used in this study is an effective requisite for developing accurate demand models. In fact, it could be argued that a finer breakdown of the business segments than used here would result in even more precise predicting models.

Finally, the relatively few number of explanatory variables used in all of the demand models indicates that there may be only a few factors influencing the demand for many types of telephone offerings. The regression technique used here does not prove a cause-effect relationship. But the evidence supplied by the demand models suggests that a small number of structural variables explain a large share of the variance in individual business firm demand for many of the criteria factors.

It is feasible that adding other variables to the models might increase their predictive accuracy. To check this possibility, regressions of each demand criterion were run on _all_ explanatory variables that were correlated significantly with the criterion factors.[1] This analysis indicated that the inclusion of a large number of additional explanatory factors did not increase significantly the correlation coefficients or significantly decrease the standard error of the estimate for any demand model. Even when the value of R was increased, the reduction in the residual sum of squares was not great enough to improve the precision of the demand models. For an increase in the value of R resulting from the addition of more explanatory variables does not lead to better predicting models when the reduction in the residual sum of squares is less than the original residual mean square.[2] An examination of the regression outputs showed this to be the case for the demand models that included a large number of predictor variables.

Including all of the independent variables for which data was obtained in the regression models did not significantly affect the predictive performance of the models.

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[1]For a list of the independent variables that are correlated significantly with each criterion at the .05, .01 and .001 levels, see Tables 4.11 - 4.15.

[2]See Draper and Smith, _op_. _cit_., pp. 117-118.

The possibility does remain that a number of relevant explanatory factors were not included in the analysis. For cases such as the Yellow Page Advertising models, where predictive performance is quite poor, it is possible that information on additional explanatory criteria would improve the demand models substantially. The types of information that might be added to the demand models to improve their forecasting performance will be discussed later in this chapter when the specific demand models are examined, and in Chapter VI under "Suggestions for Further Research."

Yellow Page Advertising Demand Models

When compared to the other demand models, the linear regressions for the Yellow Page Advertising criterion show very poor prediction results for all but the retailer segment. In fact, even when all variables that are correlated significantly with the advertising criterion are used in the regressions, the multiple correlation coefficients and standard errors are not changed significantly from those appearing in Table 5.4.

The Yellow Page Advertising regression model for the retailer segment shows the best predictors to be the number

TABLE 5.4

PREDICTING EQUATIONS FOR YELLOW PAGE ADVERTISING USAGE BY BUSINESS SEGMENT

Business Segment	Standard/Normalized Equations	R	n
Retailer	$Y_A^{1.} = 42.6 + 9.9 \times 10^{-4} \overset{(c)}{} X_{sf} + \overset{(a)}{4.8}X_o$	$\overset{(c)}{.71}$	42
	$Y_{AN}^{2.} = .46\ X_{sf} + .34X_o$		
Manufacturer	$Y_A = 11.4 + \overset{(a)}{.2}X_{\%sl}$	$\overset{(a)}{.28}$	47
	$Y_{AN} = .3X_{\%sl}$		
Wholesaler	$Y_A = 13.0 + \overset{(a)}{.007}X_{om} + \overset{(a)}{.2}X_{\%sl}$	$\overset{(a)}{.32}$	62
	$Y_{AN} = .2\ X_{om} + .2X_{\%sl}$		
Realtor	$Y_A = 38.5 + \overset{(a)}{4.1}X_o$	$\overset{(a)}{.42}$	20
	$Y_{AN} = .4X_o$		
Dry Cleaner	Y_A = n.s.		
	Y_{AN} = n.s.		

[a]Significant at the .05 level.

[b]Significant at the .01 level.

[c]Significant at the .001 level.

1. Monthly dollar amount of Yellow Page Advertising subscribed to.

2. Normalized Yellow Page Advertising predicting equation.

n.s. = No significant relationships were found between Y_A and any combination of independent variables.

of offices the retailing establishment has and the square footage of the retail facility. The normalized equation indicates that the square footage variable was more important than the number of offices variable in determining Yellow Page Advertising demand. It should be mentioned here, however, that because of the high correlation between a number of size variables and the square footage factor, a number of size variables could have been substituted for the square footage variable with little effect on the prediction results.

An examination of residuals in the retailer model indicates that some nonlinear model might better fit the data. To test this possibility, a quadratic model of the form $Y_A = a + bX + cX^2 + e$ was fitted to the Yellow Page demand data. A number of different size variables were used as independent variables in this equation. But a partial F-test showed that the data fit the linear models as well, if not better, than it fit the quadratic models. A number of other data transformations were attempted, but none improved the predictive accuracy of the basic linear models.[1]

[1]A variety of data transformations were also tried for some of the other demand models, but in no case were the results significantly better than the linear models presented in Tables 5.4 - 5.10.

For the Yellow Page models in the manufacturer, wholesaler, realtor, and dry cleaner segments, the results vary from a correlation coefficient of .46 (significant at the .05 level) in the realtor segment to no significant relationships in the dry cleaner segment. One interesting relationship appearing in the manufacturer and wholesaler models is that which exists between the independent variable "percentage of sales occurring in the local calling area" and Yellow Page usage. The positive nature of this relationship indicates that the higher the percentage of total sales occurring in the local calling area, the greater the demand for Yellow Page Advertising space. One would expect to find an even stronger relationship between Yellow Page usage and the "absolute" amount of sales in the local calling area. The fact that this relationship is quite weak implies that, regardless of a manufacturer's or wholesaler's size, the percentage of business obtained from the local area and not the absolute amount of local sales is the major influencing factor. Since the nature of the retailers, realtors, and dry cleaners' business is such that nearly all sales are made in the local areas, the percentage of sales variable has little effect on

Yellow Page demand in these segments.

Several possible reasons can be given for the poor results obtained for all but the retailer segment. First, the large amount of Yellow Page demand variance not explained in the manufacturer, wholesaler, realtor, and dry cleaner segments may indicate that a number of critical explanatory variables are not included in the models. One factor that might be expected to influence demand is the type of product(s) each business firm buys and sells. Some information pertaining to this variable is available from the firm's SIC classification, but there are not enough firms in any one SIC category to draw any relevant statistical inferences on the impact of this variable.

Another factor that may influence the demand for Yellow Page space is the firm's perception of the degree of competition it faces--particularly in the local calling area. It is logical to hypothesize that the greater the perceived competition, the more Yellow Page space a firm would feel it necessary to utilize. Unfortunately, although information was obtained on a firm's perceived demand for Yellow Page space relative to competitors, no data were collected on the perceived competition variable.

A third factor that likely influences the amount of Yellow Page space used by various firms, is the number of and time of contacts by Yellow Page salesmen. It might be hypothesized that the amount of Yellow Page Advertising subscribed to by a firm varies directly with the number of recent contacts a Yellow Page salesman has made on each firm, and the date of the most recent contact. In other words, a firm that has been contacted in each of the past five years concerning a possible increase in Yellow Page advertising is likely to have a higher usage value than a similar firm that has been contacted a lesser number of times. Unfortunately, accurate data were not available regarding this possible influencing factor.

Finally, an attempt was made to determine the importance that owners or company executives place on Yellow Page Advertising services. Any inference as to a cause-effect relationship between the importance criteria and Yellow Page usage, however, is extremely difficult to make.[1]

[1] In situations where an owner of a firm rated Yellow Page Advertising extremely important, and the firm used a large amount of advertising space, one would like to infer that the importance factor caused the heavy demand. This may not be the case, however, since a high importance ranking may simply be a way of rationalizing a heavy usage of Yellow Page Advertising.

Toll Forecasting Models

The models used to forecast toll usage are in general better than the Yellow Page demand models. As Table 5.5 shows, demand equations for total toll in each of the manufacturer, wholesaler, and retailer segments have R values of .86 or higher, using a maximum of three explanatory variables. Somewhat higher R values and somewhat lower standard errors were obtained by including more predictive factors, but the slight increases in predictive accuracy that resulted did not justify their inclusion in the models.

A comparison of the normalized total toll models across the manufacturer-wholesaler-retailer segments shows that different variables explain total toll usage for each segment. The largest amount of variance in total toll demand for the retailer group is explained by the size variable "number of clerks." The geographic dispersion of suppliers and sales also contributed significantly to explaining the variance in retailer total toll; however, the size factor was the most important explanatory variable.

In the manufacturer case the most important explanatory variable was "gross sales outside of Michigan." The

TABLE 5.5

PREDICTING EQUATIONS FOR TOTAL TOLL USAGE
BY BUSINESS SEGMENT

Business Segment		Standard/ Normalized Equations	R	n
Retailer	Y_{TT}[1.]	$= 427.2 + \overset{(c)}{6.76}\ X_c - .00085\ X_{sol} - \overset{(b)}{4.28}\ X_{\%sl}$	$\overset{(c)}{.86}$	42
	Y_{TTN}[2.]	$= 1.57\ X_c - .9\ X_{sol} - .4\ X_{\%sl}$		
Manufacturer	Y_{TT}	$= -2.1 + \overset{(c)}{12.2}\ X_{se} + \overset{(c)}{.000001}\ X_{gom}$	$\overset{(c)}{.90}$	47
	Y_{TTN}	$= .5\ X_{se} + .6\ X_{gom}$		
Wholesaler	Y_{TT}	$= 91.8 + \overset{(c)}{5.2}\ X_{ne} + \overset{(c)}{.0000007}\ X_{gol} - \overset{(c)}{21.5}\ X_{se}$	$\overset{(c)}{.98}$	62
	Y_{TTN}	$= .3\ X_{ne} + 1.0\ X_{gol} - .4\ X_{se}$		
Realtor	Y_{TT}	$= -13.3 + \overset{(c)}{6.7}X_{ne}$	$\overset{(c)}{.90}$	20
	Y_{TTN}	$= .9X_{ne}$		
Dry Cleaner	Y_{TT}	= n.s.		
	Y_{TTN}	= n.s.		

[a]Significant at the .05 level.

[b]Significant at the .01 level.

[c]Significant at the .001 level.

[1.]Dollar value of total toll usage for February, 1968.

[2.]Normalized total toll predicting equation.

n.s. = No significant relationships were found between Y_{TT} and any combination of independent variables.

size variable "number of salaried employees" was the only other factor that contributed any significant amount of information to the model. It is somewhat surprising in the manufacturer case that neither the number or location of suppliers had a strong impact on manufacturer toll usage. This would seem to bear out an earlier hypothesis that customer telephone communication is more critical to the manufacturer than is supplier communication, and thus has more influence on toll usage.

For the wholesaler segment, total toll usage is most affected by the variable "gross sales outside of Lansing." The "number of employees" and "number of salaried employees" factors are of secondary importance. As in the case with manufacturers, no supplier factors are present in the wholesaler total toll model. A possible explanation is that, although supplier communication is important to the wholesaler, the majority of supplier (manufacturer) contacts are either initiated by the manufacturer or communicated in some other fashion. This latter reasoning is borne out by the relatively heavy weighting of the customer or sales factor on manufacturer toll usage. Unfortunately, no data were collected on the questions of who originates the manufacturer-wholesaler-retailer communications process most frequently, or what amounts of various types of communication processes are used by firms in each segment.

For the realtor segment, only one variable is included in the total toll model. Other size factors were significantly correlated with the total toll criterion, but they were correlated highly with the employee factor. Their addition to the model explained little of the remaining variance. In the dry cleaner case, no explanatory variables were correlated significantly with total toll usage.

As might be expected, the models of inter- and intrastate toll usage are similar to the total toll models in the types of explanatory variables used. There are, however, several basic differences between the models shown in Table 5.5 and those of Tables 5.6 and 5.7. First, the size variable "number of clerks" is still the most important explanatory variable in the retailer segment for the intrastate toll usage case. Yet, the "number of clerical employees" (typists, bookkeepers, etc.) is the only variable used in the interstate toll model. It is

TABLE 5.6

PREDICTING EQUATIONS FOR INTRASTATE TOLL USAGE
BY BUSINESS SEGMENT

Business Segment		Standard/Normalized Equations	R	n
Retailer	Y_I [1.]	$= 7.1 + \overset{(c)}{3.2} X_c + \overset{(c)}{3.1} X_{\%sm} - \overset{(c)}{.00045} X_{sol}$	$\overset{(c)}{.84}$	42
	Y_{IN} [2.]	$= 1.5 X_c + .5 X_{\%sm} - 1.0 X_{sol}$		
Manufacturer	Y_I	$= 12.6 + \overset{(c)}{6.3} X_{se} + \overset{(c)}{.002} X_{om}$	$\overset{(c)}{.79}$	47
	Y_{IN}	$= .6 X_{se} + .4 X_{om}$		
Wholesaler	Y_I	$= 53.7 + \overset{(c)}{5.3} X_{ne} + \overset{(c)}{.0000006} X_{\%sm} - \overset{(c)}{23.3} X_{se}$	$\overset{(c)}{.99}$	62
	Y_{IN}	$= .4 X_{ne} + 1.0 X_{\%sm} - .5 X_{se}$		
Realtor	Y_I	$= -20.4 + \overset{(c)}{5.6} X_{ne}$	$\overset{(c)}{.94}$	20
	Y_{IN}	$= .9 X_{ne}$		
Dry Cleaner	Y_I	= n.s.		
	Y_{IN}	= n.s.		

[a]Significant at the .05 level.

[b]Significant at the .01 level.

[c]Significant at the .001 level.

[1.]Dollar value of Intrastate toll usage for February, 1968.

[2.]Normalized Intrastate toll predicting equation.

n.s. = No significant relationships were found between Y_I and any combination of independent variables.

TABLE 5.7

PREDICTING EQUATIONS FOR INTERSTATE TOLL USAGE
BY BUSINESS SEGMENT

Business Segment		Standard/Normalized Equations	R	n
Retailer	$Y_O^{1.}$	$= 18.2 + 4.7\, X_{ce}$	$\overset{(c)}{.76}$	42
	$Y_{ON}^{1.}$	$= .76\, X_{ce}$		
Manufacturer	Y_O	$= -14.4 + \overset{(c)}{.0000008}\, X_{gom} + \overset{(b)}{6.6}\, X_{se}$	$\overset{(c)}{.89}$	47
	Y_{ON}	$= .7\, X_{gom} + .3\, X_{se}$		
Wholesaler	Y_O	$= 29.9 + \overset{(c)}{.00001}X_{gs} + \overset{(b)}{.0000006}X_{gom} + \overset{(c)}{16.1}X_{oom}$	$\overset{(c)}{.84}$	62
	Y_{ON}	$= .7X_{gs} + .2X_{gom} + .3X_{oom}$		
Realtor	Y_O	$= 7.3 + \overset{(b)}{1.1}X_{ne}$	$\overset{(a)}{.53}$	20
	Y_{ON}	$= .5X_{ne}$		
Dry Cleaner	Y_O	= n.s.		
	Y_{ON}	= n.s.		

[a]Significant at the .05 level.

[b]Significant at the .01 level.

[c]Significant at the .001 level.

1.Dollar value of Interstate toll usage for February, 1968.

2.Normalized Interstate toll predicting equation.

n.s. = No significant relationships were found between Y_O and any combination of independent variables.

not clear why this factor is correlated so highly with interstate usage or why none of the geographical variables contribute significantly to the explanation of interstate toll usage variance.

For the manufacturer segment, there is only one difference between the variables used in any of the toll usage models. The explanatory factor "number of orders taken per month" was substituted for the geographic variable "gross sales outside of Michigan" in the intrastate toll model. For the wholesaler model, the explanatory factors varied considerably among toll models. Gross sales outside of Lansing was the most important predictor of total toll usage. The percentage of total sales made to out-state Michigan customers and total gross sales are the most critical explanatory factors in the intra- and interstate toll models respectively. Also, employee factors are more important in the total toll and intrastate toll models than they are in the interstate toll case.

In general, each of the toll models includes at least one "size" factor and, except for the retailer interstate toll model, at least one "geographic" factor. The importance of these factors, however, varied greatly among models. It should also be stated that data concerning the geographic sales and supplier variables were collected on a more rigorous basis than the simple local, instate, and out-of-state factors incorporated in the models might imply. As well as a "local" and "in-state" calling area, concentric circles of three different radii were drawn on a U.S. map to represent more distant suppliers or customers. The respondent was then asked to state the percentage of suppliers and sales that came from each of these mutually exclusive geographic areas. In all cases, however, a simple local-calling area, in-state, and out-state breakdown proved to be optimum in terms of explaining variation in toll usage.

Finally, despite the fact that high correlation coefficients were obtained for most of the toll usage models, there are a number of factors that, if included in the regressions, might lead to better prediction results. First, as was discussed in the Yellow Page Advertising section, a finer breakdown of business firms according to the nature of products sold might lead to more accurate forecasting equations. Second, a detailed examination of the member of the channel of distribution that originates a telephone communication under various buy and sell situations should help to explain variations in toll usage. Finally, more detailed data on the size, importance, and location of both suppliers and customers would likely prove valuable, especially where a business user sells or buys a large percentage of its goods from a small number of firms. Because of the nature of this investigation, much of this information was impossible to obtain via a mail questionnaire. It seems likely that an in-depth personal interview with a number of individuals in each firm would have to be used to obtain information on these additional factors.

<u>Expenditures for Equipment</u>

Table 5.8 illustrates the regression models that are the best predictors of the amount spent on telephone equipment by firms in each of the five business segments. Both the retailer and wholesaler regressions yield correlation coefficients of .99, while the manufacturer, realtor, and dry cleaner predicting equations are less precise.

As expected, variations in equipment demand are best explained by size variables in all five segments. No geographic factors are included in any of the models. The

TABLE 5.8

PREDICTING EQUATIONS FOR TELEPHONE EQUIPMENT EXPENDITURES BY BUSINESS SEGMENT

Business Segment		Standard/Normalized Equations	R	n
Retailer	Y_E [1.]	$= -28.1 + .0036^{(c)} X_{sf} + 21.4^{(c)} X_o + 5.7^{(c)} X_c$	.99 (c)	42
	Y_{EN} [2.]	$= .3 X_{sf} + .3 X_o + .6 X_c$		
Manufacturer	Y_E	$= 20.5 + 13.3^{(b)} X_o + 6.0^{(c)} X_{se}$	.75 (c)	47
	Y_{EN}	$= .4 X_o + .5 X_{se}$		
Wholesaler	Y_E	$= 21.4 + 10.2^{(c)} X_o + .00002^{(c)} X_{gs} + 3.5^{(c)} X_{ne} - 6.9^{(c)} X_{se}$	.99 (c)	62
	Y_{EN}	$= .1 X_o + .7 X_{gs} + .5 X_{ne} - .3 X_{se}$		
Realtor	Y_E	$= -46.9 + 21.0^{(c)} X_{ne}$	.95 (c)	20
	Y_{EN}	$.95 X_{ne}$		
Dry Cleaner	Y_E	$= 16.0 - .00032 X_{gs} + 2.4^{(c)} X_{ne}$	.86 (a)	9
	Y_{EN}	$= -.4 X_{gs} + 1.0 X_{ne}$		

[a]Significant at the .05 level.

[b]Significant at the .01 level.

[c]Significant at the .001 level.

1. Monthly dollar amount of equipment billings.

2. Normalized equipment billing predicting equation.

variable "number of offices" is common to all three major segments but, as indicated by the normalized equations, is not the most important variable in any model. The normalized equations show that the number of clerks is the most important explanatory variable in the retailer segment; the number of salaried employees is the most important in the manufacturer segment; and gross sales is most vital for the wholesaler group. Because of the high correlation between the predictor variables in the wholesaler model, the coefficient for X_{se} carries a negative sign. Since the elimination of this variable significantly decreases the correlation coefficient, however, it is included in the model. Because of high inter-correlations among predictors, the realtor and dry cleaner equipment expenditure models contain, respectively, one and two explanatory factors. In fact, this high correlation between predictors in the dry cleaner segment causes the gross sales coefficient to carry a negative sign. Since a significant decrease in R results when only one of these variables is used, both factors are included in the model.

Equipment Demand - Number of Lines and Locations

As was the case in the equipment expenditure models, Tables 5.9 and 5.10 show high correlation coefficients for both the number of lines and number of locations regressions in each of the five business segments. The number of offices a firm has is included in each of the models used to forecast line demand for firms in the manufacturer, wholesaler, retailer, and realtor segments. But only in the manufacturer and realtor cases is this factor most important. For the retailer case, the number of clerks is again the most important predictor. Gross sales is the most critical independent variable in the wholesaler model and number of employees is most vital in the dry cleaner model.

It is surprising to note that only in the realtor case is the number of offices variable included in any of the telephone location regression models. In the other segments, variables related to the number of different types of employees are the most important predictors of this criterion. The number of clerks is most important in the retailer group, number of salaried employees in the manufacturer case, and the total number of employees

TABLE 5.9

PREDICTING EQUATIONS FOR NUMBER OF TELEPHONE LINES
BY BUSINESS SEGMENT

Business Segment		Standard/Normalized Equations	R	n
Retailer	$Y_T^{1.}$	$= 1.56 + .4^{(b)} X_o + .1^{(c)} X_c + .000001^{(b)} X_s$	$.96^{(c)}$	42
	$Y_{TN}^{2.}$	$= .3 X_o + .6 X_c + .2 X_s$		
Manufacturer	Y_T	$= 1.12 + .009^{(b)} X_s + .3^{(c)} X_o + .0002^{(b)} X_{om}$	$.80^{(c)}$	47
		$.3 X_s + .7 X_o + .3 X_{om}$		
Wholesaler	Y_T	$= 2.0 + .0000001^{(c)} X_{gs} + .02^{(c)} X_{ne} + .1^{(b)} X_o$	$.93^{(c)}$	62
	Y_{TN}	$= .5 X_{gs} + .4 X_{ne} + .2 X_o$		
Realtor	Y_T	$= 1.4 + .5^{(c)} X_o$	$.91^{(c)}$	20
	Y_{TN}	$= .9 X_o$		
Dry Cleaner	Y_T	$= 1.4 + .032^{(a)} X_y - .00003^{(a)} X_{gs} + .14^{(b)} X_{ne}$	$.97^{(b)}$	9
	Y_{TN}	$= .4 X_y - .7 X_{gs} + 1.1 X_{ne}$		

[a]Significant at the .05 level.

[b]Significant at the .01 level.

[c]Significant at the .001 level.

[1.]Number of telephone lines or trunks used by a firm.

[2.]Normalized telephone line predicting equation.

TABLE 5.10

PREDICTING EQUATIONS FOR NUMBER OF TELEPHONE LOCATIONS BY BUSINESS SEGMENT

Business Segment		Standard/Normalized Equations	R	n
		(c) (b)	(c)	
Retailer	Y_L	$= 3.8 + 1.1\ X_c - .006\ X_s$	.99	42
	Y_{LN}	$= 1.2\ X_c - .3\ X_s$		
		(c) (a)	(c)	
Manufacturer	Y_L	$= 2.2 + .5\ X_{se} + .0004\ X_{sol}$	.81	47
	Y_{LN}	$= .7\ X_{se} + .2\ X_{sol}$		
		(c) (c)	(c)	
Wholesaler	Y_L	$= -.5 + .000001\ X_{gs} + .3\ X_{ne}$	.99	62
	Y_{LN}	$= .5\ X_{gs} + .6\ X_{ne}$		
		(c)	(c)	
Realtor	Y_L	$= -1.1 + 2.2X_o$	.90	20
	Y_{LN}	$= .9X_o$		
		(a) (a) (b)	(a)	
Dry Cleaner	Y_L	$= 1.9 + .064X_y - .00004X_{gs} + .17X_{ne}$	.91	9
	Y_{LN}	$= .5X_y - .6X_{gs} + .9X_{ne}$		

[a]Significant at the .05 level.

[b]Significant at the .01 level.

[c]Significant at the .001 level.

1.Number of telephone locations maintained by a firm.

2.Normalized telephone locations predicting equation.

in the wholesaler and dry cleaner segments.

In the retailer case it is interesting to examine the relationship between the demand for lines and locations and the predictor variable number of clerks. Holding all other factors constant, the retailer demand for lines increases in approximately a 1:7 ratio with the number of clerks, while the ratio between telephone locations and clerks is approximately 1:2. In other words, for every additional seven clerks employed, one new line and approximately 3.5 new telephone locations are added. One should recognize that these values are not completely accurate since many of the factors that are interrelated with the clerk variable are not included in the line and location demand models.

As was the case with the criterion factors discussed earlier, the prediction equations very likely could be improved by including data on a number of additional explanatory variables. The inclusion of such factors as the frequency of telephone representatives sales calls; the time of the most recent salesman contact; management attitudes towards the cost and value of telephone hardware; a finer breakdown of the classes of business firms, and the importance of the telephone in selling and buying activities, could significantly improve the equipment prediction models. As it was explained earlier, the nature of the study prohibited the collection of detailed data concerning most of these additional influencing factors. Several general findings regarding the influence of certain attitudinal factors that were measured are presented later in this chapter.

Validation Sample Results

To avoid the problems that arise when the same sample is used to both construct and verify a model, the initial sample is sometimes divided into analysis and validation sets.[1] The model is derived based on the analysis set and tested or validated on the second set of respondents. Since there were a relatively small number of firms that submitted completed questionnaires, it was not possible to use a portion of these respondents as a validating sample. However, in order to validate specific aspects of the prediction models, ten non-respondents from

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[1]For a more complete discussion on the rationale of using this approach, see William F. Massy, et al., Purchasing Behavior and Personal Attributes (Philadelphia: University of Pennsylvania Press, 1968), pp. 9-10.

the manufacturer, wholesaler, and retailer segments were selected at random. Telephone interviews were conducted with individuals from these firms and data obtained on selected dependent and independent variables. Data were obtained on the demand variables total toll billings, total equipment billings, and the number of lines utilized for the month of July, 1968.[1] These variables were chosen because information on these factors could be obtained more easily by a telephone interview than data on the more specific demand factors. Information also was obtained from the respondents concerning only those explanatory variables that were correlated significantly with the three criterion factors. It was not possible in a telephone interview to collect data on all of the structural and attitudinal factors, but data were obtained on the explanatory variables used in the total toll, equipment expenditures, and number of lines models presented in Tables 5.5, 5.8 and 5.9. A number of individuals in certain firms had to be contacted in order to obtain accurate data on both the independent and criterion variables.

The regression models developed from the analysis sample were then used to predict the three criterion factors

[1]Because the month that this data was collected was not the same as that used in the analysis sample, seasonal factors were expected to affect the predictive accuracy of

for each of the thirty firms included in the validation sample. Product moment correlations between predicted and actual demand for both the analysis and validation samples are presented in Table 5.11. For the sake of sample comparisons, significance values for each correlation coefficient and mean values for all demand variables are also presented.

An analysis of the correlations presented in Table 5.11 indicates that, in general, correlations between predicted and actual values for the validation sample are somewhat lower than those previously obtained for the analysis sample. Also, a number of the multiple correlation coefficients are no longer significant because of the decrease in R values coupled with the major decrease in sample size. It is optimistic to note, however, that in those cases in which highly significant correlation coefficients were obtained for the analysis samples, the predictive ability of the regression models on the validating data remains quite high. This is particularly true for the number of lines criterion across all three segments.

As expected, the greatest variance in the validation and analysis sample results can be seen in the toll usage

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the total toll models. However, these seasonal factors should have little influence on the demand for equipment.

TABLE 5.11

COMPARISON OF REGRESSION RESULTS OBTAINED FROM ANALYSIS AND VALIDATION SAMPLES

Business Segment/ Demand Criterion	Analysis Sample Statistics				Validation Sample Statistics			
	n	$\overline{X}$*	R**	Sig.	n	$\overline{X}$	R	Sig.
Manufacturer								
Total Toll ($/month)	47	$264.17	.90	.001	10	$229.18	.47	n.s.
Equipment Expenditure ($/month)	47	161.74	.75	.001	10	154.37	.57	n.s.
Number of Lines	47	3.71	.80	.001	10	3.47	.69	n.s.
Wholesaler								
Total Toll ($/month)	62	271.67	.98	.001	10	243.67	.56	n.s.
Equipment Expenditure ($/month)	62	181.98	.99	.001	10	173.96	.79	.05
Number of Lines	62	3.72	.93	.001	10	3.95	.81	.10
Retailer								
Total Toll ($/month)	42	109.17	.86	.001	10	87.57	.43	n.s.
Equipment Expenditure ($/month)	42	231.52	.99	.001	10	239.41	.84	.05
Number of Lines	42	5.05	.96	.001	10	5.25	.86	.05

*Sample means for criterion variables.

**R = multiple correlation coefficients for relationships between demand factors and predictor variables listed in Tables 5.5, 5.8, 5.9.

predictions. Even though there is no significant difference between the mean value of toll usage for the two samples, the correlation between predicted and actual toll values for the validation sample is much lower than is the case in the analysis sample. This indicates that some factor not included in the model has a seasonal influence on toll demand. Whether this factor is related to past or anticipated sales or some other variable cannot be determined from the limited data obtained in this study. It may be that the factor causing a variation in toll usage over time could be included in a general model by using a dummy variable to represent a seasonal influence. It is more likely, however, that models have to be developed that are based on both a finer breakdown of commerical users and specific months or periods of the year.

Effect of Attitudinal Factors on the Demand Models

The regression models discussed previously in this chapter are conspicuous by the absence of any behavioral or attitudinal factors. Certain attitudinal variables are found to be correlated significantly with several criterion factors, but these variables contribute little additional information to the demand models that include purely structural explanatory factors. In other words, basic communication needs and demand are best explained by the traditional classificatory variables related to firm type and size, number of various types of employees, products handled, and geographic sales and supplier patterns. There are several possible explanations for this.

1. Significant variances were shown to exist[1] for several attitudinal variables across the five business segments; however, these variances were not great enough within segments to contribute significant additional information to the models developed using the structural variables.
2. Where variances in attitudinal scores or rankings were significant among firms in the same segment, the variances are highly correlated with certain classificatory variables and thus add little information to the structural models.
3. Certain attitudes may not be relevant to the demand criteria. In other words, although attitudes were hypothesized to affect demand behavior, some of

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[1]See Chapter IV, pp. 109-119.

the attitudes measured in this study probably are not relevant to telephone usage and/or purchase behavior.

4. The attitude measurement techniques used in this study may not have been exact enough to discriminate among various types of users of telephone offerings. Also, some of the respondents may not have been directly responsible for telephone related buy decisions. Their attitudes, therefore, would have little, if any, impact on the demand behavior of the firm. In other words, significant attitudinal variances among respondents might be determined. But if the individuals holding these varying attitudes have no effect on the demand behavior of the firm, little association between attitudes and demand can be expected.

While the addition of attitudinal variables to the predicting equations adds little information to most of the models, several of the attitudinal factors show interesting variations and relationships with other explanatory and dependent variables. Some of these relationships were discussed in Chapter IV.[1] Several others will be mentioned

[1]See pp. 109-19 and p. 140 in Chapter IV.

in the following paragraphs.

One attitudinal variation that has not been mentioned previously is the relative importance of management's attitude toward telephone communications as related to its use as a service, cost saving, or means of obtaining new customers. No significant correlation between this attitude and demand could be determined. Yet, it is interesting to note that the large majority of retailers (80%) and dry cleaners (100%) viewed telephone communications primarily as a service. Realtors were divided in their attitudes. 47% placed greatest emphasis on telephone communications as a service and 53% saw it as an important tool in attracting new customers. Wholesalers (70%) and manufacturers (78%) placed a substantial amount of importance on telephone communications as a cost saving mechanism. Very few firms (approximately 5% in each segment) stressed its importance as a new customer generator. These categories are not mutually exclusive. Nevertheless, the emphasis placed on each activity by firms in the various segments provides some insight concerning management's attitudes toward the uses and value of telephone communications.

If these perceptions are viewed across all segments and related to firm size, it is interesting to note that 48 or the 55 largest[1] firms in the wholesaler and manufacturer segments and 7 of the 12 largest firms in the retailer segment viewed telephone communications as most important to their firms because of its cost-saving qualities. Since this implies heavy users of telephone equipment and services have adapted their usage patterns primarily on the basis of cost saving motives, a wise selling strategy may be to emphasize some other aspects or benefits of telephone communications to these users. This is especially true if this motive has been heavily emphasized in past sales approaches and its demand-creating ability has been exhausted for the frequently contacted large customer. On the other hand, the retailer potential demand may be better realized by emphasizing the added cost savings that result from increased telephone equipment and/or service utilization. This strategy, however, would be logical only for large firms that are burdened with heavy amounts of written communication requirements. A heavy

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[1]Total number of employees is used in this case as the size variable.

emphasis on cost savings in smaller firms could lead to a decrease in telephone equipment and service usage, rather than the desired increase.

Another attitudinal factor included in the survey concerns customers' forecasted response to a hypothetical increase in toll rates. Several studies have indicated it is difficult to predict accurately purchase or usage behavior solely on the basis of intentions to buy.[1] However, it was hoped that information on this "intentions" variable might provide some insight regarding the sensitivity of toll usage to a potential rate increase. Accordingly, respondents were asked to estimate their firm's expected demand response to a 20% increase in both intra- and interstate toll rates. The 20% figure was chosen following pilot sample results that indicated this figure represented a change that was realistic, yet large enough to cause significant variation in customer response.[2]

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[1]For example, see George Katona, The Powerful Consumer (New York: McGraw-Hill Book Company, 1960), Chapter VIII; and James Tobin, "On the Predictive Value of Consumer Intentions and Attitudes," Review of Economics and Statistics, February, 1959, pp. 1-11.

[2]Initially, it was planned to also include questions regarding expected responses to a 20% decrease in toll rates, but pre-test results showed no variation in responses. All pre-test respondents indicated their toll usage behavior

Analysis of responses indicates that in very few cases did respondents expect the decrease in either intra- or interstate toll usage time to be as large as the corresponding increase in toll rates. In other words, the responses in general indicate a rather strong inelasticity of demand for toll usage. There are, however, several interesting variations in user intentions across business segments, different size firms, and varying communication uses.

Table 5.12 indicates that respondents in the manufacturer and wholesaler segments expected a much greater decrease in interstate toll usage to result from an increase in toll rates then was true for firms in the other three segments.[1] A more detailed examination of responses indicates this difference results primarily from the expected

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would not be affected at all by a 20% decrease in toll rates. Possible explanations for this somewhat surprising inelastic demand response are given in this section.

[1]A chi-square test was used to test the hypotheses that the rate chance had the same affect on the manufacturer-wholesaler groups combined as on the retailer, realtor, and dry cleaner groups combined. This hypothesis was rejected at the .001 level. No significant differences were observed, however, between the manufacturer and wholesaler responses or between the retailer, realtor, and dry cleaner responses.

TABLE 5.12

NUMBER OF FIRMS EXPECTING DECLINES IN INTERSTATE TOLL USAGE RESULTING FROM A 20% INCREASE IN TOLL RATES BY BUSINESS SEGMENT

Business Segment	Expected Decrease 0-10%	10-20%	20-30%	30-40%	>40%
Manufacturer	25 (.53)	14 (.30)	5 (.11)	3 (.06)	0 (.00)
Wholesaler	41 (.66)	12 (.19)	7 (.11)	2 (.03)	0 (.00)
Retailer	37 (.88)	5 (.12)	0 (.00)	0 (.00)	0 (.00)
Realtor	21 (.91)	2 (.09)	0 (.00)	0 (.00)	0 (.00)
Dry Cleaner	9 (1.00)	0 (.00)	0 (.00)	0 (.00)	0 (.00)
TOTAL	133 (.73)	33 (.18)	12 (.07)	5 (.03)	0

*Figures in parentheses indicate the proportion of respondents in each segment that expect the designated decrease in toll usage.

impact of the rate increase on toll communications with suppliers. Although very few firms in any segment expected a decrease in communications with customers to result from a rate increase, many firms in the manufacturer and wholesaler segments did foresee a substantial decrease in supplier toll communications. This implies that customer telephone communication is relatively insensitive to rate changes while supplier telephone communication might be severely affected by a rate increase--particularly for those firms in which telephone communications is heavily relied upon for supplier contacts.

Although not included in Table 5.12, these same relationships exist for the intrastate toll communication case. The only area where the results seem to differ between the intra- and interstate cases is where the amount of instate toll usage for a firm differs substantially from the out-state usage. If a firm's toll calls are primarily out-of-state, the proposed rate increase is expected to have a much greater impact on interstate usage. This is logical, since absolute cost increases resulting from the rate increase would be much more significant in the high usage area than in the low usage toll component.

If the firms are segmented into heavy and light users[1] of toll service, a somewhat different pattern appears. The relationship between heavy and light interstate toll users and expected responses to a rate increase is shown in Table 5.13. This table shows that heavy users of toll service generally are less likely to expect decreases in either intra- or interstate toll usage to result from a rate increase than light users. These findings are particularly true for the manufacturer, wholesaler, and retailer segments where the variance between heavy and light toll users is greatest. A possible explanation for this finding is that the heavy user is also usually the larger firm. Telephone toll costs are viewed as relatively insignificant when compared to other expenses incurred by the firm. Conversely, the light users, generally the smaller sized firms, probably view telephone toll costs as a much larger expenditure relative to the total expenditures of the firm. This would suggest that the small firm is much more sensitive to changes in toll rates. Unfortunately,

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[1]If a firm was in the top 25% of the toll users in a business segment (based on a month's total toll billing) it was considered a heavy user; likewise, a firm in the bottom 25% was classified as a light user.

TABLE 5.13

EXPECTED RESPONSE OF HEAVY AND LIGHT INTERSTATE TOLL USERS TO A TOLL RATE INCREASE BY BUSINESS SEGMENT

Business Segment	Average[1] Expected Decrease in Usage: Heavy Users	Light Users
Manufacturer	6.7%	11.1%
Wholesaler	7.0	13.0
Retailer	6.0	10.5
Realtor	5.0[2]	6.7
Dry Cleaner	5.0	5.0

[1]The arithimetic mean is used here to denote the average decrease. The mean was calculated using the mid-points of the ranges shown in Table 5.12. Thus, 5% was used for all firms expected a 0-10% decrease; 15% for firms expecting a 10-20% decrease, etc.

[2]The fact that the percentage values for heavy and light users are nearly equal in the realtor segment and identical in the dry cleaner segment can be explained by the fact that 21 out of 23 respondents in the realtor group and all nine of the respondents in the dry cleaner group expected their usage to decline by 0-10% (see Table 5.12).

no data were collected concerning the cost factors for each firm; and, without this information, the actual relationships between toll billings as a proportion of a firm's variable costs and the perceived responses to increased rates can only be hypothesized.

One other point concerning the apparent insensitivity of the heavy toll user to increases in toll rates should be mentioned. The heavy user, while not perceiving a substantial decrease in usage to result from an increase in rates, may also consider alternatives such as WATS to be much more feasible and attractive when toll rates increase. Thus, the heavy user's sensitivity to rate increases might also be measured by the ability and tendency to switch to alternatives such as WATS. Unfortunately, such alternatives were not included in the possible responses. Therefore, no accurate inferences can be made concerning the cross-elasticities of demand that might exist for these types of services.

In summary, most respondents in all segments expected toll usage to be affected only slightly by a 20% increase in toll rates. Respondents in the wholesaler and manufacturer segments did indicate, however, that telephone communications with suppliers would be most seriously affected by a rate increase. Also smaller firms or lighter users of toll services seem to perceive more serious cut-backs in toll usage than do the larger firms or heavy users.

If we assume that the reactions given to the hypothetical rate increase are indicative of what actually would happen if toll rates were increased, certain managerial and regulatory implications are suggested. First, it is difficult to estimate precisely how much total revenue would increase or decrease as a result of a change in toll rates. But the findings presented here indicate that for some segments of the commercial market an increase in rates would lead to a substantial increase in revenue. For those segments or businesses where toll communication is extremely vital to a firm's operations, an effective strategy might be to raise toll rates substantially. This strategy of higher rates in inelastic segments is viewed by some utility personnel as simply pricing services highest where the "value of service" is greatest. For example, a representative of Consumers Power Company stated that "In designing a rate schedule, we price those services closer to marginal costs that have a low value of service, and we price those services further away from marginal costs that have a high value of service.[1] Thus, from a managerial point of view, a more profitable segmentation strategy based on the value of service concept could be designed whereby rates are increased to specific inelastic segments.

The social implications of this type of strategy might lead to a different regulatory policy, however, especially where inelastic segments are least able to bear the burden of higher rates. For example, this study primarily dealt with small and medium sized firms and not with the large corporations. The majority of firms responding may not have had the option of adopting such alternatives as WATS because of their limited volume of toll calls. Where the large firm may opt for WATS rather than accept an increase in toll rates, the medium and small size firms would have to simply live with increased costs. In these cases, regulatory policies might be designed to either protect certain inelastic segments from high rates or allow

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[1]William J. Jefferson, "Comment," in Performance Under Regulation, Ed. by Harry M. Trebing (East Lansing, Michigan: Institute of Public Utilities, Division of Research, 1968), p. 103.

toll rates to be increased in certain commercial segments. The added revenue could then be used to subsidize lower toll rates in more price sensitive commercial or residential sectors. The possibility that competition would find these "high rate" segments profitable future targets, however, makes the long run implications of this type of policy somewhat questionable.

In summary, the attitudinal factors discussed in this section and in Chapter IV contribute little to the prediction models. They do provide some interesting, and, perhaps helpful, insights concerning possible variations in marketing approaches to the different commercial market segments. In addition to the strategy types of inferences, a number of regulatory or policy implications were suggested by these attitudinal responses. These and other regulatory and managerial implications are discussed again in greater detail in Chapter VI.

Probabilistic Demand Models: Concept and Illustration

From a strategy viewpoint, it would be advantageous for a supplier to be able to assign some likelihood to a firm's increasing its demand for a product and/or service. For example, a salesman would benefit if he could determine the probability of a customer increasing his demand for a specific offering solely on the basis of some knowledge of certain descriptive characteristics of the customer. This ability would help the salesman allocate his time among customers in an optimal fashion. Where the customer is a multiple purchaser,[1] this knowledge would also suggest those products and/or services that have the highest potential for increased sales or usage.

To illustrate the applicability of this type of analysis, the criterion variable "number of lines" was chosen for analysis. Several reasons dictated the use of this demand criterion. First, this variable is discreet in nature, and the variance in this demand factor is, generally, quite low. Second, in most segments one or two independent variables explain over 90% of the variance in this criterion variable. Since the sample size is quite small, using more than two explanatory variables in the conditional probability matrices would make many cell sizes extremely small. Finally, this criterion variable is the only dependent factor that is correlated strongly

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[1]Multiple purchaser as used here means a customer who purchases more than one type of product or service from the same supplier.

with the same two explanatory variables across all segments. This means that all responding firms can be used as a base for developing the probabilities rather than arriving at different probabilities for each segment. It is likely that a separate analysis of each segment would improve the accuracy and validity of the probability estimates; however, the purpose of this analysis is simply to illustrate the applicability of using this approach for discriminating between customers of high and low demand potential.

The two factors chosen as indicator variables for the number of lines criterion are the number of offices and number of employees associated with each firm. Frequency distributions including these three variables are derived by combining respondents from all five segments. These distributions are then used to calculate conditional probabilities of the form:

$P = p(L/E,O)$ where P = probability of a firm with E number of employees and O number of offices demanding L number of lines.

These explanatory variables may not be the best predictors of the criterion for any one segment, but they are the two factors which are correlated most highly with the number of lines criterion over the combined segments. The probability matrices relating the predictor variables, both individually and combined, to the criterion are presented in Tables 5.14, 5.15, and 5.16. Table 5.16 shows the probability of "trunk" or line demand for a firm conditional on both the number of employees and number of offices the firm maintains.

Because of the relatively small sample size and large variance in predictor variable values, ranges are established for both the employee (E) and office (O) variables. These ranges were determined such that the number of values occurring in each vector of the frequency table were approximately equal and yet large enough to calculate a probability value for each cell. Ideally, a finer breakdown of all variables would be preferred, particularly in the number of employees case in which only three categories were used. Any expansion in categories, however, would have created a number of vectors in which few if any entries exist. This would make the calculation of probabilities totally unrealistic, if not impossible. The number of data points, therefore, constrains or limits the size of the conditional probability matrix.

Another consideration in structuring a probability matrix to be used for predictive purposes is that the terms in the matrix should be as close to "zero" or "one" as possible. This means that, given a specific number of employees and offices, the probability of a firm demanding some specified number of lines is either one or zero. Varying the number, or size, of the intervals used for the predictor variables might better satisfy the zero-one criteria, but the amount of information provided in the model would also decrease. In other words, even though increasing the width and decreasing the number of intervals used for the predictor variables might better satisfy the zero-one criteria, the usefulness of such a strategy for management decisions would be reduced greatly. This problem is clearly shown in the data presented in Table 5.14.

Because the ranges established on the employee variable are large, the managerial value of the information provided in the probability matirx in Table 5.14 is limited.[1] For example, in the 0-10 employee column, there

[1]Due to the size distribution of firms, it is not possible to expand the number of employee breakdowns. As mentioned earlier, increasing the number of employee categories would place an extremely small number of firms in some size categories and make the associated probability values totally unreliable.

TABLE 5.14

CONDITIONAL PROBABILITY MATRIX RELATING LINE DEMAND TO NUMBER OF EMPLOYEES
(P(L/E))

Number of Employees	Number of Lines 1	2	3	4	>4
0-10	.42	.31	.18	.06	.03
11-40	.03	.18	.51	.17	.11
>40	.00	.05	.29	.31	.35

is nearly an equal probability that a firm will use either one, two, or greater than two lines. There are two possible reasons for this. The demand for lines is either extremely sensitive to changes in the number of employees for these smaller size firms or sensitive to changes in some other variable. It is obvious, however, that only knowledge of the fact that a firm has from 0-10 employees is of little administrative use. Either a finer breakdown of the employee factor or some information on additional variables is needed.

This same basic problem exists on the opposite end of the employee spectrum. For the greater than forty employee category, an almost equal probability exists that a firm will demand either three, four, or more than four lines. As in the previous case, this could be the result of a greater demand sensitivity to changes in the employee factor than is shown in the matrix or due to the influence of some other variables not included in the probability model.

The information provided in Table 5.14 is not of great managerial use because of the wide ranges establish on the employee predictor; however, the data in this table do provide some insight concerning the highest potential demand customers. Based only on the employee variable, the utility salesman should contact those firms that have greater than forty employees but use only one or two lines. It seems likely that these firms are "under-lined" and would be the best prospects for additional line demand.

Table 5.15 shows the demand for lines conditional on the number of offices a firm maintains. This matrix provides more useful information than that presented in Table 5.14 since each office category has but one high probability value associated with it. For example, for those firms having one office, the probability is .62 that

TABLE 5.15

CONDITIONAL PROBABILITY MATRIX RELATING LINE DEMAND TO NUMBER OF OFFICES (P(L/O))

Number of Offices	Number of Lines 1	2	3	4	>4
1	.62	.30	.08	.00	.00
2	.15	.48	.22	.13	.02
3	.06	.30	.46	.16	.02
4,5,6	.00	.12	.24	.44	.20
>6	.00	.04	.14	.22	.60

the firm will have one line and .92 that the firm will have not more than two lines. Likewise, for those firms having more than six offices, the probability is .82 that four or more lines will be utilized.

Table 5.16 presents the probabilities for line demand conditional on both the number of offices and number of employee variables. Because the matrix entries in Table 5.16 are closer to zero or one, the probability values included in the table are much more useful than those included in Tables 5.14 or 5.15. When demand is conditional

TABLE 5.16

CONDITIONAL PROBABILITY MATRIX RELATING LINE DEMAND TO NUMBER OF OFFICES AND NUMBER OF EMPLOYEES (P(L/E,O))

No. of Empees	No. of Offices	Number of Lines 1	2	3	4	>4
0-10	1	.75	.20	.05	.00	.00
	2	.18	.64	.08	.10	.00
	3	.04	.25	.58	.09	.04
	4,5,6	*	*	*	*	*
	>6	*	*	*	*	*
10-40	1	.41	.46	.13	.00	.00
	2	.07	.15	.65	.10	.03
	3	.02	.08	.62	.18	.10
	4,5,6	.00	.04	.32	.43	.21
	>6	.00	.02	.13	.17	.67
>40	1	**	**	**	**	**
	2	.00	.04	.09	.32	.55
	3	.00	.07	.20	.27	.46
	4,5,6	.00	.00	.05	.20	.71
	>6	.00	.00	.05	.20	.75

*No firms with 0-10 employees had greater than three offices.

**No firms with greater than 40 employees had only one office.

on these two independent factors, a higher probability exists that a firm will use a specific number of lines than was the case when only one of the predictive factors was used. One could hypothesize that, given a larger sample and an additional explanatory factor, even more exacting estimates of demand would be achieved.

The information provided in Table 5.16 could be of significant assistance in the structuring of a priority system for assigning salesmen to prospective users of additional lines. If one assumes that the number of offices and number of employee variables are the only factors affecting a firm's demand for lines, a system could be structured whereby firms are ranked according to the expected return resulting from a salesman contact. For example, a simple expected value calculation could be derived for each customer based upon the information included in Table 5.16 and some knowledge of the costs and revenues associated with installing additional line capacity. If the expected value of a salesman's contacting a firm "A" is denoted by E.V.(A), then:

$$E.V.(A) = P_A(L_n) \times P(L_n - L_A)$$

where: L_A = number of lines firm "A" presently uses.

L_n = all line values greater than L_A that firm "A" could demand.[1]

$P_A\ (L_n)$ = probability of firm "A" demanding L_n lines.

$P\ (L_n - L_A)$ = profit resulting from a firm adding $(L_n - L_A)$ lines.

Since cost and revenue information related to the installation of additional line capacity was not obtained, actual expected value calculations are not made. However, this method should provide a more accurate system for allocating sales calls than would a method derived from the regression models. If one were to use the difference between actual demand the predicted demand value obtained from the regression model to arrive at a potential demand figure, information concerning the firm's varying probabilities of demanding additional numbers of lines would be lost. Because the conditional probability matrix includes information on the varying likelihoods of a firm demanding a

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[1]For the probability matrix presented in Table 5.16 no probabilities are given for any single number of lines greater than four. Ideally, a larger sample size would allow the inclusion of values much greater than this and permit greater exactness in the derivation of expected values.

specific number of additional lines, it should provide a good system for analyzing demand and allocating sales effort among prospective customers.

There are several limitations inherent in the use of conditional probability matrices. First, average actual demand values are used to derive potential demand. This means that firms in each employee-office category that have the highest actual demand also have zero potential demand. This, of course, may be misleading since high users may at times also be good prospects for additional usage.

A second limitation is that the calculation of conditional probability values was based on frequency distributions for all segments combined, rather than for each individual segment. Since the regression models were more accurate when developed for individual segments, it is logical to assume that probability models developed on a segment basis would also be more accurate. The limited sample sizes, however, prohibited this type of analysis.

Finally, just as the small sample size prohibited an analysis on an individual segment basis, this factor also limited the number of explanatory variables that could be incorporated in the probability models. Independent variables had to be used which were correlated most highly with the criterion across all segments. Since the variables chosen were not necessarily the best predictors of line demand for each segment, the probability matrices derived were likely less than optimum.

Summary

In this chapter, the varying influences that different structural and attitudinal variables had on each demand criterion were examined in detail. Linear multiple regression models were developed to illustrate how these explanatory factors interacted to affect demand. The results of these regressions are encouraging since the structural variables were good predictors of nearly all criterion factors for the five business segments. High correlation coefficients between actual and predicted values were obtained by using a maximum of four explanatory variables.

Several attitudinal variables were significantly associated with a number of criterion factors. These variables, however, did not contribute a significant amount of additional information to the structural-based forecasting models.

A number of transformations were attempted on certain independent variables in an effort to improve the predictive accuracy of the models. In all cases, however, these transformations led to little, if any, improvement in the basic linear regression models.

In general, the demand models varied greatly across the five segments--both in terms of the predictors used and the forecasting accuracy achieved. The basic segmentation strategy used in this study clearly indicates the varying effects that certain independent variables have on telephone demand in each of the business classes.

To show how data on a few, easily measured structural variables might be used to select customers of high potential demand, conditional probability matrices relating the number of lines criterion to the number of employee and number of office predictors were constructed. Although the accuracy of these matrices was limited by the relatively small sample sizes, these matrices provide a useful way for analyzing demand.

The managerial and regulatory implications of some of the findings presented in this chapter and Chapter IV, as well as some suggestions for additional research, will be the major subject of the next chapter.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Introduction

This dissertation focuses primarily on examining the relationships between selected business firms' structural and attitudinal characteristics and the demand for specific telephone communication products and services. The primary objectives of the research were:

1. To determine empirically the effect that certain variables associated with different types of business firms have on the demand for various telephone utility offerings.
2. To incorporate these demand influencing variables in models that can be used to forecast individual firm telephone communication requirements.
3. To determine the accuracy and usefulness of the models and to evaluate the managerial and regulatory implications of the research findings.

The scope of the study was limited to a stratified sample of business firms in the manufacturer, wholesaler, retailer, realtor and dry cleaner business segments in the Greater Lansing area. Questionnaires were sent to owners or managers of each sampled firm. Information was requested concerning the structural characteristics of the firms and the respondents' attitudes toward the value of various telephone communication offerings. Although the "structural" portion of the questionnaires differed somewhat for each business segment, the attitudinal sections were the same for all business firms. Telephone interviews with ten firms from the manufacturer, wholesaler, and retailer segments that had not responded to the mail questionnaire were used to obtain data on selected independent and dependent variables. These data were used to test and validate several models for each of these three segments.

Factor analysis was used to identify the meaningful dimensions and critical variables influencing demand behavior in each segment. These variables were incorporated in the regression equations that served as the basic predictor models.

General Findings

This study shows that individual firm demand for telephone communications offerings can be estimated using key structural or classificatory variables. The regression and correlation techniques used in the analysis were helpful for examining the relationship between firm characteristics and demand and for forecasting customer communication requirements. Highly significant correlation coefficients were obtained for most of the regression models.

Linear demand models fit the data examined in this study most precisely. Transformations on certain independent variables were tried when an examination of residuals indicated that a non-linear model might provide a better fit for the data. However, these transformations did not improve the forecasting accuracy of the demand models significantly.

Even though cause-effect relationships cannot be proven, an analysis of the regression models implies that structural types of factors have the greatest influence on individual firm demand. The principal components analysis showed that the most important explanatory variables grouped themselves along the basic dimensions of firm size, geographic sales variations, supplier characteristics, and employee types. Structural variables from these four areas were the primary explanatory factors used in the demand models.

Several conclusions can be stated regarding the correlations between structural variables and demand criteria. First, size variables generally were correlated more highly with demand criteria across all segments than were any other types of independent factors. However, the correlation between specific size factors and demand criteria varied greatly across the five segments. For example, the total number of employees variable was correlated highly with nearly all demand criteria in the wholesaler segment. However, this explanatory variable was associated weakly with the dependent variables in the manufacturer case. In the manufacturer models, the number of salaried employees was the best indicator of demand.

Second, although there was usually a high degree of correlation among the size variables, certain size variables were correlated much more highly with each demand criterion than were others. For example, in the retailer segment the size variable total number of employees had a much higher correlation with all demand criteria than did most other dependent factors. This indicates that some other factors besides firm size influences the demand for Yellow Page Advertising. These relationships between firm size and demand also suggest that a careful examination of each type of business is needed before the indicators and causes of demand can be determined accurately.

As expected, the explanatory factors related to geographic variations in customer locations, sales, and supplier locations most strongly affect the toll usage criterion variables. This is particularly so in the manufacturer and wholesaler segments where differences in these geographic factors are most likely to occur. The absolute number of suppliers and/or the amount of gross sales corresponding to local, in-state, and out-of-state regions were the geographic factors most frequently used in the demand equations. However, there were several cases where the percentage of total sales, and not the actual amount of sales occurring in a given geographical area, was most critical. The wholesaler and manufacturer Yellow Page Advertising demand models is the most obvious case. Here, the percentage of a firm's sales made to customers in the local calling area was a major variable influencing Yellow Page usage.

The addition of attitudinal variables to the structurally based demand models did not improve the forecasting accuracy of the models significantly. Most of the attitudinal responses, although varying significantly among business segments, did not vary significantly within business classes. For example, there was a substantial difference between what respondents in the retailer and manufacturer segments perceived as being the most important and time consuming function of telephone communications. However, there was little difference in these perceptions for firms in the same segment. Since the demand models were constructed on an individual segment basis, this meant that attitudinal factors contributed little to explaining the variance in the demand criteria.

The respondents' perceived or expected reaction to an increase in toll rates, however, did vary both within and across segments. The major influence on variations within segments was the size of the firm. In general, respondents from smaller firms expected toll usage to decrease much more in response to a rate increase than did those in larger firms. Since toll usage varied directly with firm size, this also meant that light users were more insensitive to toll increases than were heavy users.

Respondents from larger firms also perceived themselves as more aware of the total array of available telephone services than did respondents of smaller firms. Thus, demand, or usage, was related positively to the perceived understanding factor. However, because of the mediating size variable and other possible influencing factors, no definite statements or conclusions concerning the effect of providing light users with additional information can be made.

Implications of the Study

Several points should be emphasized before any specific implications of the research are discussed. First, public utilities cannot in general adopt changes in their pricing or product strategies without first obtaining approval from the appropriate regulatory agencies. Therefore, any implications or suggestions resulting from this study are subject to the unique limitations of a firm operating under regulatory constraints.[1]

[1] For a discussion of some of these constraints, see Chapter I, pp. 8-15.

Second, because the basic objectives of the study were managerial, the implications suggested by the data are primarily administrative in nature. However, as a result of the investigation several regulatory implications are also suggested. Since more detailed information is required before specific inferences can be drawn concerning the regulatory issues, these problems are covered in the section dealing with future research.

Third, the study was conducted in a limited geographical area among specific types of business firms. As such, many of the findings and implications suggested by the research may not apply to different types and/or sizes of firms. Also, variations in rates or product offerings for different utilities and geographical areas may limit the general applicability of the research findings.

Two general types of explanatory variables were analyzed in an effort to better understand and predict a business firm's demand for telephone offerings:

1. Structural or classificatory variables, which although uncontrollable, are in many cases capable of measurement and prediction over time.
2. Attitudinal variables, which are less easily monitored but which could be influenced by

variations in the utility's marketing strategy over time.

The extent to which each class of variables influences demand determines the usefulness of the models for forecasting and strategy purposes.

Since demand for most of the dependent variables was found to be most sensitive to changes in the structural factors associated with the firm, the models are useful for forecasting purposes. A periodic monitoring of the structural variables can help a utility identify changes in the demand requirements of its customers. It can also provide information concerning the best prospects for salesmen to contact. Probability models of the type illustrated in Chapter V, where a limited number of these structural factors are used as predictors, provide one method whereby only a few explanatory variables require monitoring.

The attitudinal factors provided little information for the demand models. However, variations in these factors across segments suggests that different marketing or selling strategies should be used for different market segments. For example, the survey results showed that most manufacturers viewed telephone communications as most important to their firms because of its cost-saving qualities. The majority of realtors, however, saw telephone communications as an important tool for use in attracting new customers. Thus, cost saving aspects of additional telephone offerings might be used when selling to one business segment and the use of additional telephone offerings for attracting new customers stressed as a sales appeal to another segment. Utility salesmen should be cognizant of these influences when analyzing the wants and needs of different classes of business customers. Changes in key influencing factors are likely to occur over time. Salesmen would benefit from assessing the possible impact of such changes on the demand for each service.

The forecasting models developed for telephone equipment and service demand suggest that similar models might be structured for other regulated and non-regulated industries. In regulated industries, structural variables may be of primary significance in explaining customer demand. In more competitive industries additional behavioral types of variables would probably have to be included to account for variances in the buyer's choice of suppliers. Thus, a competitive environment offering choices among alternative suppliers and products would likely lead to more complex forecasting models. Such models would not only contain factors indicating total demand for a particular type of product, but also variables to predict a customer's allocation of demand among competing suppliers.

The fact that structural variables were used to forecast demand successfully on a limited geographic and customer basis has other general implications for the development of more macro-oriented models. Forecasting equations similar to those developed in this study could be structured for other business firms. By combining this information with various census and trade data on the number and sizes of firms located in geographical areas, state-wide estimates of both actual and potential usage patterns would be developed. Thus, instead of using various economic indicators to forecast changes in demand, a build-up method based on a detailed analysis of different classes of business customers might provide a more accurate model for predicting short and long run changes in demand patterns.

The variations in perceived or expected reactions to a hypothetical toll rate increase suggest that the value of toll telephone services differs substantially among business customers. In those cases where customer demand was relatively inelastic to a toll increase, revenues would be increased substantially through higher rates. Likewise, the apparent sensitivity of certain firms to rate increases suggests that a maintenance of existing rate structures or a possible decrease in rates would be a more appropriate pricing strategy for still other segments.

Two factors may limit the utility's ability to increase rates in the more price-inelastic segments of the market. First, telephone utilities today face increasing competition in a number of product and service areas. This suggests that a discriminatory pricing strategy leading to highly lucrative returns from certain customers may also lead to increased competition in those segments. When this is combined with the regulatory consequences that might result from certain discriminatory pricing techniques, the long run interests of the utility might be served better in some cases if a policy of pricing "what the traffic will bear" is avoided.

It does seem likely, however, that a more effective pricing strategy could be developed based on a more careful analysis of the value-of-service concept or some other segmentation criteria. For if firms differ greatly in their needs and uses of communications offerings, as this study shows, they may also differ in the amount they are willing and able to pay for these services. The differences in these demand elasticities requires more careful analysis, however, before discriminatory strategies that are both optimal and fair can be developed.

Several findings also point to a need for more effective communications between the utility and its customers. First, many respondents perceived their understanding of the communications alternatives available to them to be quite poor. Allied with this finding was the fact that the majority of respondents indicated they depended almost completely on the utility salesman for suggestions concerning both the types and amount of telephone communications equipment or services to utilize. A better satisfaction of each customer's communications needs would result from (a) a more accurate and detailed information flow between buyers and sellers regarding the various product and service offerings and their uses, and (b) a greater understanding on the part of the utility salesman concerning the variables that most directly affect the demand for each offering.

Some of the findings concerning managerial recommendations that were discussed in the preceding paragraphs also suggest certain regulatory implications. For example, a more discriminatory pricing or rate making strategy based on the value of service concept or the relative sensitivity of the user to rate increases might result in high rates for certain segments of customers that are least able to bear the added cost burden. In the telephone utility area, this would be particularly true for smaller firms that have few alternatives available when performing certain types of communications activities. A policy of charging these relatively inelastic segments extremely high rates may lead to regulatory constraints that essentially control the specific prices that can be charged certain types or sizes of customers.

Another area where regulatory policy may have greater impact in the future concerns the manner in which "buy" decisions are made by users of telephone or other utility services. This study was not structured to obtain information on how well each firm's present array of telephone communications products matches its needs. Nevertheless, the lack of understanding of offerings and the dependence on utility salesmen for guidance suggests that there may be many cases where firms are either under--or over--utilizing certain types of offerings. Also, there may be specific needs of certain classes of business customers that could be better satisfied by some new or modified product offering. More detailed studies patterned closely to this one are needed in which demand is viewed from an individual firm rather than industry level. These studies can provide regulatory agencies with better ways of evaluating the efficiency with which the present utility marketing system satisfies the varying demands of different business firms.

Suggestions for Additional Research

Many of the implications and recommendations discussed previously should be viewed as tentative suggestions requiring greater research and expanded data analysis. Some suggestions were made in each of the last two chapters concerning the kinds of additional data that should be collected to expand the models and improve their forecasting accuracy. There are, however, a number of other areas where this study suggests further research efforts are needed.

1. An expanded study that considers a greater array of customer types and sizes as well as an expanded list of possible explanatory variables should be constructed. Such factors as seasonal and geographic influences on demand and a more detailed examination of the effect of attitudinal variables on usage rates are examples of the types of additional predictors that should be studied. It is likely that the detailed nature of much of this information would require the use of personal in-depth interviews rather than the mail survey technique that was used in this study.
2. This study made little attempt to assess the relative importance or influence of certain controllable variables on the different demand criteria. It seems likely, however, that factors such as personal selling and advertising would help to explain some of the variance in the demand variables among different customers. By examining the effect of such variables on demand in different buy situations, more efficient allocations of advertising and selling efforts might

be made. Such research should also provide a better understanding of the role that regulation might take in controlling the amounts and types of promotional activity engaged in by a public utility.

3. The value of various types of telephone products and services and the relative price elasticity of such offerings to different classes of users also merits further research. Some implications concerning these issues were suggested earlier based on the results of this study. However, more data is needed before specific recommendations can be made regarding both managerial and regulatory product and pricing policies. Related to these issues are questions concerning the impact of existing product and pricing strategies on different classes of business customers. For example, what types and sizes of firms face the greatest number of alternatives when selecting communication offerings? For what types and sizes of firms and for what kinds of usage needs are offerings such as WATS really considered as

alternatives to the traditional unit toll exchange communication systems? In what usage areas do basic needs exist that are not now being satisfied by present communication offerings? These kinds of questions can only be answered accurately through detailed research studies of each business segment's communications requirements.

4. Research should be conducted to assess how discriminatory rate structures for exchange and toll services have affected usage patterns historically. This analysis should be helpful for determining how value-of-service pricing has influenced the demand for various telephone communication offerings over time. It should also provide information that would assist researchers in estimating the effects of present and future changes in utility rate structures.

5. Another area that requires further research is the relationship between what utility salesmen see as the primary factors influencing demand and those variables that actually do affect demand. A salesman traditionally may use certain criteria

associated with each customer as a basis for recommending the adoption of specific types of products or services. If these criteria have little relationship to the buyer's actual needs, firms may either under- or over-utilize many of the available utility offerings. The extent to which this problem exists is related directly to the buyer's understanding of the number of alternatives available and his knowledge of the substitutability of the various product and service offerings. This study indicated that many users are unfamiliar with the total array of offerings available and thus rely heavily on the salesman's advice when selecting their mix of communication services. Therefore, it is critical that the salesman's perceptions of the major influencing variables agree with the factors that actually do reflect customer requirements. Only in this way can a firm's communication needs be optimally satisfied.

6. Research should be conducted to examine the feasibility of extrapolating the kinds of information

obtained in this study to more macro-oriented demand models. By gathering additional demand information on other sizes and types of firms and simulating changes in certain critical demand influencing variables over time, reliable estimates of both individual segment and total market communication needs should be possible. The inclusion of controllable variables in these models may also make it possible to simulate the effect of modified advertising and selling strategies on total revenue and profits. From a regulatory and managerial perspective, further research in this direction should provide a basis for evaluating the feasibility and benefits of a variety of product and rate structure innovations.

Concluding Comments

This research focused on the factors influencing the business firm's demand for a number of telephone utility offerings. However, many of the findings, implications, and recommendations derived from the study are of value to other types of utilities and non-regulated industries as well. It is hoped that one of the most significant contributions of this research is to provide a framework or focus for structuring and carrying out further utility related studies. Certainly, further managerial and regulatory oriented research is needed in all utility based industries if a better matching of utility resources with customer needs and a more efficient allocation of company marketing efforts is to be attained.

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APPENDIX I

APPENDIX I

RATIOS FOR SELECTED CRITERION AND INDEPENDENT VARIABLES

TABLE I.1

RATIOS FOR SELECTED CRITERION AND INDEPENDENT VARIABLES
BY BUSINESS SEGMENT

	Selected Ratios				
Business Segment	Locations/ Lines	Employees/ Locations	Employees/ Lines	Salaried Employees/ Locations	Salaried Employees/ Lines
Manufacturer	3.0	6.9	20.5	1.2	3.5
Wholesaler	3.9	2.0	7.8	.7	2.6
Retailer	3.7	2.7	9.8	.7	2.4
Realtor	2.5	.9	2.3	*	*
Dry Cleaner	1.4	4.3	5.7	*	*

*The variable "Salaried Employees" is not applicable to the Realtor and Dry Cleaner segments.

APPENDIX II

APPENDIX II

KENDALL COEFFICIENT OF CONCORDANCE FOR BUSINESS SEGMENTS ON THE TIME AND IMPORTANCE PLACED ON VARIOUS TELEPHONE COMMUNICATION ACTIVITIES

The values included in these tables are rank averages and do not indicate either an absolute degree of importance or amount of time attached to any one activity.

TABLE II-1

MEAN RANKINGS OF LOCAL TELEPHONE USAGE TIME SPENT
ON VARIOUS COMMUNICATION ACTIVITIES

	Business Segment									
	Manufacturers		Wholesalers		Retailers		Realtors		Dry Cleaners	
Activity	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Communicating with:										
A. Customers	2.3	1	2.1	1	1.6	1	1.2	1	1.1	1
B. Suppliers	2.7	2	2.8	2	2.7	2	5.0	5	2.1	2
C. Other Departments	3.2	3	3.4	3	2.8	3	3.7	3	*	
D. Salesmen	4.4	5	3.6	4	3.4	4	2.6	2	*	
E. Branch Facilities	3.5	4	3.9	5	3.8	5	4.4	4	3.3	3
Significance**: (.01)	W = .69									

*No responses given.
**Excepting Dry Cleaner Responses.

NOTE: Rank of "1" indicates the most time was spent on that activity.

TABLE II-2

MEAN RANKINGS OF TOLL TELEPHONE USAGE TIME SPENT
ON VARIOUS COMMUNICATION ACTIVITIES

	Business Segment									
	Manufacturers		Wholesalers		Retailers		Realtors		Dry Cleaners	
Activity	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Communicating with:										
A. Customers	2.3	2	2.6	2	2.2	2	2.0	2	1.9	
B. Suppliers	2.0	1	2.0	1	1.9	1	4.5	4	1.2	
C. Salesmen	3.6	4	3.2	4	3.6	4	1.4	1	*	
D. Branch Facilities	2.6	3	3.1	3	3.4	3	4.1	3	*	
Significance**: (n.s.)	W = .33									

*No responses given.
**Excepting Dry Cleaner responses.

NOTE: A rank of "1" indicates the respondent felt that the telephone was most important to that particular communications activity.

TABLE II-3

MEAN RANKINGS OF IMPORTANCE OF LOCAL TELEPHONE USAGE ON VARIOUS COMMUNICATION ACTIVITIES

	Business Segment									
	Manufacturers		Wholesalers		Retailers		Realtors		Dry Cleaners	
Activity	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Communicating with:										
A. Customers	1.8	1	1.5	1	1.1	1	1.3	1	1.0	1
B. Suppliers	2.2	2	2.3	2	2.4	2	5.6	5	2.7	2
C. Other Departments	3.8	5	4.3	5	3.0	3	4.7	4	*	
D. Salesmen	3.6	4	3.2	3	4.2	5	2.3	2	*	
E. Branch Facilities	3.4	3	3.9	4	3.8	4	3.3	3	3.2	3
Significance**: (.05) W = .61										

*No responses given.
**Excepting Dry Cleaner responses.

TABLE II-4

MEAN RANKINGS OF IMPORTANCE OF TOLL TELEPHONE USAGE ON VARIOUS COMMUNICATION ACTIVITIES

	Business Segment									
	Manufacturers		Wholesalers		Retailers		Realtors		Dry Cleaners	
Activity	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Communicating with:										
A. Customers	1.5	1	1.6	1	2.5	2	1.3	2	3.1	1
B. Suppliers	2.5	2	2.4	2	1.6	1	4.9	4	3.5	2
C. Salesmen	3.4	4	3.5	4	3.8	4	1.1	1	*	
D. Branch Facilities	2.8	3	3.3	3	3.2	3	2.4	3	*	
Significance**: (n.s.)	W = .38									

*No response given.
**Excepting Dry Cleaner responses.

APPENDIX III

APPENDIX III

PERCENT OF FIRMS IN EACH SEGMENT THAT PERCEIVED THEIR TELEPHONE USAGE TO BE LESS THAN, EQUAL TO, OR GREATER THAN FIRMS OF COMPARABLE TYPE AND SIZE

Scale Used:

1 = Far Below Average
2 = Below Average
3 = Average
4 = Above Average
5 = Far Above Average

TABLE III-1

PERCEIVED AMOUNT OF LOCAL TELEPHONE USAGE AS COMPARED TO FIRMS OF SIMIIAR TYPE AND SIZE - BY SEGMENT

		Rank		
Business Segment	Number of Firms	% Below Average 1-2	% Average 3	% Above Average 4-5
Realtor	23	4%	57%	39%
Dry Cleaner	9	0	89	11
Retailer	42	2	64	34
Manufacturer	47	9	72	19
Wholesaler	62	8	58	34
TOTAL	183	6	64	30

TABLE III-2

PERCEIVED AMOUNT OF TOLL TIME USED AS COMPARED TO FIRMS OF SIMILAR TYPE AND SIZE - BY SEGMENT

		Rank		
Business Segment	Number of Firms	% Below Average 1-2	% Average 3	% Above Average 4-5
Realtor	23	26%	26%	48%
Dry Cleaner	9	33	44	23
Retailer	42	10	50	40
Manufacturer	47	11	45	44
Wholesaler	62	8	47	45
TOTAL	183	13	43	44

TABLE III-3

PERCEIVED AMOUNT OF TELEPHONE EQUIPMENT USED AS COMPARED TO FIRMS OF SIMILAR TYPE AND SIZE - BY SEGMENT

		Rank		
Business Segment	Number of Firms	% Below Average 1-2	% Average 3	% Above Average 4-5
Realtor	23	13%	39%	48%
Dry Cleaner	9	22	78	0
Retailer	41	7	63	30
Manufacturer	46	13	65	22
Wholesaler	62	15	52	33
TOTAL	181	13	57	30

TABLE III-4

PERCEIVED AMOUNT OF TELEPHONE TIME USED TO CONTACT SUPPLIERS AS COMPARED TO FIRMS OF SIMILAR TYPE AND SIZE - BY SEGMENT

		Rank		
Business Segment	Number of Firms	% Below Average 1-2	% Average 3	% Above Average 4-5
Realtor	23	35%	52%	13%
Dry Cleaner	9	0	89	11
Retailer	41	5	51	44
Manufacturer	46	7	65	28
Wholesaler	62	10	53	37
TOTAL	181	11	58	31

TABLE III-5

PERCEIVED AMOUNT OF TELEPHONE TIME USED TO CONTACT CUSTOMERS AS COMPARED TO FIRMS OF SIMILAR TYPE AND SIZE - BY SEGMENT

Business Segment	Number of Firms	Rank: % Below Average 1-2	Rank: % Average 3	Rank: % Above Average 4-5
Realtor	23	0%	39%	61%
Dry Cleaner	9	11	78	11
Retailer	42	5	57	38
Manufacturer	46	15	57	28
Wholesaler	62	10	49	41
TOTAL	182	9	53	38

TABLE III-6

PERCEIVED AMOUNT OF YELLOW PAGE ADVERTISING USED AS COMPARED TO FIRMS OF SIMILIAR TYPE AND SIZE - BY SEGMENT

		Rank		
Business Segment	Number of Firms	% Below Average 1-2	% Average 3	% Above Average 4-5
Realtor	23	13%	43%	44%
Dry Cleaner	9	11	56	33
Retailer	42	10	57	31
Manufacturer	46	33	62	4
Wholesaler	62	39	46	15
TOTAL	182	26	53	21

APPENDIX IV

APPENDIX IV

ROTATED FACTOR LOADINGS* FOR EACH CRITERION VARIABLE AND ASSOCIATED EXPLANATORY VARIABLES - BY BUSINESS SEGMENT

TABLE IV-1

EXPLANATION OF ABBREVIATED VARIABLE SYMBOLS USED IN TABLES IV-2 - IV-20

Symbol	Variable Description
Adv$	Monthly Yellow Page Advertising billing
Totaltoll	Dollar value of total toll usage for February, 1968
Intratoll	Dollar value of intra-state toll usage for February, 1968
Intertoll	Dollar value of inter-state toll usage for February, 1968
Equip$	Monthly dollar amount of equipment billings
Numlines	Number of trunks or lines used by a firm
Numloc	Number of telephone locations maintained by a firm
Numempl	Total number of employees
Numclerks	Number of clerks employed by a retail establishment
Numclrem	Number of clerical employees

*Note: For convenience, only the highest loading value of each explanatory variable on a factor is given in the tables.

TABLE IV-1 (Continued)

Symbol	Variable Description
Numsalem	Total number of salaried employees
Numsuppl	Number of suppliers
NumsupplI	Number of suppliers located outside of Lansing
Numsuppl2	Number of suppliers located outside of Michigan
Sqfeet	Square footage of customer facility
Numoff	Number of offices
PctsupplL	Percentage of suppliers located in Lansing
PctsupplM	Percentage of suppliers located in Michigan
Grossale	Total 1967 gross sales
GrossaleI	1967 gross sales outside of Lansing
Grossale2	1967 gross sales outside of Michigan
Numbuild	Number of buildings customer utilizes
PctsaleL	Percentage of sales in Lansing area
PctsaleM	Percentage of sales made in Michigan
Numordmo	Average number of orders received per month
NumoutA	Number of additional outlets in Lansing
NumoutB	Number of additional outlets in Michigan outside of Lansing
NumoutO	Number of additional outlets outside of Michigan

TABLE IV-1 (Continued)

Symbol	Variable Description
Impsuppl	Importance of telephone communications in contacting suppliers
Tloccost	Ranking of time spent communicating with customers in the local calling area
Tlocsuppl	Ranking of time spent communicating with suppliers in the local calling area
Disthome	Distance of Lansing facility from the home office
Underst	Customers perceived awareness or available understanding of available telephone communications alternatives
Pctmerwh	Percentage of total revenue resulting from wholesaling activities
Pctmfgr	Percentage of total revenue resulting from manufacturing activities

TABLE IV-2

ROTATED FACTOR LOADINGS FOR TOTAL TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - MANUFACTURER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Commu-nality
Totaltoll	-.798	.303	.262	.230	-.084	.858
Grossale2	-.813					
Numoff	-.672					
Underst	.606					
PctsaleL	.595					
Numsalem	-.482					
Tloccust	-.442					
Numordmo		.698				
Numbuild		.697				
Disthome		.410				
NumsupplI			.917			
Numsuppl			.826			
Numsuppl2			.791			
Sqfeet			.618			
PctsupplL			-.391			
NumoutB				.929		
NumoutA				.921		
PctsupplM				-.510		
Grossale					-.922	
GrossaleI					-.905	
Numempl					-.870	
Numclrem					-.860	
PctsaleM					-.499	

TABLE IV-3

ROTATED FACTOR LOADINGS FOR INTRASTATE TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - MANUFACTURER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
Intratoll	.691	.493	.284	-.148	.116	.837
Numordmo	.762					
Pctmerwh	.716					
Numbuild	.703					
Pctmfgr	-.469					
Disthome	.393					
Grossales2		.765				
PctsaleL		-.639				
Underst		-.615				
Numoff		.594				
PctsupplL		-.470				
Tloccust		.437				
NumsupplI			.918			
Numsuppl			.835			
Numsuppl2			.780			
Sqfeet			.612			
Numsalem			.456			
Grossale				-.916		
GrossaleI				-.897		
Numempl				-.873		
Numclrem				-.868		
PctsaleM				-.493		
NumoutB					.934	
NumoutA					.926	
PctsupplM					-.510	

TABLE IV-4

ROTATED FACTOR LOADINGS FOR INTERSTATE TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - MANUFACTURER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
Intertoll	-.828	-.307	-.229	.101	-.033	.843
Grossale2	-.807					
Numoff	-.691					
Underst	.624					
PctsaleL	.561					
Tloccust	-.447					
NumoutB		-.930				
NumoutA		-.922				
PctsupplM		.515				
Numsuppl2			-.921			
NumsupplI			-.826			
Numsuppl			-.800			
Sqfeet			-.650			
Numsalem			-.508			
PctsupplL			.390			
Numordmo				.799		
Pctmerwh				.720		
Numbuild				.666		
Pctmfgr				-.554		
Disthome				.395		
Grossale					-.918	
GrossaleI					-.902	
Numempl					-.850	
Numclrem					-.846	
PctsaleM					-.494	

TABLE IV-5

ROTATED FACTOR LOADINGS FOR EQUIPMENT DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - MANUFACTURER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
Equip$	.720	.398	.172	-.078	-.021	.712
Numoff	-.737					
Grossale2	-.714					
Underst	.640					
PctsaleL	.533					
Tloccust	-.533					
Numsuppl		.909				
NumsupplI		.826				
Numsuppl2		.773				
Sqfeet		.636				
PctsupplL		-.347				
Numbuild			.788			
Pctmerwh			.697			
Numordmo			.658			
Pctmerwh			-.596			
Disthome			.393			
Numsalem				.941		
NumoutB				.925		
NumoutA				.911		
PctsupplM				-.411		
Grossale					-.917	
GrossaleI					-.905	
Numclrem					-.863	
Numempl					-.847	
PctsaleM					-.541	

TABLE IV-6

ROTATED FACTOR LOADINGS FOR NUMBER OF LINES DEMANDED AND ASSOCIATED EXPLANATORY VARIABLES - MANUFACTURER SEGMENT

	Loading				Commu-
Variable	Factor 1	Factor 2	Factor 3	Factor 4	nality
Numlines	-.620	.417	.295	-.10	.668
Numoff	-.737				
Grossale2	-.712				
Underst	.654				
PctsaleL	.577				
Tloccust	-.505				
PctsupplL	.354				
Numsuppl		.910			
NumsupplI		.829			
Numsuppl2		.772			
Sqfeet		.646			
Numsalem		.502			
Numordmo			.778		
Pctmerwh			.675		
Numbuild			.639		
Pctmfgr			-.622		
PctsupplM			-.446		
Disthome			.405		
Numclrem				-.920	
Grossale				-.904	
GrossaleI				-.858	
Numempl				-.857	
PctsaleM				-.509	

TABLE IV-7

ROTATED FACTOR LOADINGS FOR NUMBER OF LOCATIONS DEMANDED AND ASSOCIATED EXPLANATORY VARIABLES - MANUFACTURER SEGMENT

Variable	Loading: Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Commu-nality
Numloc	.668	.499	.242	-.067	-.049	.761
Numoff	.749					
Grossale2	.679					
Underst	-.674					
PctsaleL	-.576					
Tloccust	.524					
PctsupplL	-.375					
Numsuppl		.902				
NumsupplI		.828				
Numsuppl2		.755				
Sqfeet		.655				
Numordmo			.796			
Pctmerwh			.683			
Numbuild			.623			
Pctmfgr			-.622			
PctsupplM			-.443			
Disthome			.404			
Numsalem				.940		
NumoutB				.905		
NumoutA				.899		
Grossale					-.918	
GrossaleI					-.905	
Numclrem					-.848	
Numempl					-.843	
PctsaleM					-.536	

TABLE IV-8

ROTATED FACTOR LOADINGS FOR TOTAL TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - WHOLESALER SEGMENT

	Loading			
Variable	Factor 1	Factor 2	Factor 3	Communality
Totaltoll	-.885	.267	.071	.860
Grossale	-.968			
Numclrem	-.959			
GrossaleI	-.947			
Numempl	-.919			
Numsalem	-.899			
Sqfeet	-.565			
Numoff	-.555			
PctsaleL		-.928		
PctsaleM		.921		
Impsupp			.829	
Grossale2			.809	
Tlocsupp			-.222	

TABLE IV-9

ROTATED FACTOR LOADINGS FOR INTRASTATE TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - WHOLESALER SEGMENT

	Loading			
Variable	Factor 1	Factor 2	Factor 3	Communality
Intratoll	-.877	-.305	-.013	.862
Grossale	-.965			
Numclrem	-.958			
GrossaleI	-.947			
Numempl	-.924			
Numsalem	-.891			
Sqfeet	-.555			
Numoff	-.545			
Impsupp		-.739		
Grossale2		-.531		
Tlocsupp		.294		
PctsaleM			.909	
PctsaleL			-.907	

TABLE IV-10

ROTATED FACTOR LOADINGS FOR INTERSTATE TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - WHOLESALER SEGMENT

	Loading			
Variable	Factor 1	Factor 2	Factor 3	Communality
Intertoll	-.720	-.352	-.250	.705
Grossale	-.972			
Numclrem	-.944			
GrossaleI	-.932			
Numsalem	-.922			
Numempl	-.904			
Sqfeet	-.603			
Numoff	-.596			
PctsaleL		.937		
PctsaleM		-.905		
Numout0			-.856	
Grossale2			-.655	
Tlocsuppl			.258	

TABLE IV-11

ROTATED FACTOR LOADINGS FOR EQUIPMENT DEMAND AND ASSOCIATED EXPLANATORY VARIABLES WHOLESALER SEGMENT

	Loading		
Variable	Factor 1	Factor 2	Communality
Equip$	.933	-.110	.883
Numempl	-.958		
Numclrem	.949		
Grossale	-.936		
GrossaleI	-.928		
Numsalem	-.885		
Sqfeet	-.562		
Numoff	-.561		
Tmpsuppl	-.320		
PctsaleL		.945	
PctsaleM		-.907	
Tlocsuppl		.50	
Grossale2		-.163	

TABLE IV-12

ROTATED FACTOR LOADINGS FOR NUMBER OF LINES DEMANDED AND ASSOCIATED EXPLANATORY VARIABLES - WHOLESALER SEGMENT

Variable	Loading		
	Factor 1	Factor 2	Communality
Numlines	-.903	.107	.828
Grossale	-.960		
Numclrem	-.945		
GrossaleI	-.931		
Numempl	-.918		
Numsalem	-.893		
Numoff	-.576		
Sqfeet	-.572		
Impsuppl	-.322		
PctsaleL		-.943	
PctsaleM		.909	
Tlocsuppl		-.255	
Grossale2		.157	

TABLE IV-13

ROTATED FACTOR LOADINGS FOR NUMBER OF LOCATIONS DEMANDED AND ASSOCIATED EXPLANATORY VARIABLES - WHOLESALER SEGMENT

	Loading			
Variable	Factor 1	Factor 2	Factor 3	Communality
Numloc	-.941	.156	-.039	.911
Grossale	-.969			
Numclrem	-.950			
GrossaleI	-.938			
Numempl	-.929			
Numsalem	-.901			
Numoff	-.563			
Impsuppl	-.340			
PctsaleM		.920		
PctsaleL		-.919		
Tlocsuppl		.229		
Sqfeet			.853	
Grossale2			-.580	

TABLE IV-14

ROTATED FACTOR LOADINGS FOR YELLOW PAGE ADVERTISING DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - RETAILER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Commu-nality
Adv$	-.646	-.388	.147	-.106	.025	.601
Numempl	-.972					
Numclerks	-.952					
Numclrem	-.924					
Numsuppl2	-.903					
Numsuppl	-.880					
Sqfeet	-.857					
Numoff		-.831				
PctsupplI		-.785				
Grossale		-.690				
Numsalem		-.680				
Numbuild			.846			
Tloccust			.756			
PctsaleL				-.775		
PctsupplM				.741		
Tlocsuppl					.766	

TABLE IV-15

ROTATED FACTOR LOADINGS FOR TOTAL TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - RETAILER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Commu-nality
Totaltoll	-.799	-.307	-.192	.134	-.177	.819
Numclerks	-.968					
Numepl	-.952					
Numclrem	-.931					
Numsuppl2	-.895					
Numsuppl	-.871					
Sqfeet	-.837					
PctsaleL		-.857				
PctsupplM		-.637				
Numoff			-.832			
PctsupplL			-.806			
Grossale			-.693			
Numslaem			-.686			
Numbuild				.820		
Tloccust				.723		
Tlocsuppl					.834	

TABLE IV-16

ROTATED FACTOR LOADINGS FOR INTRASTATE TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - RETAILER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Commu-nality
Intratoll	-.612	-.592	-.283	-.155	-.089	.837
Numclerks	-.978					
Numempl	-.952					
Numclrem	-.928					
Numsuppl2	-.912					
Numsuppl	-.890					
Sqfeet	-.847					
PctsaleL		.877				
PctsupplM		-.561				
Numoff			-.831			
PctsupplL			-.801			
Grossale			-.696			
Numsalem			-.691			
PctsaleM				.815		
Numbuild					.844	
Tloccust					.718	

TABLE IV-17

ROTATED FACTOR LOADINGS FOR INTERSTATE TOLL DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - RETAILER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
Intertoll	-.821	.242	-.108	-.090	-.071	.758
Numclrem	-.965					
Numclerks	-.946					
Numempl	-.928					
Numsuppl2	-.896					
Numsuppl	-.871					
Sqfeet	-.831					
Numbuild		-.803				
Tloccust		-.721				
Tlocsuppl			-.847			
Numoff				-.825		
PctsupplL				-.812		
Grossale				-.709		
Numsalem				-.702		
PctsaleL					.787	
PctsupplM					.736	

TABLE IV-18

ROTATED FACTOR LOADINGS FOR EQUIPMENT DEMAND AND ASSOCIATED EXPLANATORY VARIABLES - RETAILER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
Equip$	-.947	-.244	.146	.022	.015	.979
Numclerks	-.978					
Numempl	-.957					
Numclrem	-.930					
NumsupplZ	-.912					
Numsuppl	-.890					
Tlocsuppl	-.855					
Numoff		-.831				
PctsupplL		-.831				
Grossale		-.689				
Numsalem		-.682				
Numbuild			.853			
Tloccust			.733			
PctsaleL				.790		
PctsupplM				-.732		
Sqfeet					.813	

TABLE IV-19

ROTATED FACTOR LOADINGS FOR NUMBER OF LINES DEMANDED AND ASSOCIATED EXPLANATORY VARIABLES - RETAILER SEGMENT

	Loading					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Commu-nality
Numlines	-.951	-.173	.148	.016	.010	.956
Numclerks	-.977					
Numempl	-.951					
Numclrem	-.922					
Numsuppl2	-.918					
Numsuppl	-.896					
Tlocsuppl	-.852					
Numoff		-.829				
PctsupplL		-.806				
Grossale		-.697				
Numsalem		-.690				
Numbuild			.854			
Tloccust			.732			
Sqfeet				.815		
PctsaleL					.796	
PctsupplM					-.726	

TABLE IV-20

ROTATED FACTOR LOADINGS FOR NUMBER OF LOCATIONS DEMANDED AND ASSOCIATED EXPLANATORY VARIABLES - RETAILER SEGMENT

Variable	Loading Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
Numloc	-.971	-.158	.133	.049	-.038	.984
Numclerks	-.979					
Numempl	-.952					
Numclrem	-.923					
Numsuppl2	-.919					
Numsuppl	-.849					
Numsalem		-.826				
PctsupplL		-.808				
Grossale		-.702				
Numoff		-.697				
Numbuild			.853			
Tloccust			.736			
PctsaleL				.788		
PctsupplM				-.733		
Sqfeet					-.811	

APPENDIX V

APPENDIX V

COVER LETTERS, PERMISSION REQUEST FORMS, AND QUESTIONNAIRES

STUDY OF COMMUNICATION NEEDS IN BUSINESS

MICHIGAN STATE UNIVERSITY
Department of Marketing and Transportation Administration
Graduate School of Business Administration
315 Eppley Center East Lansing, Michigan 48823

In a few days you will be receiving a questionnaire concerning the role that telephone communications plays in certain aspects of your business. The data you supply in the questionnaire will provide the information needed to complete my doctoral dissertation. Any information which you provide will be considered strictly confidential.

The study is being undertaken with the combined support of the Michigan Bell Telephone Company and the Institute of Public Utilities at Michigan State University. The results of the research should aid telephone companies in better meeting the future needs of firms such as yours.

Many factors influence the types of telephone equipment and services a particular business firm requires. The questionnaire, therefore, is quite detailed. As you well realize, however, your response is necessary if the study is to be a success and contribute to a better understanding of the communication problems facing today's business firms.

Should you wish an advance summary of the results, please indicate so by a note on your questionnaire. I would be happy to send you this as advance information.

Your cooperation is sincerely appreciated.

Yours truly,

Richard F. Sauter
Research Director

STUDY OF COMMUNICATION NEEDS IN BUSINESS

MICHIGAN STATE UNIVERSITY
Department of Marketing and Transportation Administration
Graduate School of Business Administration
315 Eppley Center East Lansing, Michigan 48823

With the aid of a grant from the Ford Foundation, I am presently engaged in research for my doctoral dissertation to determine how various business factors affect the demand for certain communications products and services. The study will investigate such problems as what future communication needs will be in certain segments of the business community, how these needs can best be met, and what factors will be most influential in determining these needs. I hope you will complete the enclosed questionnaire as it is vital to my doctoral research and to my obtaining an accurate understanding of these relationships.

Since there are a large number of factors that may influence communication needs, some of the questions included here will ask you to provide detailed information on certain aspects of your business. All of the information will be held in the strictest confidence and the name of your firm will not appear anywhere in the research findings. Data will be lumped together and no information will be analyzed on an individual firm basis.

Since the basic purpose of this study is to identify those factors which determine a firm's need for communication offerings, it is necessary to secure data from Michigan Bell concerning the types of equipment and services your firm presently utilizes. A release form is enclosed which I hope you will sign and return along with the completed questionnaire. Upon receipt of your release Michigan Bell has agreed to furnish the data listed on the release form. Let me reemphasize that no data will be sought or collected concerning either individual local or long distance calls nor will your firm's name be associated in any manner with the information you release.

If you have any questions regarding any aspect of the questionnaire or study, please feel free to call me at either 355-4619 or 355-5837.

As you know, the success of this research will depend upon your cooperation, and your assistance will be greatly appreciated.

I have enclosed a self-addressed envelope for your convenience.

Thank you for your time and effort.

Sincerely yours,

Richard F. Sauter
Research Director

STUDY OF COMMUNICATION NEEDS IN BUSINESS

MICHIGAN STATE UNIVERSITY
Department of Marketing and Transportation Administration
Graduate School of Business Administration
315 Eppley Center East Lansing, Michigan 48823

June 25, 1968

You will remember my request for assistance with a study I am conducting concerning the role that telephone communications plays in certain types of business firms. Preliminary tabulation of responses is providing valuable information about these questions.

I hope to begin final tabulation shortly and need your assistance to complete the data collection. I would, therefore, appreciate your reply at your earliest convenience. If for some reason the earlier questionnaire did not reach you or was mislaid I have enclosed a duplicate.

I want to reemphasize that any information which you provide will be held in the strictest confidence. Should you wish an advance summary of the results, please indicate so by a note on the questionnaire and I will be happy to send you this as advance information.

As you know the validity of the findings will depend on your cooperation. Thank you for your assistance.

Very truly yours,

Richard F. Sauter
Research Director

Permission Request

May I have your permission to obtain data from Michigan Bell records concerning:

A. Total monthly toll billings of your firm for the past 3 months.

B. Total local service billings of your firm for the past 3 months.

C. The types of telephone equipment and services your firm presently utilizes.

to be used in a research study I am presently undertaking at Michigan State University. The name of your firm will not be associated with this data in any aspect of the research.

Thank you for your cooperation.

Richard F. Sauter
Research Director

Mr. Sauter:

You have our permission to obtain the information mentioned above from Michigan Bell records.

Date ________________ Signature ____________________________

Title ____________________________

STUDY OF COMMUNICATION NEEDS IN BUSINESS

MANUFACTURER/WHOLESALER INFORMATION

(Strictly Confidential)

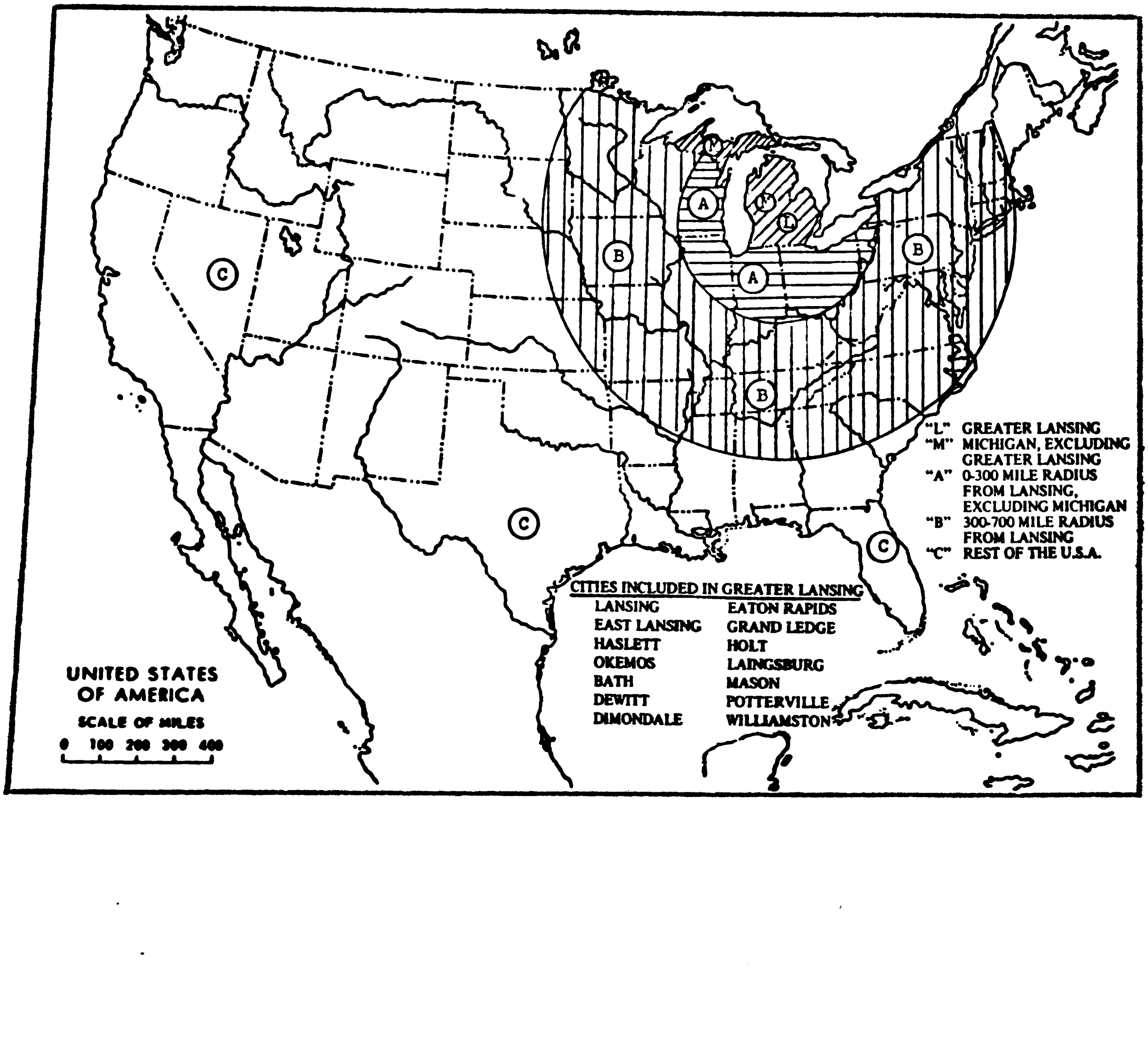
Graduate School of Business Administration
Department of Marketing and Transportation
Michigan State University

The questionnaire is divided into two parts. Part A deals with certain characteristics related to your firm, its customers and its suppliers that may affect your need for various types of communications offerings.

Part B of the questionnaire is primarily concerned with your evaluation of the present and future role of telephone communications in various areas of your firm's operations. Your responses to this portion of the questionnaire will aid us in determining where telephone communication needs are greatest and how these needs vary from one sector of the business community to another.

Please note that the responses given in this questionnaire will be considered strictly confidential and will not in any way be identified with any individual or firm.

The entire questionnaire should take approximately 20–30 minutes to complete. Your cooperation will be most sincerely appreciated.



"L" GREATER LANSING
"M" MICHIGAN, EXCLUDING GREATER LANSING
"A" 0-300 MILE RADIUS FROM LANSING, EXCLUDING MICHIGAN
"B" 300-700 MILE RADIUS FROM LANSING
"C" REST OF THE U.S.A.
CITIES INCLUDED IN GREATER LANSING
LANSING
EAST LANSING
HASLETT
OKEMOS
BATH
DEWITT
DIMONDALE
EATON RAPIDS
GRAND LEDGE
HOLT
LAINGSBURG
MASON
POTTERVILLE
WILLIAMSTON
UNITED STATES OF AMERICA
SCALE OF MILES
0 100 200 300 400
A
B
C
L
M

PART A

Unless stated otherwise, the following questions refer only to the facility or plant located at the address to which this questionnaire was mailed. Any questions pertaining to branch plants located elsewhere in the city, state or country will be clearly identified. Thus unless stated specifically in the question, any information given should refer only to the facility to which this questionnaire was addressed.

1. How long has your firm been operating in its present facility? _______ yrs.

2. How many separate or adjoining buildings do you have at this location? (excluding garages, sheds, etc.) _______ _______

3. Approximately, how many square feet of floor space does your physical plant encompass? .... _______

4. How many separate offices do you have in the building(s)? .... _______

5. What were your gross sales during the fiscal year 1967? _______ _______

6. What has been the average number of employees working at this location during the past year? .... _______ _______

7. How many of this total were salaried employees? .... _______

8. Of your total number of employees, how many on the average during the past year have been employed in each of the following areas? ....

	Past Year
Administrative and Supervisory	_______
Production	_______
Engineering	_______
Clerical	_______
Sales	_______
Other (please specify)	_______

9. Approximately, how many different suppliers do you presently receive products from? .... _______

10. Approximately how many customers do you ship or sell products to? _______

11. Approximately how many orders are placed with your firm on an average every month? .... _______

12. Of this total, what per cent of these orders would you estimate are taken by:

    a) mail at this location _______%

    b) phone at this location _______%

    c) other (please specify) _______%

13. How many salesmen do you presently have working in the field? .... _______

14. Does your firm presently utilize telephone lines for data transmission as well as vocal communication? Yes _______ No _______

15. If yes, approximately how many hours per month are used for strictly data transmission activities? .... _______

The following questions should be answered by referring to the enclosed map (see page 2 indicating various labeled geographic regions). Please approximate the values asked for in the following 3 questions to the best of your ability.

16. What per cent of your sales are made to customers:
   a) within the Greater Lansing Area ("L") .... _______________ %
   b) outside the Greater Lansing Area but within Michigan ("M") .... _______________ %
   c) within region "A" .... _______________ %
   d) within region "B" .... _______________ %
   e) within region "C" .... _______________ %
   f) outside U.S.A. "O" .... _______________ %
   Total = 100%

17. What per cent of your suppliers are located in each of the following areas?
   a) within the Greater Lansing Area ("L") .... _______________ %
   b) outside the Greater Lansing Area but within Michigan ("M") .... _______________ %
   c) within region "A" .... _______________ %
   d) within region "B" .... _______________ %
   e) within region "C" .... _______________ %
   f) outside U.S.A. "O" .... _______________ %
   Total = 100%

18. Using the enclosed map, please indicate in the appropriate column the *number of additional outlets of facilities* your firm maintains in each geographical area. ....

Greater Lansing Area "L"	Outside "L" but within Michigan	Region "A"	Region "B"	Region "C"	Outside U.S.A. "O"

19. In what city and state are your main offices located?

   city .... state ....

20. What are the central telephone numbers to which your firm is billed? (Please include the number of any private lines or WATS lines to which separate billings are made.)

   ....

21. Please indicate below the category (s) into which you would place your firm and if more than one, the percentage of your total revenue derived from each.

	% of total revenue derived from each activity		% of total revenue derived from each activity
Retailer	................................%	**Agent Middleman**	................................%
Merchant Wholesaler	................................%	**Manufacturer**	................................%
Manufacturers Agent	................................%	**Other (please specify)**	................................%

22. Under what Standard Industrial Classification (SIC) code (s) is your company listed?

   Major SIC Code .... Minor SIC Code (s).................... ....

23. **Position of person (s) completing questionnaire.**

   ....

PART B

The following questions concern your own personal attitudes and opinions toward the value of telephone communications – both in general and in respect to the value of specific communication offerings to certain aspects of your firm's operations.

(Table for Questions 1 – 5)

A. Communicating with customers

B. Communicating with suppliers

C. Interdepartmental communications

D. Communicating with salesmen in the field

E. Communicating with branch facilities and/or the home office

F. Utilizing telephone lines for data transmission (other than voice)

G. Other (please specify)

1. Considering *telephone usage* in the *local* calling area only (i.e. no toll charge), please rank the following activities from 1 to 7 in terms of the *amount of time* your firm spends in the average month on each activity in relation to the others. *(1 being the most time; 7 being the least; 0 if no time at all)* ....

2. Considering *long distance telephone usage only*, please rank the following activities from 1 to 7 in terms of the *amount of time* your firm spends in the *average* month on each activity in relation to the others. *(1 being the most time; 7 being the least; 0 if no time at all)*

3. Please rank the following activities from 1 to 7 in terms of where you feel telephone communications will make its most important contribution to your firm 5 years from today. *(1 being most important; 7 being least important; 0 if no contribution* ....

4. If in-state long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease?* (Write 0 if you would expect no decrease.)
% decrease

5. If *inter-state* long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease? (Write 0 if you would expect no decrease)*
% decrease

	A. Communicating with customers	B. Communicating with suppliers	C. Interdepartmental communication	D. Communicating with salesmen in the field	E. Communicating with branch facilities and/or the home office	F. Utilizing telephone lines for data transmission (other than voice)	G. Other (please specify)
1.							
2.							
3.							
4.							
5.							

6. *Compared to other firms of a similar type and size*, where would rank your firm in terms of:

A. local telephone usage

far above average......... above average......... average......... below average......... far below average........

B. long distance telephone usage

far above average......... above average......... average......... below average......... far below average........

C. the amount of telephone equipment you presently utilize

far above average......... above average......... average......... below average......... far below average........

D. the amount of yellow page advertising you presently subscribe to

far above average......... above average......... average......... below average......... far below average........

E. utilizing telephone wires for data transmission

far above average......... above average......... average......... below average......... far below average........

F. utilizing the telephone to contact suppliers

far above average......... above average......... average......... below average......... far below average........

G. utilizing the telephone to contact customers

far above average......... above average......... average......... below average......... far below average........

H. your salesmens' use of the telephone

far above average......... above average......... average......... below average......... far below average........

7. Which of the following statements most accurately describes your understanding of the different types of equipment, services, and rate structures Michigan Bell offers to business firms? (Check only one.)

_______1. We have an excellent understanding of the various alternatives available.
_______2. We have a good understanding of these alternatives.
_______3. We have a fair understanding of these alternatives.
_______4. We have a poor understanding of these alternatives.
_______5. We have no knowledge of these alternatives.

8. Which of the following statements best describes the process you would go through prior to changing all or part of your communication system? (Assume this to be a major change such as the adoption of WATS or a private line.) Check only one.

_______1. We would determine our needs *and* specify the types of equipment and/or services that would best satisfy these needs.
_______2. We would determine our needs and let Michigan Bell consultants specify the types of equipment and/or services that would best satisfy these needs.
_______3. We would determine our needs, suggest the types of equipment and/or services that might best satisfy these needs, but leave the final decision up to Michian Bell consultants.
_______4. We would let Michigan Bell consultants determine our needs *and* specify the types of equipment and/or services that would best satisfy these needs.

9. Please rank the following phrases from 1 to 5 in terms of how you feel they reflect your firm's attitude toward the value of telephone communications. (1 being most important; 5 being least important.)

_______A. A necessary service to our customers and suppliers.
_______B. A cost-saving service.
_______C. A primary aid to developing new customers
_______D. A competitive tool
_______E. Other (please specify)

STUDY OF COMMUNICATION NEEDS IN BUSINESS

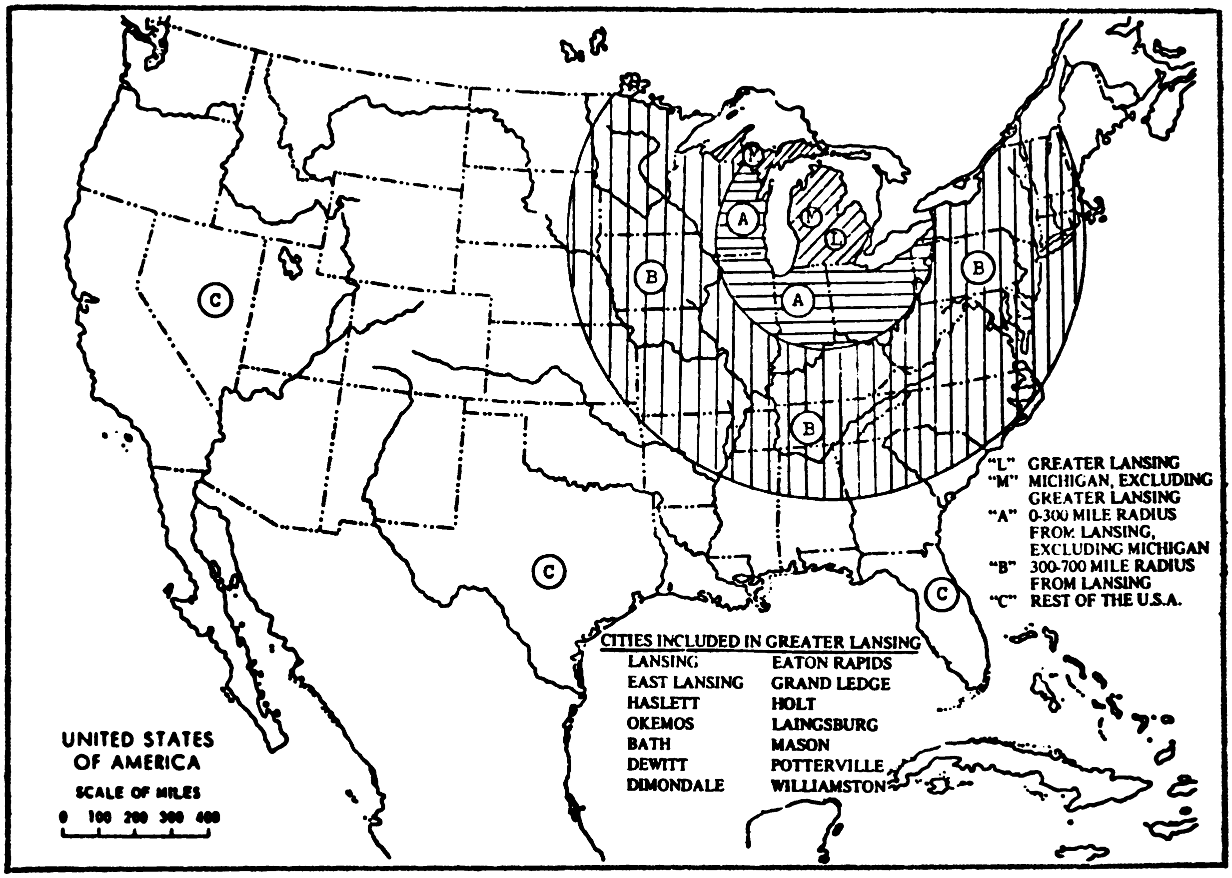
RETAILER INFORMATION
(Strictly Confidential)
Graduate School of Business Administration
Department of Marketing and Transportation
Michigan State University

The questionnaire is divided into two parts. Part A deals with certain characteristics related to your firm, its customers and its suppliers that may affect your need for various types of communications offerings.

Part B of the questionnaire is primarily concerned with your evaluation of the present and future role of telephone communications in various areas of your firm's operations. Your responses to this portion of the questionnaire will aid us in determining where telephone communication needs are greatest and how these needs vary from one sector of the business community to another.

Please note that the responses given in this questionnaire will be considered strictly confidential and will not in any way be identified with any individual or firm.

The entire questionnaire should take approximately 20–30 minutes to complete. Your cooperation will be most sincerely appreciated.



A
M
L
B
C
"L" GREATER LANSING
"M" MICHIGAN, EXCLUDING GREATER LANSING
"A" 0-300 MILE RADIUS FROM LANSING, EXCLUDING MICHIGAN
"B" 300-700 MILE RADIUS FROM LANSING
"C" REST OF THE U.S.A.
CITIES INCLUDED IN GREATER LANSING
LANSING
EAST LANSING
HASLETT
OKEMOS
BATH
DEWITT
DIMONDALE
EATON RAPIDS
GRAND LEDGE
HOLT
LAINGSBURG
MASON
POTTERVILLE
WILLIAMSTON
UNITED STATES OF AMERICA
SCALE OF MILES
0 100 200 300 400

PART A

Unless stated otherwise, the following questions refer only to the facility or plant located at the address to which this questionnaire was mailed. Any questions pertaining to branch plants located elsewhere in the city, state or country will be clearly identified. Thus unless stated specifically in the question, any information given should refer only to the facility to which this questionnaire was addressed.

1. How long has your firm been operating in its present facility? _______ yrs.
2. How many separate or adjoining buildings do you have at this location? (excluding garages, sheds, etc.) ________________
3. Approximately, how many square feet of floor space does your physical plant encompass? .... ________________
4. How many separate offices do you have in the building(s)? .... ________________
5. What were your gross sales during the fiscal year 1967? ____________
6. What has been the average number of employees working at this location during the past year? .... ____________
7. How many of this total were salaried employees? .... ________________
8. Of your total number of employees working at this location, how many on the average during the past year have been employed in each of the following areas? ....

	Past Year
Administrative and Supervisory Positions	________
Clerical	________
Sales Clerks	________
Buyers	________
Other (please specify)	________

9. Approximately, how many different suppliers do you presently receive products from? .... ________________
10. Does your firm maintain a mail order department?

    Yes ______ No ______

11. *If yes,* what per cent of your total gross yearly sales are derived from mail order business? ________________ %

The following questions should be answered by referring to the enclosed map (see page 2) indicating various labeled geographic regions. Please approximate the values asked for in the following 3 questions to the best of your ability.

12. What per cent of your sales are made to customers:
    a) within the Greater Lansing Area ("L") .... ____________ %
    b) outside the Greater Lansing Area but within Michigan ("M") .... ____________ %
    c) within region "A" .... ____________ %
    d) within region "B" .... ____________ %
    e) within region "C" .... ____________ %
    f) outside U.S.A. "O" .... ____________ %

    Total = 100%

13. What per cent of your suppliers are located in each of the following areas?
  a) within the Greater Lansing Area ("L") .... ________________ %
  b) outside the Greater Lansing Area but within Michigan ("M") .... ________________ %
  c) within region "A" .... ________________ %
  d) within region "B" .... ________________ %
  e) within region "C" .... ________________ %
  f) outside U.S.A. "O" .... ________________ %
  Total = 100%

14. Using the enclosed map, please indicate in the appropriate column the *number of additional outlets of facilities* your firm maintains in each geographical area. ....

Greater Lansing Area "L"	Outside "L" but within Michigan	Region "A"	Region "B"	Region "C"	Outside U.S.A. "O"

15. In what city and state are your main offices located?

city .... state ....

16. What are the central telephone numbers to which your firm is billed? (Please include the number of any private lines or WATS lines to which separate billings are made.)

....

17. Please indicate below the category (s) into which you would place your firm and if more than one, the percentage of your total revenue derived from each.

	% of total revenue derived from each activity		% of total revenue derived from each activity
Retailer	................................%	Agent Middleman	................................%
Merchant Wholesaler	................................%	Manufacturer	................................%
Manufacturers Agent	................................%	Other (please specify)	................................%

18. Under what Standard Industrial Classification (SIC) code (s) is your company listed?

Major SIC Code .... Minor SIC Code (s).................... ....

19. Position of person (s) completing questionnaire.

....

PART B

The following questions concern your own personal attitudes and opinions toward the value of telephone communications – both in general and in respect to the value of specific communication offerings to certain aspects of your firm's operations.

(Table for Questions 1 – 5)

A. Communicating with customers

B. Communicating with suppliers

C. Interdepartmental communications

D. Communicating with salesmen in the field

E. Communicating with branch facilities and/or the home office

F. Utilizing telephone lines for data transmission (other than voice)

G. Other (please specify)

1. Considering *telephone usage* in the *local* calling area only (i.e. no toll charge), please rank the following activities from 1 to 7 in terms of the *amount of time* your firm spends in the average month on each activity in relation to the others. *(1 being the most time; 7 being the least; 0 if no time at all)* ....

2. Considering *long distance telephone usage only*, please rank the following activities from 1 to 7 in terms of the *amount of time* your firm spends in the *average* month on each activity in relation to the others. *(1 being the most time; 7 being the least; 0 if no time at all)*

3. Please rank the following activities from 1 to 7 in terms of where you feel telephone communications will make its most important contribution to your firm 5 years from today. *(1 being most important; 7 being least important; 0 if no contribution* ....

4. If in-state long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease?* (Write 0 if you would expect no decrease.)
% decrease

5. If *inter-state* long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease? (Write 0 if you would expect no decrease)*
% decrease

Question	A. Communicating with customers	B. Communicating with suppliers	C. Interdepartmental communication	D. Communicating with salesmen in the field	E. Communicating with branch facilities and/or the home office	F. Utilizing telephone lines for data transmission (other than voice)	G. Other (please specify)
1							
2							
3							
4							
5							

6. *Compared to other firms of a similar type and size,* where would rank your firm in terms of:

A. local telephone usage

far above average......... above average......... average......... below average......... far below average........

B. long distance telephone usage

far above average......... above average......... average......... below average......... far below average........

C. the amount of telephone equipment you presently utilize

far above average......... above average......... average......... below average......... far below average........

D. the amount of yellow page advertising you presently subscribe to

far above average......... above average......... average......... below average......... far below average........

E. utilizing telephone wires for data transmission

far above average......... above average......... average......... below average......... far below average........

F. utilizing the telephone to contact suppliers

far above average......... above average......... average......... below average......... far below average........

G. utilizing the telephone to contact customers

far above average......... above average......... average......... below average......... far below average........

H. your salesmens' use of the telephone

far above average......... above average......... average......... below average......... far below average........

7. Which of the following statements most accurately describes your understanding of the different types of equipment, services, and rate structures Michigan Bell offers to business firms? (Check only one.)

______1. We have an excellent understanding of the various alternatives available.
______2. We have a good understanding of these alternatives.
______3. We have a fair understanding of these alternatives.
______4. We have a poor understanding of these alternatives.
______5. We have no knowledge of these alternatives.

8. Which of the following statements best describes the process you would go through prior to changing all or part of your communication system? (Assume this to be a major change such as the adoption of WATS or a private line.) Check only one.

______1. We would determine our needs *and* specify the types of equipment and/or services that would best satisfy these needs.
______2. We would determine our needs and let Michigan Bell consultants specify the types of equipment and/or services that would best satisfy these needs.
______3. We would determine our needs, suggest the types of equipment and/or services that might best satisfy these needs, but leave the final decision up to Michian Bell consultants.
______4. We would let Michigan Bell consultants determine our needs *and* specify the types of equipment and/or services that would best satisfy these needs.

9. Please rank the following phrases from 1 to 5 in terms of how you feel they reflect your firm's attitude toward the value of telephone communications. (1 being most important; 5 being least important.)

______A. A necessary service to our customers and suppliers.
______B. A cost-saving service.
______C. A primary aid to developing new customers
______D. A competitive tool
______E. Other (please specify)

STUDY OF COMMUNICATION NEEDS IN BUSINESS

REALTOR INFORMATION

(Strictly Confidential)
Graduate School of Business Administration
Department of Marketing and Transportation
Michigan State University

The questionnaire is divided into two parts. Part A deals with certain characteristics related to your firm, its customers and its suppliers that may affect your need for various types of communications offerings.

Part B of the questionnaire is primarily concerned with your evaluation of the present and future role of telephone communications in various areas of your firm's operations. Your responses to this portion of the questionnaire will aid us in determining where telephone communication needs are greatest and how these needs vary from one sector of the business community to another.

Please note that the responses given in this questionnaire will be considered strictly confidential and will not in any way be identified with any individual or firm.

The entire questionnaire should take approximately 20–30 minutes to complete. Your cooperation will be most sincerely appreciated.

PART A

Unless stated otherwise, the following questions refer only to the facility or plant located at the address to which this questionnaire was mailed. Any questions pertaining to branch plants located elsewhere in the city, state or country will be clearly identified. Thus unless stated specifically in the question, any information given should refer only to the facility to which this questionnaire was addressed.

1. How long has your firm been operating in its present facility? ______ yrs.

2. How many separate offices do you have at your present location? ______

3. Approximately how many separate real-estate transactions did you carry out during the past year? ______

4. What was your gross revenue from all transactions during the fiscal year 1967? ______ .... ______

5. Please estimate below what *per cent of your total revenue* during the past year was derived from each of the following types of activities. (If you are not involved at all in a particular activity write a 0 in the blank.)

   ____% residential real estate
   ____% residential construction
   ____% commercial real estate
   ____% commercial construction
   ____% farm properties
   ____% residential property insurance
   ____% commercial property insurance
   ____% personal insurance
   ____% other (please specify)

6. What per cent of your total revenue during the past year was derived from property dealings or other activities taking place in each of the following geographic areas.

   Greater Lansing Area
   (Local Telephone Calling Area) .... ______

   Within Michigan but Outside
   of the Greater Lansing Area .... ______

   Outside of Michigan .... ______

7. What has been the average number of employees working at this location during the past year? ______

8. How many salesmen or brokers on the average have you had working for you at any one time during the past year? ______

9. How many secretaries *on the average* have you had working for your firm at any one time during the past year? ______

10. Please indicate the number of *additional offices* (if any) your firm maintains in each of the geographical areas listed below.

   Greater Lansing Area
   (Local Telephone Calling Area) .... ______

   Within Michigan but Outside
   of the Greater Lansing Area .... ______

   Outside of Michigan .... ______

11. In what city and state are your main offices located?

city .... state ....

12. What are the central telephone numbers to which your firm is billed? (Please include the number of any private lines or WATS lines to which separate billings are made.)

....

13. Under what Standard Industrial Classification (SIC) code (s) is your company listed?

Major SIC Code .... Minor SIC Code (s).................... ....

14. Position of person (s) completing questionnaire.

....

PART B

The following questions concern your own personal attitudes and opinions toward the value of telephone communications – both in general and in respect to the value of specific communication offerings to certain aspects of your firm's operations.

(Table for Questions 1 – 5)

A. Communicating with customers

B. Communicating with suppliers

C. Interdepartmental communications

D. Communicating with salesmen in the field

E. Communicating with branch facilities and/or the home office

F. Utilizing telephone lines for data transmission (other than voice)

G. Other (please specify)

1. Considering *telephone usage* in the *local* calling area only (i.e. no toll charge), please rank the following activities from 1 to 7 in terms of the *amount of time* your firm spends in the average month on each activity in relation to the others. *(1 being the most time; 7 being the least; 0 if no time at all)* ....

2. Considering *long distance telephone usage only,* please rank the following activities from 1 to 7 in terms of the *amount of time* your firm spends in the *average* month on each activity in relation to the others. *(1 being the most time; 7 being the least; 0 if no time at all)*

3. Please rank the following activities from 1 to 7 in terms of where you feel telephone communications will make its most important contribution to your firm 5 years from today. *(1 being most important; 7 being least important; 0 if no contribution* ....

4. If in-state long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease?* (Write 0 if you would expect no decrease.) **% decrease**

5. If *inter-state* long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease? (Write 0 if you would expect no decrease)* **% decrease**

	A. Communicating with customers	B. Communicating with suppliers	C. Interdepartmental communication	D. Communicating with salesmen in the field	E. Communicating with branch facilities and/or the home office	F. Utilizing telephone lines for data transmission (other than voice)	G. Other (please specify)
1.							
2.							
3							
4.							
5.							

6. *Compared to other firms of a similar type and size,* where would rank your firm in terms of:

   A. local telephone usage

   far above average......... above average......... average......... below average......... far below average........

   B. long distance telephone usage

   far above average......... above average......... average......... below average......... far below average........

   C. the amount of telephone equipment you presently utilize

   far above average......... above average......... average......... below average......... far below average........

   D. the amount of yellow page advertising you presently subscribe to

   far above average......... above average......... average......... below average......... far below average........

   E. utilizing telephone wires for data transmission

   far above average......... above average......... average......... below average......... far below average........

   F. utilizing the telephone to contact suppliers

   far above average......... above average......... average......... below average......... far below average........

   G. utilizing the telephone to contact customers

   far above average......... above average......... average......... below average......... far below average........

   H. your salesmens' use of the telephone

   far above average......... above average......... average......... below average......... far below average

7. Which of the following statements most accurately describes your understanding of the different types of equipment, services, and rate structures Michigan Bell offers to business firms? (Check only one.)

______1. We have an excellent understanding of the various alternatives available.
______2. We have a good understanding of these alternatives.
______3. We have a fair understanding of these alternatives.
______4. We have a poor understanding of these alternatives.
______5. We have no knowledge of these alternatives.

8. Which of the following statements best describes the process you would go through prior to changing all or part of your communication system? (Assume this to be a major change such as the adoption of WATS or a private line.) Check only one.

______1. We would determine our needs *and* specify the types of equipment and/or services that would best satisfy these needs.
______2. We would determine our needs and let Michigan Bell consultants specify the types of equipment and/or services that would best satisfy these needs.
______3. We would determine our needs, suggest the types of equipment and/or services that might best satisfy these needs, but leave the final decision up to Michian Bell consultants.
______4. We would let Michigan Bell consultants determine our needs *and* specify the types of equipment and/or services that would best satisfy these needs.

9. Please rank the following phrases from 1 to 5 in terms of how you feel they reflect your firm's attitude toward the value of telephone communications. (1 being most important; 5 being least important.)

______A. A necessary service to our customers and suppliers.
______B. A cost-saving service.
______C. A primary aid to developing new customers
______D. A competitive tool
______E. Other (please specify)

STUDY OF COMMUNICATION NEEDS IN BUSINESS

DRY CLEANER INFORMATION
(Strictly Confidential)
Graduate School of Business Administration
Department of Marketing and Transportation
Michigan State University

The questionnaire is divided into two parts. Part A deals with certain characteristics related to your firm, its customers and its suppliers that may affect your need for various types of communications offerings.

Part B of the questionnaire is primarily concerned with your evaluation of the present and future role of telephone communications in various areas of your firm's operations. Your responses to this portion of the questionnaire will aid us in determining where telephone communication needs are greatest and how these needs vary from one sector of the business community to another.

Please note that the responses given in this questionnaire will be considered strictly confidential and will not in any way be identified with any individual or firm.

The entire questionnaire should take approximately 20–30 minutes to complete. Your cooperation will be most sincerely appreciated.

PART A

Unless stated otherwise, the following questions refer only to the facility or plant located at the address to which this questionnaire was mailed. Any questions pertaining to branch plants located elsewhere in the city, state or country will be clearly identified. Thus unless stated specifically in the question, any information given should refer only to the facility to which this questionnaire was addressed.

1. How long has your firm been operating in its present facility? ______ yrs.
2. How many separate or adjoining buildings do you have at this location? (excluding garages, sheds, etc.) ______
3. Approximately, how many square feet of floor space does your physical plant encompass? .... ______
4. How many separate offices do you have in the building(s)? .... ______
5. What was the total revenue for the store located at the address to which this questionnaire was sent during the fiscal year 1967? ______
6. What was the total revenue for all of your Greater Lansing Area dry cleaning establishments during the fiscal year 1967? ______
7. What has been the average number of employees working at this location during the past year? .... ______
8. How many of this total were salaried employees? .... ______
9. Of your total number of employees, how many on the average during the past year have been employed in each of the following areas? .... ______

	Past Year
Administrative and Supervisory	______
Clerical	______
Sales Clerks	______
Other (please specify)	______

10. What percent of your yearly gross revenue is presently derived from the following types of customers? .... ______

    ______ % Residential

    ______ % Commercial or Industrial

    ______ % Other (please specify)

11. Which of the following services does your firm presently offer? (please check)

    ______laundry ______drapery cleaning

    ______dry cleaning ______winter storage

    ______rug cleaning ______other (please specify)

12. Please indicate in the appropriate column the number of additional dry cleaning establishments your firm maintains in each of the geographical areas listed below:

    Greater Lansing Area
    (Local Telephone Calling Area) .... ______

Outside Greater Lansing
but within Michigan .... ________________________

Outside of Michigan .... ________________________

13. In what city and state are your main offices located?

city .... state ....

14. What are the central telephone numbers to which your firm is billed? (Please include the number of any private lines or WATS lines to which separate billings are made.)

....

15. Position of person (s) completing questionnaire.

....

PART B

The following questions concern your own personal attitudes and opinions toward the value of telephone communications – both in general and in respect to the value of specific communication offerings to certain aspects of your firm's operations.

(Table for Questions 1 – 5)

A. Communicating with customers

B. Communicating with suppliers

C. Interdepartmental communications

D. Communicating with salesmen in the field

E. Communicating with branch facilities and/or the home office

F. Utilizing telephone lines for data transmission (other than voice)

G. Other (please specify)

1. Considering *telephone usage* in the *local* calling area only (i.e. no toll charge), please rank the following activities from 1 to 7 in terms of the *amount of time* your firm spends in the average month on each activity in relation to the others. *(1 being the most time; 7 being the least; 0 if no time at all)* ....

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3 Please rank the following activities from 1 to 7 in terms of where you feel telephone communications will make its most important contribution to your firm 5 years from today. *(1 being most important; 7 being least important; 0 if no contribution* ....

4. If in-state long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease?* (Write 0 if you would expect no decrease.)
% decrease

5. If *inter-state* long distance telephone rates were to be *increased* by 20%, by what per cent would you expect your usage in each of the following areas to *decrease? (Write 0 if you would expect no decrease)*
% decrease

	A. Communicating with customers	B. Communicating with suppliers	C. Interdepartmental communication	D. Communicating with salesmen in the field	E. Communicating with branch facilities and/or the home office	F. Utilizing telephone lines for data transmission (other than voice)	G. Other (please specify)
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2.							
3							
4.							
5.							

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   A. local telephone usage

   far above average......... above average......... average......... below average......... far below average........

   B. long distance telephone usage

   far above average......... above average......... average......... below average......... far below average........

   C. the amount of telephone equipment you presently utilize

   far above average......... above average......... average......... below average......... far below average........

   D. the amount of yellow page advertising you presently subscribe to

   far above average......... above average......... average......... below average......... far below average........

   E. utilizing telephone wires for data transmission

   far above average......... above average......... average......... below average......... far below average........

   F. utilizing the telephone to contact suppliers

   far above average......... above average......... average......... below average......... far below average........

   G. utilizing the telephone to contact customers

   far above average......... above average......... average......... below average......... far below average........

   H. your salesmens' use of the telephone

   far above average......... above average......... average......... below average......... far below average........

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9. Please rank the following phrases from 1 to 5 in terms of how you feel they reflect your firm's attitude toward the value of telephone communications. (1 being most important; 5 being least important.)

______A. A necessary service to our customers and suppliers.
______B. A cost-saving service.
______C. A primary aid to developing new customers
______D. A competitive tool
______E. Other (please specify)