

USING ADOPTION PROCESS VARIABLES
AS A PREDICTOR OF PRODUCT
CONTINUANCE OR DISCONTINUANCE

Thesis for the Degree of Ph. D.
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PATRICK MICHAEL DUNNE
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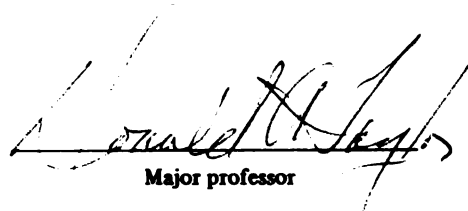
USING ADOPTION PROCESS VARIABLES AS A PREDICTOR
OF PRODUCT CONTINUANCE OR DISCONTINUANCE

presented by

Patrick Michael Dunne

has been accepted towards fulfillment
of the requirements for

Ph.D degree in Marketing


Major professor

Date Oct 19, 1972

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ABSTRACT

USING ADOPTION PROCESS VARIABLES AS A PREDICTOR OF PRODUCT CONTINUANCE OR DISCONTINUANCE

By

Patrick Michael Dunne

Over \$300 billion will be spent on new product innovation in the 1973 fiscal year. Yet, over 70 per cent of this cost will go to products that will not be successful in the market place. Nowhere is this problem of new product introduction more prevalent than in the retail food industry. Thus, the stated purpose of this study was to provide the retail food manager a means of predicting which of the products distributed through his retail food outlet should be eliminated from his product line at a point in time far earlier than the usual analysis of thirteen weeks sales data. Instead of reviewing the initial three months sales results, it was hypothesized that knowledge of the level of consumer adoption process variables, as well as knowledge of the rate of growth of these variables, could be used to

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predict management's decision to continue or discontinue a new product at a point in time earlier than in present use today. The point in time chosen for this study was five weeks after product introduction. While admittedly, this was an arbitrary decision, it was chosen so as to make a significant reduction in the amount of time needed to make the continuation decision.

Six variables of the adoption process were selected for testing in this research. The research measured the levels of activity for these six predictor variables against seven new products introduced in the Des Moines, Iowa market during the summer of 1972. The seven products studied were of a similar nature in both terms of level of newness and in terms of consumer product classification. The study presented its own analysis of this definitional classification as well as what items were to be considered important in the adoption process. A telephone survey was conducted of customers for a selected chain store in Des Moines to determine the level of activity for the products.

The approach to analyzing the data was twofold. First, linear discriminate analysis was used to test if the weekly percentages for the second through fifth week after introduction of the six predictor variables chosen were

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able to discriminate between the products which management, according to its criteria, decided to continue or discontinue at the end of thirteen weeks. Second, the rate of growth hypothesis was tested by means of eighteen independent t-tests. Also, two-way analyses of variance were performed on the mean rates of growth between the continued and discontinued groups by the six predictor variables for the same time period as the earlier tests.

The study was able to differentiate between the continued and discontinued products by using the weekly percentage levels of the six variables. In the fifth week the discriminate function was found to be significant at the .01 level and to correctly assign all seven products to their proper grouping. The thesis, also, analyzed the data from the second, third and fourth week. This was to see if an earlier time period could produce significant results, likewise. While the second week's function was found to be significant at the .02 level and correctly predicts the outcome of all seven products, the observed difference in the means of the two product groups was only nine times the week's standard error. The fact that the observed difference of the means for the fifth week was seventy times as great supported the notion that the fifth week is able to

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The function for the other two weeks was believed to have been influenced by extraneous variables. Nevertheless, they were still able to predict five of the seven product groupings correctly. Three of the six predictor variables were found to exercise a great deal of influence on the continuation of a new product. They were weak interest, weak information seeking, and knowledge of the product type.

The analysis of the rates of growth as a predictive tool presented evidence, which tends to support the hypothesis that the rates of growth cannot be used to predict the continuation or discontinuation of the product.

Nevertheless, it was shown that for at least one product grouping at one time and in one geographic location, a linear discriminate function of six adoption variables could be used to predict product continuation or discontinuation. Prior to this time the adoption variables have been used as a post-operative tool to explain what has happened. Now these variables have been shown to be useful as a predictive tool as well.

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By

Patrick Michael Dunne

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Marketing and Transportation Administration

1972

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1972

To Joe, Ray
and their families

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Dr. Leo G.

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The completion of a doctoral program is never a function of one individual. While space limitations prevent the author from thanking all those whose efforts contributed to that completion, the following people should be especially noted for their assistance:

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Dr. Richard J. Lewis, Professor of Marketing and Transportation Administration, Michigan State University, has always been a helpful counselor to the author. As both a member of the research committee and a neighbor, Dr. Lewis was always available with advice to solve the problem at hand.

Dr. Leo G. Erickson, Professor of Marketing and

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Transportation Administration, Michigan State University, as a member of the research committee served tirelessly from the inception of the research. His assistance is deeply appreciated.

Dr. Eddie V. Easley, Professor and Chairman, Department of Marketing, Drake University, and Dr. Vasanth B. Solomon, Assistant Professor of Statistics, Drake University, were instrumental in the development of the research design. Dr. Solomon's assistance with the statistical methodology is greatly appreciated.

Miss Mary Hershberger, who did all the rough draft typing, and Mrs. Jo McKenzie, who typed the final copy, are to be thanked for putting up with the author's constant pressure. In addition, sincere appreciation goes to the company, which must remain anonymous, that permitted the author to use its store for this study.

A final word of thanks must go to the members of the faculty of the Graduate School of Business Administration at Michigan State University for their assistance in the development of the author's professional career.

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CHAPTER I

INTRODUCTION

Background

Each year American business firms introduce several million "new" products to the market place. The introduction of these so-called "new" products is an attempt by the firm to obtain a differential advantage by means of product differentiation over their competition.¹ However, some thought should be given to the question of what is a "new" product.

Wasson has noted that a product can be classified as "new" in at least thirteen possible ways. Each of these ways will have some effect, either positive or negative, on the introduction strategy chosen by the firm.² Robertson has defined "new" innovations in three ways, depending upon its effects on established patterns of consumer behavior.³ Buzzzell and Nourse have defined new products as the products are looked upon by the processor and distributor.⁴ Yet none of these definitions have become universally accepted so that the term new product means the same to all readers.

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Nevertheless, American firms continue to introduce a variety of "new offerings" each year. A possible explanation for this behavior can be found in an interpretation of Alderson. Alderson has been interpreted as saying that a firm seeks power through product differentiation in order to resolve negotiations between the firm and the consumer in the firm's favor. One of the most common methods of product differentiation is by means of differentiating the product physically from all competitive offerings so as to remove it from any margin of perfect substitution. Other acceptable methods include (1) psychological differentiation through communication; (2) differentiation in the purchase environment; (3) differentiation in after-purchase assurances of satisfaction in use; and (4) differentiation in price and terms of sale.⁵

It is through these power-seeking, differentiation activities, that the firm seeks to reduce risks and create a preference among purchasing units that is sufficiently strong to withstand the efforts of competing firms. The profits a firm earns are in part a payment for the risk involved in the firm's efforts to achieve this power, and in part to guide a firm to other than low risk alternatives. Business Week quotes a Chicago industrial designer as saying these risks are causing companies to face "situations they

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Today's American economy has reached a stage where product innovation has become a major factor of economic expansion. Each decade brings a higher percentage of sales from products not in production in the previous decade. This statement is most pronounced for those industries which account for a growing proportion of the United States' Gross National Product.⁷ (See Figure 1-1). A study by Printers' Ink has shown that 43 per cent of 1957 gross sales resulted from products not in production in 1947 and has estimated that the figure has increased to 56 per cent for 1966 using 1956 as a base year and 62 per cent for products offered during the decade ending in 1971.⁸ Of the companies with the highest growth rate for the past several years, over 50 per cent of their sales have come from products introduced during the previous decade while only 10 per cent of the sales of low growth firms came from this source. Of special interest is the fact that the majority of high-growth companies achieved diversification by acquiring other companies in addition to internal developments.⁹ The situation is further verified when one considers the results of a 1965 study of United States firms. Of 742 firms studied in the six months starting January 1, 1965, 522 firms launched some 1,236 new products in that period.¹⁰

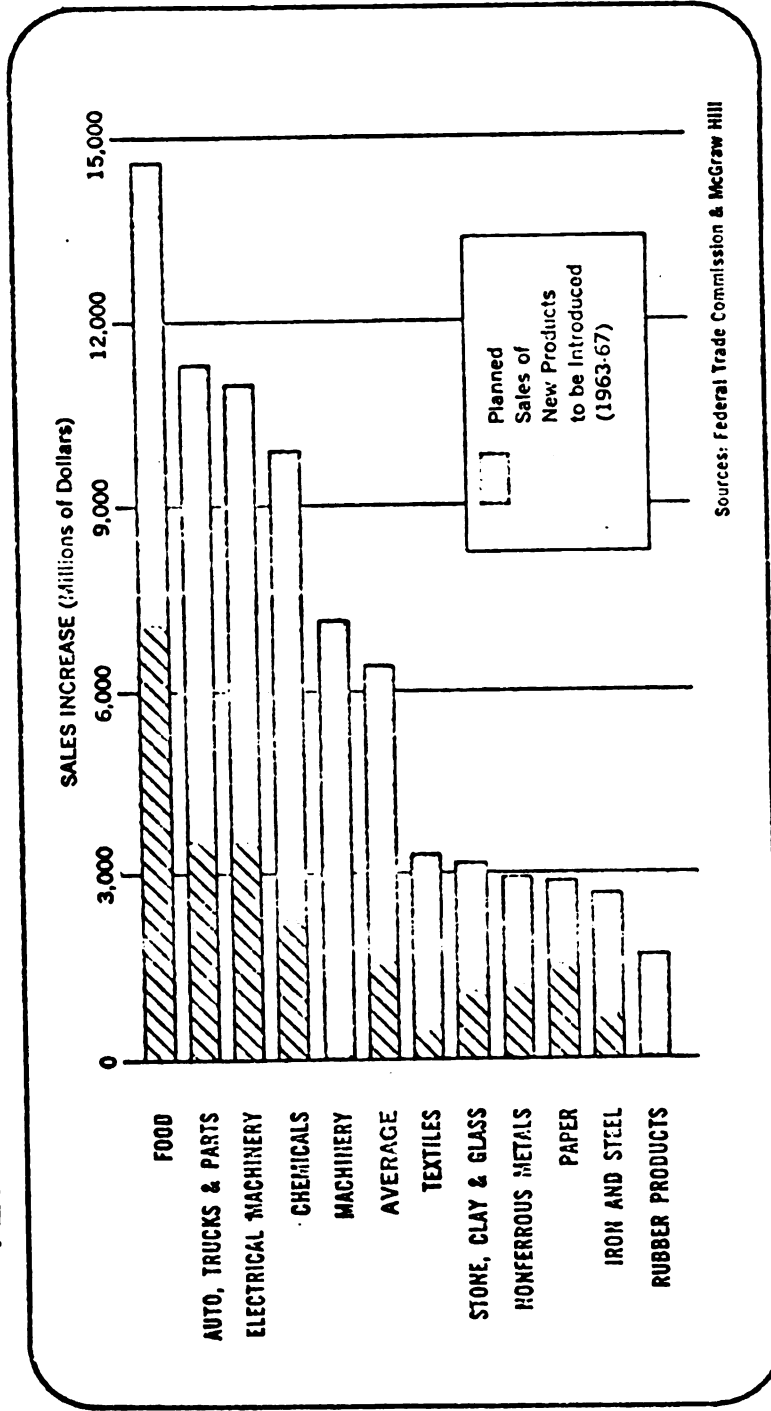
PLANNED CONTRIBUTION OF NEW PRODUCTS TO SALES GROWTH, 1963-1967

PERCENTAGE 1-1

SALES INCREASE (Millions of Dollars)		1963	1964	1965	1966	1967
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FIGURE 1-1

PLANNED CONTRIBUTION OF NEW PRODUCTS TO SALES GROWTH, 1963-1967



Source: Booz-Allen and Hamilton, Inc., Management of New Products (New York: 1968), p. 5.

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The cost of this new product innovation for the 1968 fiscal year amounted to over \$250 billion, or over 25 per cent of the Gross National Product.¹¹ Yet, over 70 per cent of this cost went to products that were not successful in the market place, in fact over two-thirds went to products eliminated in the development stage. Thus, about eight of ten development engineers may be said to be working on projects that will not be justified in terms of commercial usefulness. (Basic research is not included here.)¹²

However, in spite of the increasing efforts to remove unsuccessful products in the development stages before they reach the market place, many new products fail when they are finally introduced. (It should be noted that estimates of the rate of new product failures are almost invariably exaggerated. The actual rate of failure depends, of course, on what products are included in the base against which a failure rate is computed, as well as on the criteria employed to identify failures. Weiss has found that over 80 per cent of new products are not "new" but "simply modifications" of existing products.¹³) Booz-Allen and Hamilton report that in a survey of all industry groups only 62.5 per cent of the products presented to the consumer will do more than break-even over their first three years of sales.¹⁴

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analysis by the American Management Association which concluded that 19 of 20 new products could be expected to fail,¹⁵ a 1972 Business Week prediction that of the 120,000 soaps, food snacks and other supermarket products introduced in the 1970's roughly 10,000 will bomb out¹⁶ or a report of Advertising Age which predicted that 80 per cent of new supermarket products will fail as they will not meet sales goals.¹⁷

A more conservative estimate of the failure rate of new products can be found in a study by Buzzell and Nourse on the food industry. Of the 127 distinctly new food products they examined, 39 per cent were discontinued either after test marketing or after regular introduction. Also, 42 per cent were classified by their sponsors as either extremely unsuccessful or moderately unsuccessful. Another criterion of product performance is the length of time required for the contribution to profit earned from a product to offset its development and introduction costs. By this criterion, 44 per cent of the products failed to break even after two years of regular distribution.¹⁸

In summary it can be stated that advancing technology and increasing research and development give no assurance that new products will have a high probability of success. It is not uncommon to find studies which reveal

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Resource allocation for new product research and development presents a problem for the firm when the failure probability is so high. While industry is constantly confronted with product obsolescence as new developments threaten to limit the market life of existing goods, and consumer spending patterns undergo constant shifts, few firms can take comfort even in a success-failure average of two to one. The profit squeeze of today's economy has limited the amount of financial set-backs a firm can encounter. Yet, if a firm doesn't seek out new products to satisfy the consumer's ever-changing wants and desires, it will also suffer financial disaster as competitors fulfill these needs.

Statement of the Problem

In view of the above research findings, it can be seen that the firm faces a high risk situation if it fails to at least keep pace with its competitors in new product development. Similarly, the firm experiences a high financial risk every time it undertakes to introduce a new product in the market place. If one subscribes to the theory that the ultimate objective of a firm is that of survival,

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then the firm is forced into a condition of new product introduction. This means of seeking a differential advantage presents only two alternatives for the firm in order to reduce the high financial risks. First of all, the firm could re-examine its internal developmental process from the first stage of determining firm objectives to the final stage of test marketing. Secondly, the firm could seek out newer research techniques in order to make profitable marketing decisions during the introduction process.

No longer can the firm take the leisurely approach towards predicting product success during the introduction process. Today there is a dollar premium on time which is greater in the first month of a new product's life than at any other stage. Crawford specifically listed six important reasons for the firm to rapidly determine a new product's success or failure probabilities immediately after launch. These are:

1. The attention span of consumers in the market place is short.
2. Changes can be made rapidly thanks to the speed of mass communication.
3. The size of the initial investment grows with each new product to the point where the launch of important new items is backed by dollar

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4. In any creative, market oriented company, opportunity cost decisions abound.
5. Top management isn't known for patience.
6. Finally, launch of a new product signals the start of many ongoing problems throughout the corporation.¹⁹

This study will concern itself with the introduction of new food products because nowhere is the problem of new product introduction more prevalent than in the retail food industry. The ex-Secretary of Agriculture, Orville Freeman, stated, "Each year about 5,000 new food products are offered to stores that already carry 8,000 different items."²⁰

Business Week in a 1972 survey of new product marketing problems found that the three year payout is some eighteen months too long. During the last ten years, as new brands introduction more than doubled in the frozen-food and dry-grocery business, average product "life expectancies" fell from 36 months to 12 months.²¹

Thus, one can see that today's supermarket is faced with the problem of selecting those products which offer the potential of success and eliminating those with limited possibilities. This thesis will attempt to provide a

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guideline for the store manager in his selection of products to be retained. The current supermarket method includes sales analysis, in which the sales of the products in question are examined over a three month introduction period before a final decision is reached. However, in view of the above information, the manager can no longer afford the luxury of a three month trial program. His low operating margin will not permit him to use valuable shelf space on a non-successful product. Today's manager needs to be able to make his decision at a much earlier point in time. Any marketing tool which could be used at this stage would be a contribution to the individual manager and likewise to the distributor as well as producer.²²

In view of these above reasons the stated purpose of this research undertaking will be to provide a means of predicting which food products should be eliminated from the firm's product line at a point in time far earlier than the usual analysis of thirteen weeks sales data. Instead of reviewing initial three months sales results, it is hoped that the proposed method will enable the retail food manager to make a profitable prediction on the basis of consumer behavior patterns during the initial 5 weeks of introduction.

Implications for Marketing Problems

A great deal of research has been conducted by marketing scholars and professionals concerning the way new products are conceived and progress through different stages of the introduction process. These may be classified into two analytical frameworks. New sales information can be thought of in terms of diffusion processes or adoption processes.

Diffusion process is the name given to the process by which "new ideas are communicated to the members of the social system."²³ To model a diffusion process, one works with a few macroparameters that will locate a curve that describes the path of the innovation over time. Some of the major diffusion models which have been developed by those who have worked on the first purchase forecasting problem include concave models, S-curve models, epidemiological models and reliability engineering models.²⁴

The adoption process, however, focuses on the "mental process through which an individual passes from first knowledge about an innovation to a decision to adopt or reject and to a confirmation of that decision."²⁵ Adoption itself is the act of buying the product in the case of nonrepurchasable products, or the decision to use the product regularly, in the case of repurchasable products.

These models require a more behavioral and detailed rendering of the individual's process of moving toward the trial and use of a new product. Here some common models are the DEMON model, Urban's model and Alba's model.²⁶

Other works in this area include Lavidge and Steiner's²⁷ examination of the use of advertising for predicting effectiveness, and Bader,²⁸ as well as Britt and Lucas,²⁹ who examined the use of point of purchase displays for existing products. Yet none of these models have presented the retail store manager with a useful tool for predicting product success at an early stage in the product introduction phase. All have used sales as the measurable variable for predicting success. The closest anyone has come to predicting success without waiting for complete sales returns has been Crawford. Crawford used a trajectory projection to predict sales results. However, these trajectory curves, which were based on consumers' awareness and knowledge of the new product, percentage of repeat sales and dealers' promotional activities, were obtained over a long time period and at great expense, something most retailers would be unable to afford.³⁰

In an attempt to provide the retail store manager with a useful tool for predicting product performance at an early stage in the introduction process, this thesis

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proposes a model for predicting which products are doomed to failure. The model is a two phase product classification model, which will be used to define what is meant by the term "new product" and to provide a means for analyzing new product information. The first phase classifies the "newness" of the product in a three dimensional matrix with each of the dimensions reflecting the different levels of newness as perceived by the different members of the marketing channel; the producers, the middlemen and the ultimate consumers. The model is further structured by combining the level of newness with an analysis of the product's characteristics. Miracle's³¹ revision of Aspinwall's product classification is used to relate the behavior of new products in comparison with other new products of similar levels of newness and product classification.

By combining these product characteristics with the new product classifications and then measuring the levels of activity of the stages of the adoption process, it is felt that a contribution can be made for determining which new products should be eliminated from a firm's total product line at a point earlier in time than is presently the case. It is to be noted that while this model does not make use of the repeat purchase patterns of the consumers in an attempt to predict product retention, it does serve as

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a means for predicting which products will be retained by management. Thus, the fact that the model does not predict elimination from the line for the product in question, it does not necessarily predict success for that product. It does, however, guide management in their attempts to eliminate those products which will have a very low probability for continuation. The low probability for success is based on the fact that the eliminated products will never experience a significant level of first time purchasers.

Conceptual Framework

The conceptual framework for this study involves the selection of various phases of the adoption process which can be used to differentiate between those new products which management will either retain or drop at a later date. It is hypothesized that by measuring the level of activity for the initial six phases of the adoption process presented in this thesis, a significant reduction in the time needed to evaluate the retention of a new product can be achieved. The general retailing practice in use today is for retail food management to analyze sales data for the initial thirteen weeks and then make a judgment as to continuation or discontinuation on the basis of analysis of sales trends, ROI or profit.

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This thesis will measure the level of activity for the six predictor variables from a group of products possessing a common level of newness and product classification in an attempt to see if a significant difference exists between the two groups, the retained and dropped products, which can serve as a tool for assigning future product introductions to their correct grouping. The initial selection of product grouping will be made by the management on the basis of their thirteen week analysis of sales results. From this analysis, a discriminate function will be derived which will enable the management to classify both present and future products to their proper grouping on the bases of measurements taken before significant sales results are available.

An illustration of the proposed is as follows: Given that we were able to measure the levels of six variables (x_1, x_2, \dots, x_6) during the fifth week after introduction and mark them on a graph with x's representing continued products and o's representing discontinued products, as classified by management at the end of thirteen weeks as shown in Figure 1-2.

The resultant ellipses in Figure 1-2 enclose some specified proportion of the points, say 98 per cent in each product group. A straight line is drawn through the two

ILLUSTRAT

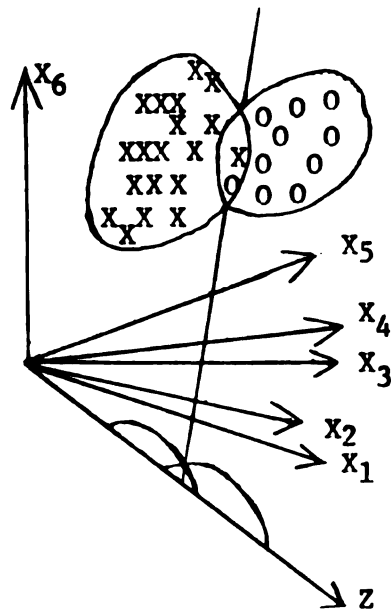


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FIGURE 1-2

ILLUSTRATION OF A DISCRIMINATE FUNCTION



points where the ellipses intersect and then projected to a new axis Z . The axis Z condenses the information about group separability into a set of points on a single axis. The axis Z is the discriminate function in this illustration and it can be used to predict correctly the product grouping for present as well as future products on the basis of measurements of the activity occurring in the early phases of the adoption process in the initial five weeks of product introduction.

The information shown in Figure 1-2 can also be expressed in terms of an equation where x_1, x_2, \dots, x_6 represent the six predictor variables. In such a case, a numerical value can be determined for each of the products under

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question and the products assigned to a group on the basis of which group mean value is closest to the new product's value.

Thus, the stated objective of this study is that measurements of the initial stages of the adoption process can be analyzed and a decision can be made at end of five weeks with regard to the continuation or rejection of the product from the line if thirteen weeks sales results were available. For purposes of verification, the fifth week decision can be compared with the actual management decision eight weeks later to determine the assignment error. It is hypothesized that such an analysis of the adoption process can product significant results.

Methodology

The data to be used for this study will be obtained by means of a phone survey of supermarket shoppers in the Des Moines, Iowa market. One supermarket chain whose retail sales accounted for 26 per cent of Des Moines' 1971 retail grocery sales cooperated with this study. The choice of Des Moines as well as this chain was fortuitous. Any analysis of the results of this study with the total United States population can only be made insofar as the consumers of the above chain in Des Moines, Iowa are representative of

the United States market.

The proposed research design involved the selection of seven products from a list of products the store management was planning to introduce within the next three months. This was the maximum number of products available for the study since basic criteria for the product selection were that all the products were defined as having the same level of newness and that each fit into a similar classification in Miracle's groupings. After selecting the products a phone survey of the store's customers was conducted to determine the amount of customer awareness, knowledge, interest (strong and weak) and information seeking activities (strong and weak) with regard to the new products at the end of the second, third, fourth and fifth week after introduction.

Linear discriminate analysis was used to test if the weekly measurements of activity of the six predictor characteristics chosen were able to differentiate between the continued and discontinued products. The rate of growth hypotheses were tested by means of eighteen independent t-tests. These eighteen tests, each with the standard assumptions of normality, equality of variance and independence, were used to analyze the data to determine if there was a significant difference in the means of

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the continued and discontinued products for each of the six predictor variables for the third-second week period, fourth-third week period and the fifth-fourth week period. Also, two-way analyses of variance were performed on the mean rate of growth between the continued and discontinued groups by the six predictor variables for the same time periods as the t-tests.

Limitations of the Study

The thesis has several limitations. First of all, the data were collected during one time period. If the data could have been collected over different time periods, and compared to these different periods, different results might have been obtained. However, because of the resources available to the researcher, the idea of a longitudinal collection process was not considered. The five week cut-off point was admittedly an arbitrary decision. This point in time, which may need readjusting in future studies, was chosen so as to make a significant reduction in the amount of time needed to make the continuation decision.

Due to time and expense constraints the researcher was able to study the consumer purchasing behavior for one particular product grouping at one retail location. This selection of product grouping and location also provided no

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means for measuring the advertising effectiveness of the products due to the chosen retail store's established advertising policies. It can be noted that the absence of store advertising might not be a limitation, since the advertising of the manufacturer could be considered to be a part of the product offered for sale. Nevertheless, these limitations might produce some variance in the thesis results. Every effort, however, was made to have customer selection by day and hour representative of the total store population and all findings were considered to be valid only for the particular store studied. Another possible limitation is that this study assumed that there was a common homogeneity between the households selected for interviewing for each of the four different weeks. It is further noted that a final limitation of the thesis was the fact that only a limited number of new products of the same grouping were available for study during the time of this study.

Some Possible Contributions of the Study

The major contribution of this study was that by the use of a product classification systems, which considered both the level of newness and the product's consumer and market characteristics, a useful tool was developed which could enable one particular store to predict the

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continuation or discontinuation of a product before meaningful sales results were available.

The thesis further provided a basis for examining the results of combining three marketing tools: new product dimensions, product-market classifications and adoption studies into a useful research technique.

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CHAPTER II

LITERATURE REVIEW

The primary objective of Chapter II is to establish a theoretical background for the research by reviewing the relevant literature. Chapter II is divided into four sections: Adoption Process, Diffusion Process, Innovation Characteristics, and Product Elimination Studies.

No review of the literature in this area could ever be made without use of Everett M. Rogers and his Bibliography on the Diffusion of Innovation.¹ As of July, 1968, when the last bibliography was compiled, Rogers had gathered, analyzed and summarized 1,084 diffusion and adoption studies. Some sixty-four of these studies were classified as marketing studies. It should be noted that only six years earlier Rogers rejected Katz and Levin's classification of marketing as a research tradition because as he stated, "there are relatively few research studies available in this field (marketing)."² Also, the work of Thomas S. Robertson who has been most active in relating the studies in the area of diffusion and adoption to basic

marketing concepts was extremely useful. Thus, the most recent texts of Rogers and Robertson³ will serve as benchmarks for this chapter.

The Adoption Process

This review of the literature begins by studying the adoption process and then going to the diffusion process. This is the reverse of the traditional case because of the nature of the research being conducted. In this study the stages of the adoption process are used as the predictive variables. Also, it can be argued that the adoption process actually takes place before the social system completes the diffusion process.

Rogers and Shoemaker have defined the adoption process as "the mental process through which an individual passes from first knowledge of an innovation to a decision to adopt or reject and to a confirmation of that decision."⁴ This is a revision of Rogers' earlier definition of the process as it allows for the rejection of the innovation under question.⁵ The adoption process should be distinguished from the diffusion process by which "new ideas are communicated to the members of the social system."⁶ Thus diffusion occurs within a social system, while adoption takes place within an individual.

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Several adoption models have been proposed. The one common bond between them is their conceptualization of a flow of events rather than an "instant metamorphosis". These models propose a series of "stages" to represent the sequence of mental and/or behavioral events assumed to be antecedents of adoption. However, there is a great deal of differences in the number of stages and in the nature of these stages. Thus, the reader should realize that all these models are conceptual frameworks only and that their value must be determined by how well they operate in a given situation. This section of Chapter II will attempt to review the major models pertaining to the adoption of new innovations in their chronological order. It should also be noted that the innovation as used in these adoption studies will refer to any product or idea which is perceived as new by the individual in question. This may be either a product for which a new use has been developed, which has undergone minor changes or is a completely new offering with no direct substitute.

Ryan and Gross Hybrid Corn Study

The landmark study of the adoption process is the 1943 study of the introduction of hybrid corn in Iowa. The innovation of hybrid corn was the result of years of

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intensive research by agriculture scientists. The hybrid vigor of the seed did not continue in the second generation, so farmers had to purchase hybrid seed each year, whereas previously they had selected their own open-pollinated seed. The major advantage of the innovation was a 20% increase in yield. While the new corn was first made available in 1928, it wasn't completely adopted by Iowa farmers until 1941.⁷

Ryan and Gross found that the first use of the hybrid seed followed a bell-shaped (but not exactly a normal) distribution when plotted over time. They also noted that the process contained at least three stages: awareness, or first hearing of the new idea; trial, or first use; and adoption, or complete use of the new seed. The average time for this process was nine years. A final finding of their study was that the typical farmer first heard of the new seed from a salesman, but neighbors were the most influential source in leading to adoption.

Rogers has pointed out several criticisms of this pioneering effort. Two of the criticisms are:

1. Ryan and Gross made no analysis of opinion leadership in the process.
2. They defined "acceptance" as first use of the seed (the trial stage), and largely ignored the adoption (complete use of the

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new product) dimension in the data they had gathered.⁸

Five-Stage Adoption Process Model

Yet, in spite of these shortcomings, this study has long been regarded as the forerunner of all others in this area. In 1955, when the North Central Rural Sociology Subcommittee for the Study of Diffusion of Farm Practices defined the stages of the adoption process, they relied heavily upon this work and that of Wilkening.⁹ The five stage model adopted by the committee was:

1. Awareness: The individual learns of the existence of the new idea but lacks information about it.
2. Interest: The individual develops interest in the innovation and seeks additional information about it.
3. Evaluation: The individual makes mental application of the new idea to his present and anticipated future situation and decides whether or not to try it.
4. Trial: The individual actually applies the new idea on a small scale in order to determine its utility in his own situation.
5. Adoption: The individual uses the new idea on a full scale.¹⁰

However, this conceptualization has been subject to criticism in recent years. First of all, the process seldom ends with adoption as the individual is exposed to

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dissonance in evaluating his behavior.¹¹ McCarthy in his latest text has listed a sixth stage to the above model. McCarthy calls this final stage confirmation, and defines it as the process of seeking reinforcement. He, also, has renamed the fifth stage, decision.¹²

Another criticism is that the above model always ends in adoption decisions. Robertson points out that it is possible for the individual to reject the innovation. He further points out that no provision is made for the individual to skip stages, nor are any feedback loops provided.¹³ Thus, this model fails to account for non-adoption, impulse buying behavior and feedback of past experiences which can affect present behavior.

"Hierarchy of Effects" Model

Marketing researchers have proposed a hierarchy-of-effects model as a result of a 1961 study by Lavidge and Steiner.¹⁴ This model consists of the six steps in the purchase process, which they found to be related to the three basic psychological states: cognitive, affective, and conative. Their six stages were:

1. Awareness: The individual is aware of the product's existence.
2. Knowledge: The individual knows "what the product has to offer".

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3. Liking: The individual has favorable attitudes toward the product.
4. Preference: The individual's favorable attitudes have "developed to the point of preference over all other possibilities".
5. Conviction: Preference is coupled "with a desire to buy" and confidence "that the purchase would be wise".
6. Purchase: "Attitude" is translated into actual buying behavior.

Lavidge and Steiner have stated that since time and difficulty involved in each stage depends upon both product and consumer characteristics, the stages are not necessarily equidistant. However, a buyer may sometimes go through several stages simultaneously (an impulse purchase). Robertson has pointed out this model, also, made no effort to use feedback behavior.¹⁵ Nevertheless, this model was the first to explicitly rely on an information-attitude-behavior theory of communication effect.

"AIDA Model"

Another marketing effort to define the process is the "action-oriented framework" called AIDA. This model which was first proposed in personal selling texts consists of four fundamental tasks which have been recognized for many years: (1) to get attention, (2) to hold interest, (3) to arouse desire, (4) to obtain action. The

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relationship of these models is shown in Figure 2-1.

FIGURE 2-1

RELATIONSHIP OF THE THREE ADOPTION
PROCESS MODELS HIERARCHY

	<u>Hierarchy of Effect</u>	<u>AIDA</u>	<u>McCarthy</u>
	Purchase		Confirmation
Behavioral Level			Decision
	Conviction		Trial
		Desire	
	Preference		Evaluation
Attitude Level	Liking		
		Interest	Interest
	Knowledge		
Information	Awareness	Attention	Attention

Critique of Adoption Process Models

Robertson in his text, Innovative Behavior and Communication summarizes several critiques of these models. He repeats Mason's¹⁶ challenge that five discrete stages (Mason was referring to the basic rural sociology model, but this critique will apply to all three models) are necessary to account for adoption. Mason found several forms of the process occurring and no single process amounted for all forms of behavior. He did find that only two stages

are actually necessary: awareness and adoption (or rejection as supported by later studies of Rogers¹⁷), with awareness always occurring first. Robertson, also, notes that Mason found that evaluation apparently occurred before interest and that adoption was not the terminal stage, but was followed by interest and information seeking.¹⁸ This finding appears to be in agreement with those who hold to the theory of cognitive dissonance, mentioned earlier in this chapter, in that some purchasers seek out information to evaluate and reconfirm their previous purchase behavior.

Robertson, therefore, has concluded that a consistent adoption process conceptualization seems unlikely across any range of consumer goods. For inexpensive, low-risk products, deliberateness in purchase may not be as necessary as for expensive high-risk products.¹⁹ Important differences also seem to exist in the process for continuous as opposed to discontinuous innovations.²⁰

Robertson continues his critique by reviewing Campbell's two contentions that first of all the process may not be rational and secondly, that it might not start at awareness. Campbell has sought to show that the previous models, which only pertained to rational buying situations, failed to consider a situation where the perception of a problem could be the first stage. As has been noted,

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whether consumers are relatively active or passive at the beginning stages probably depends on the situation, for example, whether the products involved are expensive, infrequently purchased items or inexpensive, frequently purchased ones.

Campbell advocates four adoption processes. These four processes, which follow, are outgrowths of his two criticisms of previous models.

1. Rational/problem solving: Here the consumer becomes aware of a problem, looks for a solution, and carefully evaluates any product which potentially solves his problems.
2. Rational/innovation: Here the consumer becomes aware of the product before the problem and rationally judges it.
3. Nonrational/problem solving: Here the problem is perceived in advance of product awareness, but "in seeking a solution, the consumer impulsively accepts the innovation without careful consideration or evaluation".
4. Nonrational/innovation: Here the individual sees something new and impulsively adopts the item without deliberation as to its utility.

The relationship of these four models by Campbell is shown in Figure 2-2.

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FIGURE 2-2

RELATIONSHIP OF ADOPTION PROCESS STAGES
OF THE FOUR CAMPBELL MODELS:

<u>Rational/ Problem Solving</u>	<u>Rational Innovation</u>	<u>Nonrational/ Problem Solving</u>	<u>Nonrational/ Innovation</u>
Problem or interest	Awareness	Problem or interest	Awareness
Awareness	Interest		
Evaluation	Evaluation	Adoption Re- jection	Adoption Re- jection
Rejection Trial Rejection Adop- tion	Trial Adoption	Resolution	Resolution ²¹

Innovation-Decision Model

Rogers in an attempt to respond to the above mentioned critiques proposed a revision of the earlier adoption process which he titled the "Innovation-Decision Process". This model is the result of his effort to put some conceptual order as to the number of stages in the process in view of the many conflicting theoretic approaches to the process. This proposed model consists of four functions or stages:

1. Knowledge: The individual becomes exposed to the innovation's existence and gains some understanding of how it functions.
2. Persuasions: The individual forms a favorable or unfavorable attitude toward the innovation.

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3. Decision: The individual engages in activities which lead to a choice to adopt or reject the innovation.
4. Confirmation: The individual seeks reinforcement for the innovation-decision he has made, but he may reverse his previous decision if exposed to conflicting messages about the innovation.

Rogers states that this model is designed to account for the major criticisms raised about earlier models, to profit from recent research, and to be consistent with the learning process, theories of attitudes change and general ideas about decision making. He, also, notes that the knowledge stage is influenced by the: a) social system norms, b) communication integration and, c) the tolerance of deviancy. The persuasion stage is influenced by the innovation perceived characteristics of: a) relative advantage, b) complexity, c) compatibility, d) trialability and, e) observability.²² (These characteristics will be discussed in the third section of this chapter.) Rogers cites a 1960 study by himself and Beal as the empirical evidence for the validity of this process.²³

Marketing's Explanations of Consumer Decision-Making Process

The past decade has seen the introduction of three major consumer behavior models in marketing literature as

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an attempt to explain the dynamics of consumer decision-making with regard to new product introduction: Andreasen,²⁴ Howard and Sheth²⁵ and Nicosia.²⁶

The basic assumptions of the Nicosia model (Figure 2-3) are that the firm is introducing a new brand and that the consumer is unfamiliar with it. Nicosia used the technique of computer flow charting to designate elements and relationships, and it should be noted that there are four basic fields in Figure 2-3. It is explicitly assumed that field one includes the output of an advertising message from a business firm and that the consumer recipient was not previously familiar with the product. As the message (subfield one) reaches the consumer, it serves as an input into subfield two, consumer attitude. As this message is received and acted upon, the output hopefully is formation of an attitude toward the product, which then serves as the input for field two. Field two represents a search for and an evaluation of the advertised product and other available alternatives as well. The output from this field may or may not be a motivation to buy the advertised brand. If such a motivation emerges, it serves as the input for field three-the transformation of motivation into purchasing action. Finally, field four is storage or use of the purchased item, and the output is feedback of sales results to

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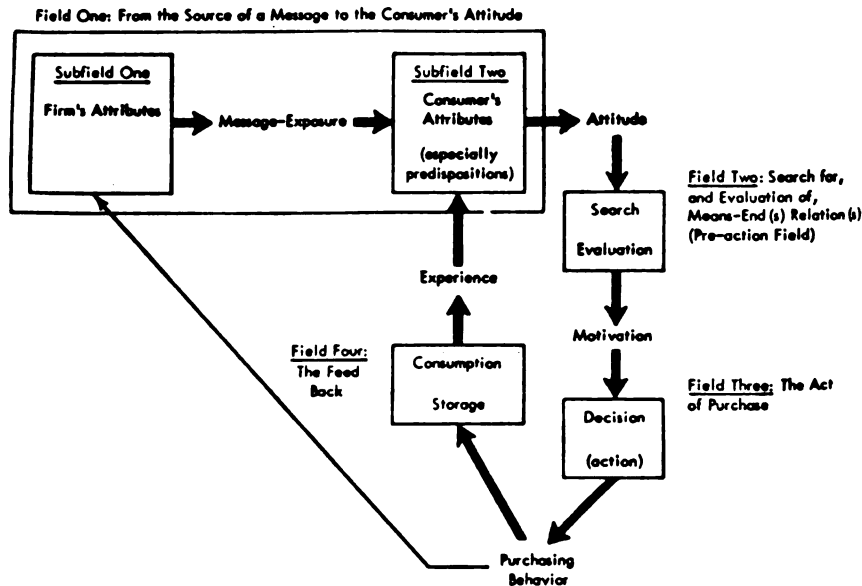
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FIGURE 2-3

THE NICOSIA CONCEPTUALIZATION OF THE PURCHASE DECISION PROCESS

The Comprehensive Scheme: A Summary Flow Chart



Source: Francesco M. Nicosia, Consumer Decision Processes (Englewood Cliffs, N.J.: Prentice-Hall, 1966), p. 156.

the business firm and retention of the consequences of the purchase in the buyer's memory.

Nicosia noted that a major advantage of his model is that his is amenable to simulation techniques for analyzing the effects of the various variables. Also, the model indicates the occurrence of feedback and successfully integrates communication input and response output variables.²⁷

Robertson points out a criticism of this model.

The model consists of "long listings of variables that might possibly enter into a consumer behavior model with

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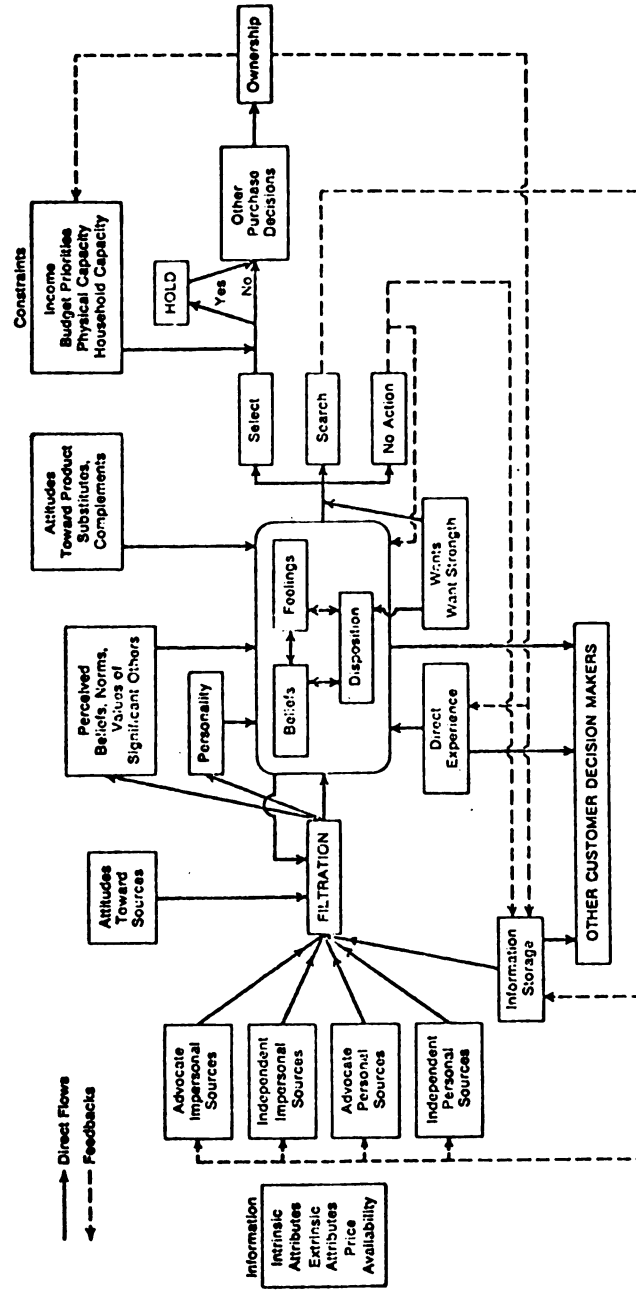
little, if any, explicit treatment of how they are inter-related".²⁸

The Andreasen model (Figure 2-4), also, assumes innovative behavior since the product is either a new product, or at least new to the individual. Andreasen advises the marketing manager to make note of the type of newness involved in the product. This model begins with the individual in a state of unawareness, therefore, having developed no attitude toward the given innovation. One of a number of sources communicates a form of information to the consumer which he filters out (selective process). The information then affects his attitude, defined in terms of belief, feeling and disposition components. At this point he may do one of three things: (1) select the product, (2) search for more information, or (3) take no action. A "select" decision will be mediated by certain constraints, and other purchase decisions (store, quantity, etc.) will have to be made before ownership is final.²⁹ The model contains all the advantages as well as the disadvantages of the previous model including an even more incomplete specification of variable interrelationships.

Unlike the preceding models, the Howard and Sheth model (Figure 2-5) focuses on repeat purchase behavior and has four major components: stimulus variables, response

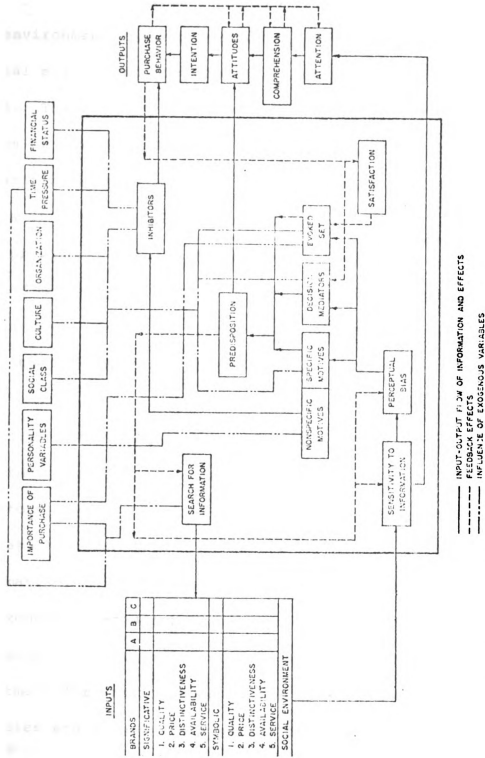
FIGURE 2-4

THE ANDREASEN CONCEPTUALIZATION OF THE PURCHASE DECISION PROCESS



Source: Alan R. Andreason, "Attitudes and Customer Behavior: A Decision Model", Reprinted in Harold H. Kassarian and Thomas S. Robertson, Perspectives in Consumer Behavior (Glenview, Illinois: Scott, Foresman and Company, 1968), p. 508.

FIGURE 2-5
THE HOWARD-SHETH "THEORY OF BUYER BEHAVIOR"



Source: John A. Howard and Jagdish N. Sheth, "Theory of Buyer Behavior", 1967 Winter Conference Proceedings (Chicago, 1968), p. 255.

variables, hypothetical constructs, and exogenous variables. The inputs to the buyer's internal state are stimuli from the environment, either commercial or social. These commercial stimuli are the marketing activities of the various firms. They may come either via the physical brands themselves or some linguistic or pictorial representations of the attributes of the brands. The social stimulus input refers to the information that the buyer's social environment provides regarding a purchase decision, for example, word of mouth communication. The hypothetical constructs are enclosed within the large rectangular box, which represents the consumer's internal state. Howard and Sheth have noted that the two hypothetical constructs, learning and perceptual, serve the role of endogeneous variables. The learning constructs include motives, evoked set, decision mediators, predispositions, inhibitors and satisfaction; whereas, the perceptual constructs include sensitivity to information, perceptual bias and search for information. The exogenous variables, shown at the top of the diagram, influence the hypothetical constructs and provide for adjustment for interpersonal differences. The response variables are ordered to create a hierarchy similar to the variety of hierarchies of the AIDA and Lavidge and Steiner models. However, Howard and Sheth have incorporated

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several feedback effects.³⁰

While admitting that it is difficult to do justice to these models in so short a description, it is important that the reader notes the significant step forward that these models have provided the marketing manager.

Summary of Adoption Models

After an analysis of the different adoption models presented thus far, one is left with the feeling that the concept of an adoption model is logical. If a behavioral act is to occur, it must have antecedents. Therefore, such a model, by merely forcing attention on these antecedents, provides a service for the marketing manager. The concept of an adoption model is of invaluable use in increasing our understanding of consumers behavior.

However, regardless of which model the market researcher chooses to follow, certain observations should be remembered.

First of all, the process need not always conform to a single form. Granted, while most behavior is of the rational/decision-making form, the market researcher should keep in mind that the nonrationalpsychosocial form as well as the nonrational/impulse form are possible explanations of human behavior.³¹

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Second, there is no maximum number of stages although the minimum number appears to be two.

And thirdly, no specified sequence of stages must occur. Allowance must be made for consumers to skip stages and for the occurrence of feedback.

For the above reasons the author proposes another model of the adoption process. This model is derived from the 1971 innovation-decision process of Rogers and makes alterations for the above observations. This model is shown in Figure 2-6.

The model is a logical extension of the previous discussion and has four advantages.

1. The model may be conceptualized as either an innovation-oriented process, that is starting with awareness, or a problem-oriented process, starting with problem perception.
2. Feedback effects are taken into consideration.
3. The model enables the reader to trace the different sequences of behavior which might occur as the consumer may skip some stages in the adoption process.
4. The model's final stage, confirmation, allows either a continuation of the action taken in the decision stage, or the rejection of that

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This model will be discussed in greater detail in Chapter III.

Industrial Goods and the Adoption Models

Ozanne and Churchill have examined the process in the industrial goods market and found the industrial process to be the same as the traditional one except that the trial stage might be eliminated with indivisible innovations.³³ They did state that where limited scale prototypes could be used, the trial stage would be continued. Contrary to predictions, however, they found "personal sources (in particular personal selling) were more important at early stages, while impersonal sources (especially the price quotation and tooling proposal) were paramount at the evaluation stage. The available evidence also suggests that as the final decision approaches, the need for informational inputs increases. At the evaluation stage the industrial decision makers employ a larger number and a greater variety of information sources than at the earlier stages."³⁴

The Diffusion Process

Rogers has defined diffusion as the process by which innovations spread to the members of a social system. (He had previously defined it as the process by which one

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follows the spread of a new idea from its source of invention or creation to its ultimate users or adopters.³⁵ Thus, as he sees it, there are four crucial elements in the diffusion of new ideas: the innovation which is communicated through certain channels over time among the members of a social system. Here the term innovation is the idea, practice or object perceived as new by an individual. Rogers states that it is the perceived or subjective newness of the idea, and not the "objective" newness, for the individual that is important. Communication is the process by which messages are transmitted from a source to a receiver. The channel is the means by which these messages move from source to receiver.

Time is the important element in the process. Katz has been quoted as saying "time is the key to diffusion research". Time is usually measured in three dimensions:

1. The length of time in innovation-decision process, that is the length of time during which an individual passes from first knowledge of the innovation to the adoption or rejection of that product.
2. The innovativeness of the individual, that is, the relative earliness-lateness with which an individual adopts an innovation when compared

with other members of his social system.

3. The innovation's rate of adoption in a social system, usually measured as the number of members of the system that adopt the innovation in a given time period.

A social system is defined as a collectivity of units which are functionally differentiated and engaged in joint problem solving with respect to a common goal. The members or units of a social system may be individuals, informed groups, complex organizations or subsystems.³⁶

The Diffusion Process in Marketing

The diffusion process in marketing can be conceptualized as: the adoption of new products and services over time by consumers within social systems as encouraged by marketing activities. Adoption refers to the use of a new innovation. New products can be any product perceived as providing additional utility by the consumer. The time dimension will distinguish early adopters from late adopters. Consumers will refer to the consumer adopting unit, be it individual, family, organization or political unit. Social systems constitute the boundaries within which diffusion occurs. This may range from family to friendship groups to the entire market place. Marketing

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activities will refer to those activities undertaken by the firm in order to gain consumer patronage. These most generally include the mixing of the various marketing variables of product, price, promotions and place in forming an optimum marketing mix.

These aspects of the diffusion process are interdependent. For example: the attributes of the new product will affect the rate of adoption over time, the types of consumer who will adopt, the kinds of social systems within which diffusion will take place, and the marketing efforts needed to achieve diffusion. Similarly, the marketing manager must realize that successful new product diffusion is critically dependent upon the communication of relevant product information and matching the self images of social system members with the perceived product images. That marketing activities can guide and control the rate of adoption is witnessed by Zaltman, in which the various marketing strategies are explained in terms of past studies from the area of behavioral sciences.³⁷

Adopter Categories

Not all individuals in a social system adopt an innovation at the same time. Rather, individuals adopt in an ordered time sequence and they may be classified into

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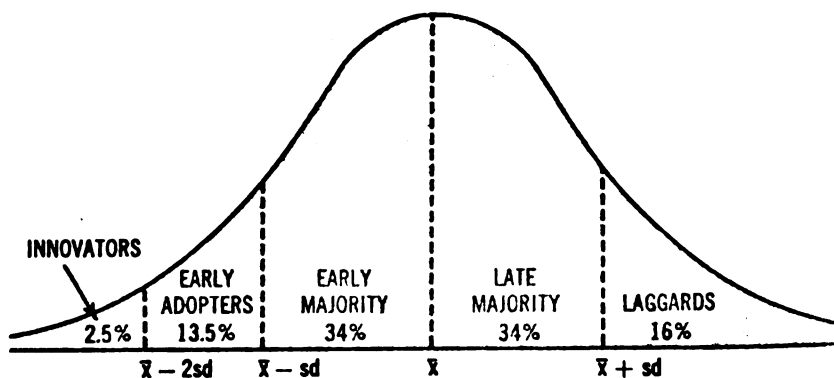
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adopter categories on the basis of when they first begin using a new idea. Figure 2-7 shows the traditional five categories of classifying adopters. The figure, also, shows the approximate percentage of individuals in these five categories (innovators, early adopters, early majority, late majority, and laggards). Rogers notes the above classification is not symmetrical and it fails to account for incomplete adoption. However, neither of these criticisms has distracted from the model.³⁸

FIGURE 2-7

ADOPTER CATEGORIZATION ON THE
BASIS OF INNOVATIVENESS



The innovativeness dimension, as measured by the time at which an individual adopts an innovation or innovations, is continuous. However, this variable may be partitioned into five adopter categories by laying off standard deviations from the average time of adoption.

Source: Everett M. Rogers with F. Floyd Shoemaker, Communication of Innovations (New York: The Free Press, 1971), p. 182.

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Stanton, in reviewing the work of Rogers, has drawn the following observations concerning these five categories.

- Innovators:** They are the first to adopt and have been referred to as venturesome. They tend to be young and, at the same time, high in social and economic status. They are cosmopolites, with many contacts outside their own social groups and community. This group tends to rely on impersonal and scientific information sources or other innovators rather than personal salesmen.
- Early adopters:** This group is likely to be relatively high in social status, probably being opinion leaders. They may be younger, more mobile and more creative than later adopters. Their social relationships are confined to local groups and they have the greatest contact of all the groups with salesmen.
- Early majority:** This category consists of those with above average social status. They usually will not consider an innovation until early adopters have tried it. A long period may elapse between trial and adoption. This deliberate group has considerable contact with mass media and salesmen and early adopters.
- Late majority:** People in this group tend to be below average in social status and income. They are less likely to follow opinion leaders and early adopters. Some social pressure might have to be applied to this group in order for the product to be tried. They are a skeptical group. This group makes little use of mass media and of salesmen. They tend to be oriented more to other late adopters than to outside sources of information.
- Laggards:** This group has the lowest social status and income, and tends to be tradition-bound. Their main source of information is other laggards.³⁹

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From a content analysis of over 3,000 research findings relating various independent variables to innovativeness, Rogers has made thirty-two generalizations concerning innovativeness on the basis of (1) socio-economic status, (2) personality variables and (3) communication behavior.⁴⁰ These findings are reprinted here in summary form along with the number of supporting and non-supporting studies.

Socio-economic Characteristics

1. Earlier adopters are no different from later adopters in age. (228: 44 younger, 108 no relationship, 76 older)
2. Earlier adopters have more years of education than do later adopters. (275: 203-72)⁴¹
3. Earlier adopters are more likely to be literate than are later adopters. (38: 24-14)
4. Earlier adopters have higher social status than later adopters. (402: 275-127)
5. Earlier adopters have a greater degree of upward social mobility than do later adopters. (5: 5-0)
6. Earlier adopters have larger size units (farms, etc.) than do late adopters. (227: 152-75)
7. Earlier adopters are more likely to have a commercial (rather than a subsistence) orientation than are later adopters. (28: 20-8)
8. Earlier adopters have a more favorable attitude toward credit than later adopters. (25: 19-6)
9. Earlier adopters have more specialized operations than later adopters. (15: 9-6)

Personality Variables

10. Earlier adopters have greater empathy than later adopters. (14: 9-5)
11. Earlier adopters are less dogmatic than later adopters. (36: 17-19)
12. Earlier adopters have a greater ability to deal with abstractions than do later adopters. (8: 5-3)
13. Earlier adopters have greater rationality than later adopters. (14: 11-3)
14. Earlier adopters have greater intelligence than later adopters. (5: 5-0)
15. Earlier adopters have a more favorable attitude toward change than later adopters. (57: 43-14)
16. Earlier adopters have a more favorable attitude toward risk than later adopters. (37: 27-10)
17. Earlier adopters have a more favorable attitude toward education than later adopters. (31: 25-6)
18. Earlier adopters have a more favorable attitude toward science than later adopters. (27: 20-7)
19. Earlier adopters are less fatalistic than later adopters. (17: 14-3)
20. Earlier adopters have higher levels of achievement motivation than later adopters. (23: 14-9)
21. Earlier adopters have higher aspirations (for education, occupations, etc.) than later adopters. (39: 29-10)

Communication Behavior

22. Earlier adopters have more social participation than later adopters. (149: 109-40)

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23. Earlier adopters are more highly integrated with the social system than later adopters. (6: 6-0)
24. Earlier adopters are more cosmopolite than later adopters. (174: 132-42)
25. Earlier adopters have more change agent contact than later adopters. (156: 135-21)
26. Earlier adopters have greater exposure to mass media communication channels than later adopters. (116: 80-36)
27. Earlier adopters have greater exposure to interpersonal communication channels than later adopters. (60: 46-14)
28. Earlier adopters seek information about innovations more than later adopters. (14: 12-2)
29. Earlier adopters have greater knowledge of innovations than later adopters. (80: 61-19)
30. Earlier adopters have a higher degree of opinion leadership than later adopters. (55: 42-13)
31. Earlier adopters are more likely to belong to social systems with modern rather than traditional norms than are later adopters. (46: 32-14)
32. Earlier adopters are more likely to belong to well integrated systems than are later adopters. (15: 8-7)⁴²

The Innovation-Decision Period

The innovation-decision period is the length of time required to pass through the innovation-decision process.⁴³ The length is usually measured from first knowledge until the decision to adopt (or reject), although in a

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strict sense it should perhaps be measured to the time of confirmation. This last step is often impractical or impossible because the confirmation functions may continue over an indefinite period of time. Rogers has listed ten generalizations concerning variables affecting this period and the length of time involved. By way of providing a summary for the reader of the research already performed in this area the Rogers list follows along with the number of supporting and nonsupporting studies.

1. Earlier knowers of an innovation have more education than later knowers. (24: 17-7)
2. Earlier knowers of an innovation have higher social status than later knowers. (28: 18-10)
3. Earlier knowers of an innovation have greater exposure to mass media channels of communication than later knowers. (29: 18-11)
4. Earlier knowers of an innovation have greater exposure to interpersonal channels of communication than later knowers. (18: 16-2)
5. Earlier knowers of an innovation have greater change agent contact than later knowers. (26: 23-3)
6. Earlier knowers of an innovation have more social participation than later knowers. (13: 11-2)
7. Earlier knowers of an innovation are more cosmopolite than later knowers. (5: 5-0)
8. Later adopters are more likely to discontinue innovations than are earlier adopters. (6: 6-0)

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9. The rate of awareness-knowledge for an innovation is more rapid than its rate of adoption. (2: 2-0)
10. Earlier adopters have a shorter innovation-decision period than later adopters. (6: 5-1)⁴⁴

Rogers' earlier text, also, went into the differences between personal and impersonal communications as factors of increasing awareness. At that time he made the generalization that "impersonal information sources are most important at the awareness stage, and personal sources are most important at the evaluation stage in adoption process".⁴⁵ A second generalization from that text was that "cosmopolite information sources are most important at the awareness stage, and localite information sources are most important at the evaluation stage".⁴⁶ Later marketing studies have supported these generalizations. Arndt disclosed that "product-related word of mouth was found to flow from early to late adopters and non-adopters. More than two-thirds of the comments were received by respondents who had not bought yet".⁴⁷ Two other interesting findings of his were that "compared with the non-exposed individuals, those receiving favorable word of mouth pressure were more likely to buy the product, while those exposed to unfavorable word of mouth were less likely to buy",⁴⁸ and "respondents low in generalized self-confidence seemed to react to

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word of mouth in an ego defensive manner. They also tended to be less likely to be exposed to word of mouth."⁴⁹

Summers stated that his research suggests that the volunteering of unsolicited product information is generally more common in interpersonal channels than information seeking behavior.⁵⁰

Diffusion Effect

The diffusion effect⁵¹ is the cumulatively increasing degree of influence upon an individual to adopt or reject an innovation, resulting from the increasing rate of knowledge and adoption or rejection of the innovation in the social system.⁵² The diffusion effect is often listed as the reason for the increasing rate of growth of the innovation in the diffusion process. It is thought that if every consumer considered adopting on an individual basis, without social influence, then the probability of adoption would be the same for everybody regardless of time period. However, if consumer influence is introduced than a "snowballing" effect will occur, since other's previous experience with the innovation will influence the present decision. Summers' work can lead to the generalizations that personal influences gain as the risk involved increases (higher prices, greater complexity of product) and that

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other factors which will induce the diffusion effect include product ownership and competence.⁵³

Other research to support the diffusion effect include the studies used in abandonment of the hypodermic needle model which postulated that the mass media had direct, immediate and powerful effects on a mass audience. Another is the introduction of the "two-step flow" model which hypothesized that information is moved from sources to opinion leaders, who in turn influence their followers. The three most famous studies here include the 1940 Erie County Election Study, 1954 Decatur Study of Opinion Leadership and the Coleman, Katz and Menzel Drug Study.⁵⁴

Subsequent research by Allvine and Arndt in the area of retail grocery sales have reconfirmed the diffusion effect and use S-shape growth patterns in diffusion process. Allvine's findings in a study of the acceptance of promotional games by supermarkets found that the growth patterns suggested both a diffusion effect (he called it interaction) and a S-shape diffusion process. He also found that the rate of diffusion was proportional to the importance of the first adopter.⁵⁵ Arndt found two measures of sociometric integration (number of close friends and number of persons with whom you are likely to discuss new food products) were significantly positively related both

to whether a respondent received word of mouth communication and to acceptance of the new product. Generalized self-confidence was also positively related.⁵⁶

Opinion Leadership

Much has already been written in this chapter with regard to opinion leaders, communication flows and interpersonal relationships affecting buyer behavior. Yet, Mancuso's reminder to marketing managers that "opinion leaders have not been fully utilized...in assisting with new product introduction", still remains true.⁵⁷

Opinion leadership,⁵⁸ the degree to which an individual is able to influence informally other individual's attitudes or overt behavior in a desired way with relative frequency,⁵⁹ have been widely discussed in recent marketing publications,⁶⁰ yet marketing managers still know very little concerning its profitable use.

At the present time, there appear to be four basic strategies with regards to use of opinion leadership in new product introduction. The first is to create leaders in a manner similar to Mancuso's record shop experiment, in which teenage panels were used to enable "select" records to reach the Top Ten charts only in panel cities.⁶¹

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consumers "special deals" on new products. This method is costly and usually does not locate new opinion leaders. The third method would be to locate and identify opinion leaders. However, this becomes more difficult as market size increases.

The most common approach toward influencing the buyer is to focus on the characteristics of the opinion leaders in general and then aim a promotional campaign at those characteristics.

Industrial Goods and the Diffusion Process

Martilla has found in research conducted in three industrial markets that word of mouth communication within firms is an important influence in the later stages of the adoption process. Word of mouth communication between firms was found to be more situational. Opinion leaders were found to be more heavily exposed to impersonal sources of information than other buying influentials in the firm. The study also reported that, as in consumer marketing, industrial opinion leaders are difficult to locate and identify using available demographic data.⁶² Webster, a year earlier in interviews with industrial buyers, failed to identify a significant amount of word of mouth communication in industrial markets and suggested a key role for manufacturers'

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salesmen.⁶³

Innovation Characteristics

Rogers' Characteristics

As noted earlier, the rate of growth and the extent of product diffusion are largely a function of the perceived attributes of the innovation. Rogers has proposed a set of five characteristics which contribute to the explanation of the different rates of adoption. While realizing that they are not a complete list, but at least the most important characteristics, he has found that (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability are useful in describing the rate of adoption.⁶⁴

Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes. While this characteristic is often measured in terms of utility by the user. For example, Rogers notes that the major advantage of 2,4-D weed spray was the reduction in unpleasant labor tasks, rather than in financial gains per se. In his review of the literature, Rogers found 29 of 43 studies agreed that relative advantage was positively related to rate of adoption.⁶⁵ Thus, marketing managers have sought means of encouraging the consumer to perceive a

greater value in their product than that of the competition.

Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of the consumers.⁶⁶ The introduction of self-cleaning ovens required no changes in the way a housewife went about baking. Electronic ovens, however, cook much more rapidly and don't "brown" food to the same extent. Because they require a change in the way cooking has traditionally been done, electronic ovens are likely to encounter a slower rate of adoption.⁶⁷ Rogers has found 18 of 27 studies agreeing with the premise that the greater the need for consumers to restructure their thinking and to engage in new forms of behavior, the less quickly the item is to be adopted.⁶⁸

Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. Nine of sixteen studies have agreed to the negative relationship between complexity and rate of adoption. An example of this was diffusion of canasta and television among different social classes. Television was considered to be less complex for the lower classes.

Trialability is the degree to which an innovation may be experimented with on a limited basis. In-store sampling of a new food product or the introduction of trial

size packages account for the factor in which nine of thirteen studies agree.

Observability is the degree to which the results of an innovation are visible to others. Fashion trends move rapidly through their life cycles due to their observability. Seven of nine studies agree to this finding.

As mentioned earlier, the important point is how these characteristics are perceived by the consumers and not the subjective evaluation. Thus, it can be generalized that the rate of adoption is positively related to relative advantage, compatibility, trialability and observability and negatively related to complexity.⁶⁹

Other Studies

Other studies have pointed out other characteristics. One of these studies was by Mansfield and the results of that study have been used to support the idea of the diffusion effect. Mansfield studied the rapidity with which twelve innovations spread through the industrial sector. A major finding was that the proportion of firms already using an innovation would increase the rate of adoption. This lends support to the notion of the bandwagon characteristic. Mansfield's hypotheses were:

1. Profitability of an innovation relative to others that are available will increase the

rate of adoption.

2. The larger the investment required, assuming equally profitable innovations available, the slower the rate of adoption.
3. The type of industry will affect the rate of adoption depending on its aversion to risk, market competitiveness, and financial health.⁷⁰

Finally, as mentioned earlier, the only other marketing studies in this area are with regard to risk perception. These studies have shown that the risk perceived by consumers in new product adoption is negatively related to buying behavior. Studies have also shown it to be a major factor in buyer response to new products.⁷¹

Product Elimination Studies

Background

No other area of marketing probably has as little written on it as that pertaining to products which are to be eliminated from the firms product line.⁷² Berenson, Grashof and Rothe⁷³ all have commented that the literature on product elimination is extremely sparse and vaguely defined; no body of knowledge exists that can be referred to for guidance for action in this idea. The few contributions have all been theoretical in nature and of somewhat limited use to small-to-medium size retailers. The product elimination area is further clouded as to whom should have

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the responsibility for such action. The traditional approach has been to centralize such authority in the home office of the chains,⁷⁴ however at the present time a change is being made toward giving the individual store managers some authority on their product line.⁷⁵ (It should be noted that the chain co-operating with this research project was an early adopter of the latter method.)

Rothe has studied the different factors involved in the product elimination decision in the food industry, as well as the drug, clothing and major and minor appliances industries. One of his findings was that firms in the food industry rated product elimination activities approximately one-third as important as new product activities. In the recognition stage of locating weak products, little attention was given to product profitability. This came at the next stage, analysis. The major factors for food items at the recognition stage were: minimum dollar volume, minimum unit volume, minimum market share percentage, some comparison of today's market share with previous years and percentage of total company sales this product contributes. Product profitability is the major factor in the analysis stage. A final finding of Rothe was that while much of the literature dealing with this subject dwells on the formality issue, the food industry respondents were less formal in

their elimination decisions.⁷⁶

Traditional Approaches

Before reviewing the theoretical approaches to product elimination suggested in the literature and moving on to a discussion of actual practices in the retail grocery industry, it will be useful to first review some of the traditional lines of thought. According to Berenson, product elimination decisions have traditionally been dominated by four different viewpoints: the accountant's, the economist's, the sales manager's and, perhaps to a lesser extent, the government policy maker's.

The accountant's customary view of a product line deletion involves a comparison of the dollar costs of retention with the dollar cost of abandonment. This approach is concerned with quantitative measures of depreciation or product disposal costs of a food item, current expenditures and revenues. The primary emphasis is on quantifiable financial items. While Berenson makes a distinction between the accountant's and the economist's view, both are basically cost-revenue decisions.

For the economist, Berenson notes that product elimination is a matter of emphasizing the future and leaving the past for historical record. The prime considerations

in this method are alternative choices and marginal costs. It involves questions of incremental profits - for example, the possibility that the product may be in the black on an out-of-pocket cost basis and can therefore make some contribution to general overhead.

Hopefully, the sales manager's viewpoint would be a synthesis of both the accounting and economic traditions. However, this expectation is usually unfulfilled. The sales manager's approach to the problem has been largely intuitive. It stresses the factors that may make the line easier to sell but not necessarily more profitable - for example, it favors carrying a full line and seeking to build volume at the expense of over-all, long-term profit.

The decision criteria for the government policy maker relates to public interest. The government tends to consider continued satisfaction of the consumer as an overriding criterion. Hence, railroads regulated by the ICC cannot readily abandon trackage or other services when the line as a whole is making a profit.⁷⁷

Theoretical Approaches

As has been noted earlier, the vast majority of firms do not have established procedures for pruning their products. Such action is usually undertaken either (1) on

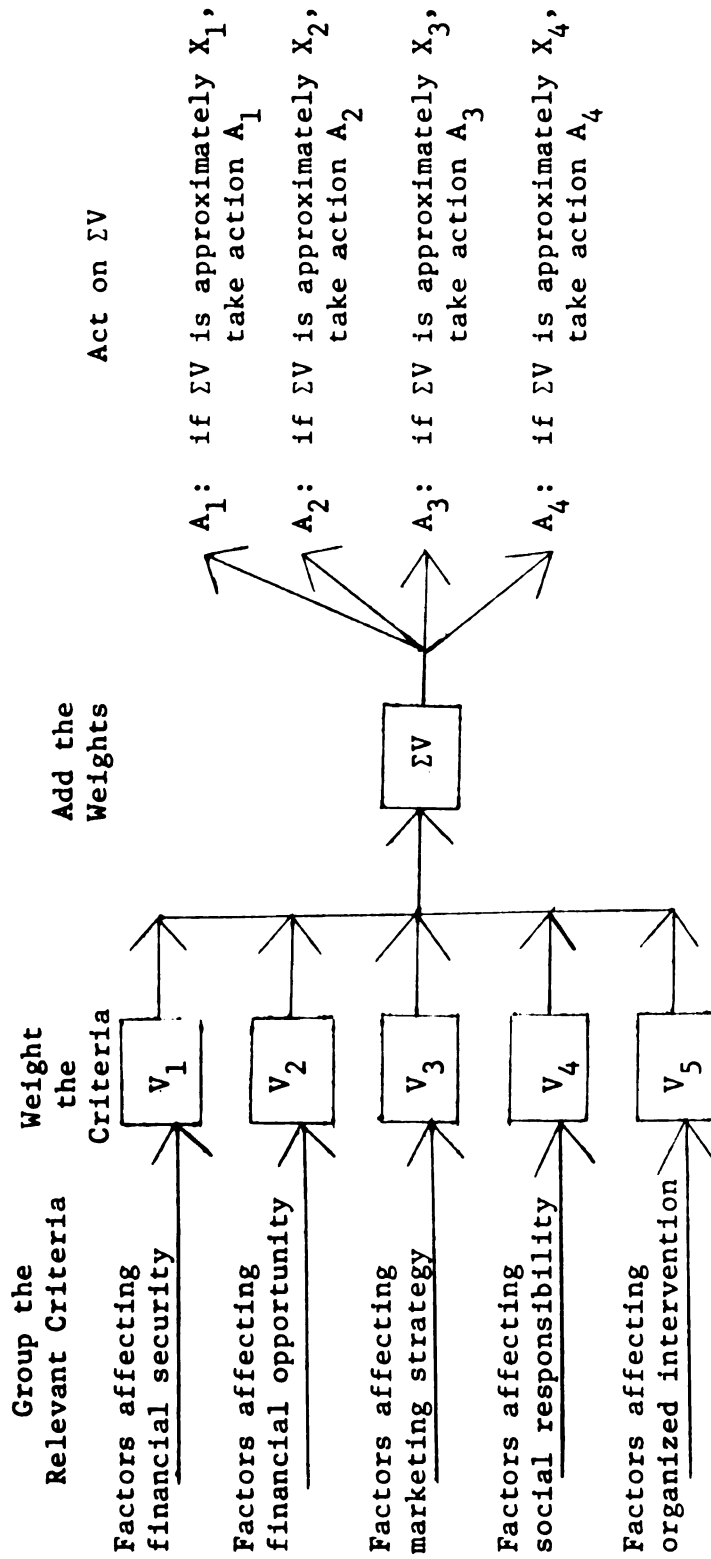
a piecemeal basis, as in instances where the product's money-losing status is incontrovertible, conspicuous, and embarrassing, or (2) on a crisis basis, wherein the precipitating event may be a financial setback, a persistent decline in total sales, piling inventories or rising costs.

However, neither of these practices has been successful in the long run.⁷⁸ In an attempt to provide the firm with a more reliable method of eliminating non-producing products from their line a number of theoretical models have been proposed. These models have as their basis a thorough analysis of the basic concepts of marketing, finance, management, psychology and accounting.

One of the earlier theoretical models proposed was that of Berenson. He presented a model (Figure 2-8) which considered five major decision factors: financial security, financial opportunity, marketing strategy, social responsibility, and the possibility of organized intervention against product deletion. The first two criteria are readily quantified; the first relating an evaluation of the basic profit criteria of the firm, and the second which provides an opportunity to consider the profitability of the product in terms of opportunity costs, phase of the product's life cycle, and the amount of return in excess of the firm's minimum goal. He suggested that a judgment-

FIGURE 2-8

THE BERENSON ABANDONMENT MODEL



Key:

V = a measure of the relative importance of the criteria

ΣV = the sum of the measures

A = the action indicated by ΣV

X = the level of ΣV that is correlated with a specific action

Source: Conrad Berenson, "Pruning the Product Line", Business Horizons, Summer, 1963, p. 66.

determined numerical scale could be established to accommodate the remaining three factors. The subjective weights assigned to these factors are to reflect the degree of importance attributed them by management. The score for each category is then multiplied by the weighting factor, and the summation of the five weighted scores becomes the overall rating of the product under question.⁷⁹

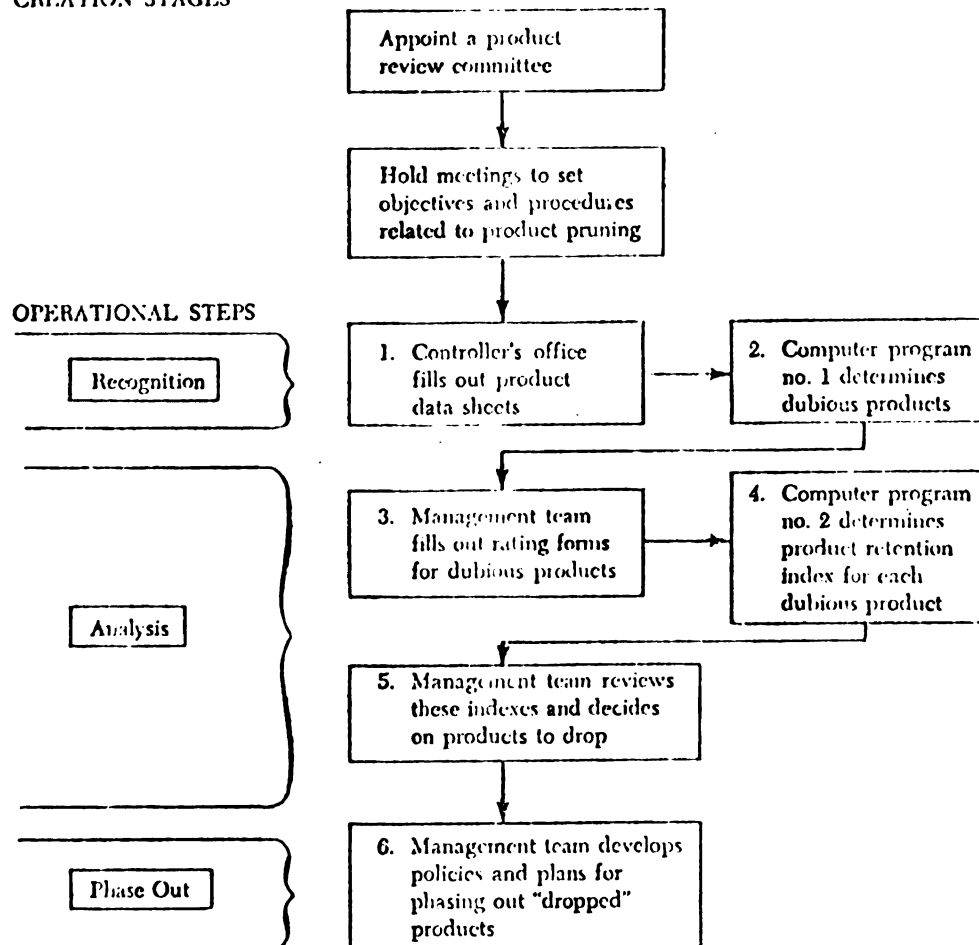
The Kotler model (Figure 2-9) for product pruning is, as he admitted, an expensive one in terms of executive time, but the cost must be compared to the greater cost of keeping a sub-optimal product in the line. The model, a PERT approach, is made up of a creation and operational level. The creation level is composed of the development of a representative corporate team and the establishment of objectives and procedures related to product pruning.

The operational level is a six-step approach, the first of which consists of management preparing a data sheet for every company product. The data sheet contains all the important information about the product during the past three years. The data sheet is to provide information for judging the product by the management team. Step 2 consists of a computer program to review the data from Step 1 for any signs of weakness. For example, the firm might set the standard of a sales decline in any four

FIGURE 2-9

THE KOTLER ABANDONMENT MODEL

CREATION STAGES



Source: Philip Kotler, "Phasing Out Weak Products", Harvard Business Review, March-April, 1965, p. 112.

periods during the three years as a sign of weakness. The remaining three steps are similar to Berenson's model. A rating form is proposed for detailed analysis of the deletion candidates. Management then assigns a numerical score to the categories on the form. Weighted factors are applied to the scores, and the weighted scores are summed to obtain an overall "product retention index". Product deletion decisions can then be made using a cut-off point in the retention index. At this point management may make some subjective judgments as to possible customer reactions. Lastly, plans and policies for phasing out "dropped" products are developed. For each product, management must determine its obligations to the various parties affected by the decision. Here it may decide to stock a reasonable amount of replacement parts or to seek out another manufacturer for the product.⁸⁰

Hamelman and Mazze in 1972 introduced an extension of the Kotler model called PRESS (Product Review and Evaluation Subsystem). This model is different from other product-elimination models in that it is capable of coping with a company's total product line rather than a segment of the line thought to be weak.

The program consists of four integrated parts, PRESS I through PRESS IV. PRESS I contains the primary

model and uses standard cost accounting and marketing performance data, while PRESS II, III, and IV perform analyses concerned with price changes, sales trends, and product interaction.

The PRESS model differs from Kotler's approach in that it reduces the amount of executive management decision time and that it looks at the entire product line. Whereas Kotler provided broad guidelines for his model, PRESS considers product line interactions and operational aspects of deletion decisions. The retention index of Kotler yielded a single number indicating the degree of product desirability from the weighted ratings on the seven subjective scales. PRESS offers cutoff points for deletion decisions by a systematic review of Selection Index Numbers, which are based on a series of performance ratios using standard cost accounting data.⁸¹

It is interesting to note at this point, that any of the adoption process models mentioned earlier in this chapter can, also, be used as a product elimination model. The adoption criteria and the retention criteria are basically the same, the difference is that one involves forecasting and the other measurement. However, both include a subjective weighting of the processes' elements.

Retail Grocery Practices

At the present time the actual practice being undertaken in the retail grocery industry appears to be moving away from the main office and back to the store manager with regard to product elimination decisions. The supermarket operations of today while approaching the problem in a manner similar to the theoretical concepts mentioned earlier do it with far less sophisticated techniques. Grashof reviewed the process and noted that the chains have two procedures for the identification of items that should be considered for deletion. The first method is that one old product be dropped for every new one added. Since all figures indicate that the number of retail food items carried in stock by the average supermarket increases by over 20% each year, one must realize that this rule is not adhered to 100 per cent.

The second procedure is for a periodic review of all items the chain handles. This review can be conducted by the buyer for each product family, the head buyer who examines all items carried by the chain or, as the trend is now moving, by the manager of the individual store who reviews all his own products.

As reported by Grashof and confirmed by later interviews with three chain executives, the prime factor in

the identification of items for possible deletion, as well as the most important criterion for use in the final decision is lack of consumer demand for an item as indicated by a low rate of sales for the item.

Another important criterion is the level of the gross margin percentage of the item. By combining these two factors a third criterion - gross margin dollars generated per unit of time - can be determined. While this third method is not as important as the first two, it does permit a comparison between dissimilar items in a product family, as well as across product families.

At this point, two other factors should be mentioned. First, the chain will view the trend as well as absolute values for the three criteria stated earlier; and, second, the chains, in their desire to maintain variety on the store's shelves, will hesitate to delete one-of-a-kind items.⁸²

Thus, one can see that while the chains have never developed a mathematical model for eliminating products from their stock, they have a set of criteria. Unfortunately, they still appear to make these important decisions by weighing these three factors and adding a fourth one, the individual's making the decision, personal interest in the product.

Summary

Chapter II has reviewed the relevant literature with regard to the adoption and diffusion of innovations, the relationship between these processes and the consumer's perception of the innovation's characteristics and the present policies of product elimination.

These four areas were chosen for study since this thesis develops a new method of predicting which products should be eliminated from the product line on the basis of their rate of diffusion into a social system.

The adoption process has been presented as a means of determining what the final diffusion cycle will be. It is hypothesized that the measurements of the level of activity in the early stages of the process can be used to predict the ultimate outcome of the decision stage.

It might also be noted that while this thesis is concerned with the consumer's adoption process in an attempt to predict product elimination it can also be used to support the notion that product elimination is the central focus in the decision or trial stage of the retailer's adoption process.

FOOTNOTES

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7. Bryce Ryan and Neal C. Gross, "The Diffusion of Hybrid Seed Corn in Two Iowa Communities," Rural Sociology, VIII (March, 1943), 15-24.
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31. For a more complete definition of the different behavioral types see George Katona, The Powerful Consumer (New York: McGraw-Hill, 1960), p. 138.
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37. Gerald Zaltman, Marketing: Contributions from the Behavioral Sciences (New York: Harcourt, Brace and World, Inc., 1965).
38. Rogers with Shoemaker, p. 175-182.
39. William J. Stanton, Fundamentals of Marketing, 3rd ed. (New York: McGraw-Hill, 1971), pp. 206-208.
40. Rogers with Shoemaker, p. 185.
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44. Rogers with Shoemaker, Appendix A.
45. Rogers, Diffusion of Innovation, p. 99.
46. Ibid., p. 102.
47. Arndt, 1966 Winter Proceedings, p. 646.
48. Ibid., p. 647.
49. Ibid., p. 648.
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Conferences, 1971. (Chicago, 1971), 433.

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52. Rogers with Shoemaker, p. 161.
53. Summer, p. 433.
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62. John A. Martilla, "Word-of-Mouth Communication in the Industrial Adoption Process," Journal of Marketing Research, VIII (May, 1971), 173-178.
63. Frederick E. Webster, Jr., "Informal Communication in Industrial Markets," Journal of Marketing Research, VII (May, 1970), 186-89.
64. Rogers with Shoemaker, pp. 22-23. It should be noted that in Chapter 5 of his 1962 text, Rogers referred to the last two stages as "divisibility" and "communicability".
65. Ibid., pp. 138-144.
66. Ibid., p. 145.
67. Robert D. Buzzell, Robert E. M. Nourse, John B. Matthews, Jr., and Theodore Levitt, Marketing: A Contemporary Analysis (New York: McGraw-Hill, 1972), p. 175.
68. Rogers with Shoemaker, Appendix A.
69. Ibid., pp. 154-157.
70. Edwin Mansfield, "Technical Change and the Rate of Imitation," Econometrica, XXIX (October, 1961), 741-766.
71. See footnote #19.
72. Peter F. Drucker, "Care and Feeding of the Profitable Product," Fortune (March, 1964), 133.
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74. Information obtained in a letter from Dr. Willard R.

Bishop, Jr., Director of Research, Super Market Institute, June 7, 1972.

75. Stated by executives of three major Mid-west chains during personal interviews in April and May, 1972.
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77. Berenson, 64-66.
78. Philip Kotler, "Phasing Out Weak Products," Harvard Business Review (March-April, 1965), 107-18.
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80. Kotler, 107-118.
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CHAPTER III

RESEARCH DESIGN

Set forth in this chapter are the framework and methodology employed in this thesis. The first section of Chapter III will identify the method of product classification used in this study. This will be followed by a discussion of the sample design, the data collection procedures and the techniques used to analyze the data.

Product Classification

Each year businessmen are confronted with research studies which list the percentage of product failures for the previous year's new offerings between 40 and 90 percent. Yet, as pointed out in Chapter I, most of these failure estimates are exaggerated. The actual rate of failure depends of course, on what products are included in the base against which the failure rate is computed, as well as the criteria employed to identify failures. Weiss noted that 80 per cent of the new products studied in these past studies are not really new products.¹

In an attempt to overcome the problem of mis-defining what is meant by the term new product and to provide a means for obtaining and analyzing new product information in a more useful manner, a two phase product classification model was developed for this study.

The first phase was an attempt to provide the reader with a more definitive classification of product newness. A three dimensional matrix was developed. Each of these dimensions reflected the different levels of newness perceived by the different members of the marketing channel; the producers, the middlemen or distributors and the ultimate consumer.

The producer level was divided into three groups: distinctly new products, product line extensions and product improvements. The distinctly new products were substantially different in form, technology or ingredients from any of the company's previous offerings. Product line extensions were merely new package sizes, flavors or shapes of existing products. Product improvements included changes in existing products, such as changes in taste, ingredients, appearances or textures.

The distributor segment was categorized by levels of newness. In descending order, these are new product types, new brands and new items. New product types are

those substantially different in form, basic ingredients, and/or method of use in the home from any other product previously stocked by the middleman in question. New brands are any brands not previously carried in stock by the middleman. New items are any products added to stock for the first time.

The consumer view of product newness is broken into two segments. The first segment is that of non-perception, that is the consumer doesn't really perceive the product as being new. Products in this category included those items which while considered new by the manufacturer or middleman fail to provide the consumer with any additional utility over the previous offerings. An example of this type of newness is the unobservable improvement of a laundry soap. Thus, while the soap package might declare "new, improved", the customer considers it the same as his old package of the product.

The other segment of the consumer dimension refers to cases in which the consumer does perceive a difference in the product. Here the consumer perceives the product as new to the firm, that is the firm produces no product which possesses a positive cross-elasticity with the product under question. The second grouping refers to the conditions when no firm produces a product with a positive cross-elasticity.

By grouping these three dimensions together, it is now possible to explain what is meant by the term "new product" in a more definite manner. Now it is possible to explain the term in 27 different ways, with each way taking into account the level of newness as perceived by the members of the channel. An example of these can be shown by referring to Figure 3-1 where the box selected is marked with an X. The X in this box indicates that the new product selected was considered to be a product improvement by the producer, a new brand by the middleman, and a product which is not in direct competition with other brands of the manufacturer.

However, the introduction of a 27 matrix diagram for defining the level of newness of a product only answers half of the question of how to define a new product in a more definitive manner which will be useful as a tool of market prediction? Some manner of utilizing product characteristics as a means of determining the market mix must be developed. The traditional approach to the classification of goods has been that of convenience, shopping and specialty goods. The definitions of these goods are based on consumer buying habits. Miracle, in a revision of an earlier work by Aspinwall notes that this is not an altogether satisfactory solution as they focus on consumer

Figure 3-1

New Product Dimension Model

		<u>Buyer Dimensions</u>			
		Non-Perceptive		Perceptive	
				No firm substitute	No substitute
<u>Producer Dimensions</u>	Distinctly new products				New Product types
					New Brand
					New Items
	Product line extensions				New Product types
					New Brand
					New Items
	Product improvements				New Product types
					New Brand
					New Items

Distributor Dimensions

behavior and can't answer all questions as to why a consumer "shops" for some goods and not for others. Miracle, thus, redefined consumer and market characteristics in order to develop a single list of characteristics. The list consists of

1. Unit value
2. Significance of each individual purchase to the consumer
3. Time and effort spent purchasing by consumers
4. Rate of technological change
5. Technical complexity
6. Consumer need for service
7. Frequency of purchase
8. Rapidity of consumption
9. Extent of usage

Using these characteristics and their interdependence he projected five product groups.

Product Characteristics of Five Groups

Product characteristic	Group				
	I	II	III	IV	V
1	Very low	Low	Medium to high	High	Very high
2	Very low	Low	Medium	High	Very high
3	Very low	Low	Medium	High	Very high
4	Very low	Low	Medium	High	Very high
5	Very low	Low	Medium to high	High	Very high
6	Very low	Low	Medium	High	Very high
7	Very high	Medium to high	Low	Low	Very low
8	Very high	Medium to high	Low	Low	Very low
9	Very high	High	Medium to high	Low to medium	Very low

By utilizing these product groupings with the new product classifications described earlier, it is felt that a contribution for research methodology has been made by this thesis. A contention of this thesis is that this new categorization will be useful in attempts to relate the behavior of new products in comparison with other new products of the same category.

The author's summary model (Figure 2-5) proposed in Chapter II was an attempt to overcome the shortcomings of the previously mentioned adoption models. The model made allowances for these shortcomings by:

1. The model accounted for both rational and non-rational behavior as it is possible to go directly from the knowledge stage to the adoption-rejection stage or to make use of the intermediate stages.
2. The model made allowances for problem solving situations as it may begin with either the point of problem perception or knowledge.
3. The model made allowances for all possible consumer behavioral patterns by allowing one to skip some stages and/or by the use of feedback to redo others.

However, this thesis is primarily concerned with the activities of the consumers in their rational consideration of a new product. Thus, the research design made an attempt to measure the amount of consumer activity in the different stages of the process before adoption or rejection.

The model for this research was conceived as beginning with the knowledge stage, which commences when the individual is exposed to the innovation's existences (awareness) and gains some understanding of how it functions (knowledge). Most past research studies have conceptualized awareness as occurring due to random or nonpurposive activities of the individual.³ However, knowledge-seeking

was felt to be an initiated and not a passive activity. The predispositions of individual influence his behavior toward communication messages and to the responses these messages generate. Hassinger notes that even if an individual is exposed to messages concerning the innovation, there will be little effect of such exposure unless the individual perceived the innovation as relevant to his needs and is consistent with his existing attitudes and beliefs.⁴

At the persuasion stage the individual forms a favorable or unfavorable attitude toward the innovation. Whereas the mental activity at the knowledge stage was mainly cognitive (or knowing), the main type of thinking at the persuasion stage is affective (or feeling).

At this stage the individual becomes more psychologically involved (interest seeking) with the innovation. He actively seeks information about idea. His personality, as well as his social system's norms, will affect where he seeks out this information, what messages are perceived, and how they are interpreted. It is at this stage that a general perception of the innovation is developed. Such perceived attributes of an innovation as its relative advantage, compatibility, and complexity are especially important at this stage.

In forming a favorable or unfavorable attitude

toward the innovation, the individual may mentally apply the new product to his present or future needs. As he progresses with his mental application, he will seek reinforcement of his attitude toward the new product. The individual is likely to seek convictions that his attitude is correct from peers by means of interpersonal communication channels. Mass media messages are too general to provide the specific kind of reinforcement that the individual needs to confirm his beliefs about the new product.

At the decision stage, the individual engages in activities that will lead to a choice to adopt or reject the innovation. This decision is confirmed or rejected at the final stage of the model, the confirmation stage. Throughout this terminal stage, the individual seeks to avoid a state of dissonance or to reduce it if one occurs.

Thus, this thesis is an attempt to measure the early activities of the adoption process which occur before the decision stage and compare these activities with products from the same classification by use of the previously defined methods. The hypotheses of this study contended that either the absolute measurement of these early activities or the changes in their relative growth can be used to predict which products should be eliminated from a firm's line at a point earlier in time than in present use.

Hypotheses

This thesis will provide a model which should be able to show through measurement of the initial phases of the consumer's adoption which products are unlikely to be retained by store management after a thirteen week analysis of sales data. Thus, the model presented in this thesis will identify those products which are prime candidates for elimination from the firms product line. If these products are not eliminated then the model will predict a very low probability of success for them.

The more specific hypotheses of the study follow. These hypotheses are listed in the null.

1) The knowledge of the level of consumer adoption process variables (awareness of the new product, knowledge of its product type, weak and strong interest in the product and weak and strong information seeking activities toward the product) within an earlier period of time makes no difference in management's ability to identify products, which, according to its criteria, should be continued relative to those which should be discontinued.

2) The knowledge of the rate of growth in consumer adoption process variables (awareness of the new product, knowledge of its product type, weak and strong interest in the product and weak and strong information seeking

activities toward the product) within an earlier period of time makes no difference in management's ability to identify products which, according to its criteria, should be continued relative to those which should be discontinued.

Sample Design

The Sampling Frame

The data to be used for this study was obtained by means of a phone survey of supermarket shoppers in the Des Moines, Iowa market. Several regional and national chains, a major voluntary chain and a number of strongly competitive local supermarkets are presently operating in the Des Moines market. Among the local supermarkets is the Abel Chain (a fictitious name) which was chosen for cooperation in this thesis. Abel, which has nine stores in Des Moines, accounted for 26% of the city's 1971 retail grocery sales. With the cooperation of the chain's top management one of these nine stores was randomly selected to participate in this study. The selection of Des Moines was fortuitous. Any analysis of the results of this study with the total United States population can only be made insofar as the consumers of the above chain in Des Moines are representative of the United States market.

The selected store's trading area (Appendix A shows

the 1970 Census Tract data for Des Moines, Polk County and the selectes store's trading area) covers approximately twenty-eight miles and has a population of over 20,000 in some 5,500 households. The trading area's boundaries include an interstate highway system on two sides, a major east-west thoroughfare and the city's incorporation limits. These boundaries are in agreement with the research findings of Cox and Cooke⁵ in their study of dimensions involved in shopping preference.

The selected store had a weekly sales volume of over \$100,000 and an average inventory of over 11,000 food items. A major reason for selecting this particular chain was the fact that it has competed successfully in this market without the use of any means of advertising. While it is noted that national advertising will have some effect on consumer behavior, the retailer will consider this to be part of the total product being offered to the consumer. Thus, this thesis has attempted to eliminate the effects of local sales promotion from its results.

With the cooperation of store management and representatives of Des Moines' food wholesalers, seven products were chosen for this study. The basic criteria for selection was that all the products come from the same cell of the matrix of this study's proposed new product

classification system⁶ and that each product was from the same product group in the Miracle classification. A further set of criteria was placed upon the selected products. The products could not be ones in which Des Moines was to serve as a test market for analysis by their producer. These products were withdrawn from consideration since the marketing variables could be altered by the manufacturer or distributor. Likewise, products being introduced with either a sampling or couponing campaign were not considered. These promotional strategies were felt to be capable of presenting an unfair bias to the six predictor variables chosen for analysis in the five weeks past introduction. The Abel Chain also agreed to hold prices constant for the products and not to vary the amount or location of shelf space during the initial 13 weeks. The seven products selected which were considered to be a product improvement by the producer, a new brand by the middleman, a product which is not in direct competition with other brands of the manufacturer and belonging to same product grouping, according to Miracle's model. Since the study concerned itself with new products distributed through retail food outlets, the products were all members of Miracle's second group. The combination of this product grouping, along with the level of newness mentioned above, resulted in the largest number of

products available for study during the summer of 1972.

The seven products included a:

1. cooking oil
2. ready-to-eat meal in a can
3. floor cleanser
4. furniture conditioner
5. snack food
6. fabric softener
7. instant dessert

Data Collection

After the selection of the products a phone survey of the selected store's customers was conducted to determine the amount of customer awareness, knowledge of product type, strong and weak interest in trying the product and strong and weak information seeking activities with regard to the seven products at the end of the second, third, fourth and fifth week after introduction. A copy of the questionnaire used is shown in Appendix B.

In an effort to determine the sample size needed for this study, the following assumptions were made. First, a 95% confidence level with a maximum of a 3.0% error in estimating proportions in the 25% to 30% range was selected. These confidence limits were in agreement with previous

studies in the area and store management estimated that approximately 30% of their customers become aware of a new product during its initial month of introduction. By substituting this above information into the formula for determining sample size ($\sqrt{\frac{x}{2}} = \sqrt{\frac{pq}{n}}$), a sample size of 800 was determined for this experiment, $\frac{.03}{2} = \sqrt{\frac{(.27)(.73)}{n}}$.

Nevertheless, while the store's manager did not know what was the total number of regular customers for his store, it was shown in Appendix A that the number of households in the store's trading area was 5,552. Thus, the sample of 800 households for interviewing can be considered as being greater than ten per cent of the population.

Since past studies by the Drake University Research Center indicated a completion rate of 66%, an effort was made to randomly select 1,200 households for interviewing. In order to assure that these 1,200 households were randomly selected, a list of 3,600 households was prepared during the three weeks prior to the introduction of the new products. This prepared list was derived by selecting automobile license plate numbers from the supermarket's parking lot in proportion to that day's sales volume and tracing them with the assistance of the State of Iowa's Motor Vehicle Registration Office. The Abel Chain does not make either hourly or intraday cash register tape readings so

that the license plates were not selected in accordance with the store's hourly sales volume. To overcome this problem and prevent any sampling bias a random selection of the store's hours was performed by groupings the hours into four groups of four hours each and randoming selecting two groups for each of the twenty ones in which the license plate numbers were gathered. Thus, a total of 3,600 license plate numbers were selected and these numbers were grouped into 1,200 groups of three names each.

The phone survey was operationized by randomly selecting the second number from each group as the one to be called first and then proceeding to the first, then the third number of the group is no response could be gathered from the original selection. The interviewer would start with the second name from each group, regardless of which household she contacted in the previous group. If the name selected belonged to a non-household or had a unlisted number, the interviewer was to go to the next number in that group. This grouping of names was an attempt to give all households using the store's facility an equal chance of being interviewed and reduce the number of non-completions by eliminating all non-households. A total of 200 interviews a week were made in this manner with fifty households being asked about one product and three groups of fifty

households about two products. The products were rotated each week. The calls were, also, rotated between product groups, so as not to produce a unfair day-product bias.

The survey operation was conducted during the summer of 1972. Two female interviewers with prior instruction and identifying themselves as being from the Drake University Business Research Center were hired for the study. A copy of the procedures followed by these interviewers is shown in Appendix B.

These interviewers followed the questionnaire shown in Appendix B. This questionnaire was pretested by 25 senior level marketing students in an effort to remove all ambiguity. The final copy of the questionnaire was again pretested by a random selection of 25 homemakers from the Greater Des Moines area in an effort to confirm its meaningfulness. Thus, it is felt to be fair and unbiased.

The data were recorded according to the procedures shown in Appendix B.

These procedures were followed as the female interviewers contacted fifty households per week for each of the seven products. The thesis assumed that the fifty households selected per week for each product possessed a common homogeneity in their buying behavior. The data were then recorded in terms of percentages of households who responded

affirmatively for each predictor variable for that week. These percentages were non-cumulative from week to week.

Analysis of the Data

The approach to analyzing the data was twofold. First, linear discriminate analysis was used to test if the weekly percentages of the six predictor variables chosen were able to differentiate between the continued and discontinued products. Second, the rate of growth hypothesis was tested by means of eighteen independent t-tests. Also, two-way analyses of variance were performed on the mean rates of growth between the continued and discontinued groups by the six predictor variables for the same time periods as used in the t-tests thus resulting in a 2 by 6 design. These time periods were the third-second week, fourth-third week and fifth-four week.

This research used the decision rule that if the test value of any test exceeded the critical value of .02 the hypotheses was rejected.

Linear discriminate analysis was chosen to determine if some function could be used to separate the two product groups (the continued and the discontinued) on the basis of the level of the six predictor variables chosen for this study. The major advantage of this particular

statistical tool is that it provides the researcher with a function that best discriminates between the continued and discontinued products. Also, since the research assumed that the data was obtained from a multivariate normal population, such statistical tools as analysis of variance analysis were unusable. This is because analysis of variance is only able to use data from a univariate sample. Linear discriminate analysis, thus, assumes that the dependent variable must be a dichotomy, there must be a random sample, that the relationship between the independent and the dependent variables is linearity. There must be a normal distribution and there must be a homogeneity of variance.

Other tools such as multiple regression and canonical analysis could also have been used in certain situations when working with multivariate data. However, it was the intent of this research to determine if a function could be derived which could serve as a means of predicting which of the two product groups a new product would ultimately belong. Thus, multiple regression which is used to provide a continuous function, and canonical analysis which seeks only to determine the linear combinations of the predictor variables and the two product groups that are very highly correlated with each other were not used.

Green and Tull listed the major objectives of discriminate analysis. They are:

1. Determining which variables account most for intergroup differences in average profile.
2. Determining whether significant differences exist among the average "score" profiles of two (or more) a priori defined groups, assuming group covariation and dispersion are equal and the distributions are multinormal.
3. Determining linear combinations of the predictor variables that be used to represent the groups by maximizing among-group relative to within-group separation.
4. Establishing procedures for assigning new products whose profiles, but not group identity, are assumed to be from one of the a priori defined groups.⁷

An example of the use of linear discriminate analysis can be shown by assuming that Table 3-1 is the result for the second week. (Since it is unknown how the test results will end, four products will be placed into each group.)

The linear discriminate function for this hypothetical example is $Z = 1.00x_1 + 4.69x_2 - 2.54x_3 + 11.24x_4 +$

TABLE 3-1

HYPOTHETICAL SECOND WEEK LEVELS
OF THE SIX PREDICTOR VARIABLES

(Percentage of consumer sample possessing indicated attributes)

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued	9%	8%	7%	6%	8%	4%
Products	8 10 8	6 7 4	6 8 5	5 2 4	9 8 7	9 6 5
Mean rating	8.75%	6.25%	6.50%	4.25%	8.00%	6.00%
Discontinued	4%	4%	4%	6%	4%	4%
Products	3 2 1	6 4 2	6 5 2	3 2 1	6 4 1	3 4 2
Mean rating	2.50%	4.00%	4.25%	3.00%	3.75%	3.25%

$16.34x_5 + 7.89x_6$ where x_1 is awareness of the new product, x_2 is knowledge of its product type, x_3 is having a weak interest in the product, x_4 is having a strong interest in the product, x_5 is undergoing weak information seeking activities concerning the product, and x_6 is undergoing strong information seeking activities concerning the new product.

One can see from Table 3-2 that weak information seeking activities make the greatest contribution in discriminating between the two groups. Its importance value, 69.45, may be interpreted as the contribution this variable makes toward over-all product continuation. Strong information and strong interest are the only other variables with a relative importance of greater than 10%.

If the six predictor variables scores are placed into the discriminate equation and a \bar{z} value is determined for each product, the products can be assigned to the continues or discontinued category on the basis of their being closer to $\bar{z}_c = 247.38$ or $\bar{z}_d = 131.10$ where \bar{z}_c and \bar{z}_d represent the average means of the continued and discontinued products. The results are shown below:

		Predicted		Total
		Continued	Discontinued	
Actual	Continued	4	0	4
	Discontinued	<u>0</u>	<u>4</u>	<u>4</u>
	Total	4	4	8

TABLE 3-2

MEAN VALUES OF PREDICTOR VARIABLES, DISCRIMINATE
WEIGHTS, AND IMPORTANCE VALUES; SECOND WEEK

Variables	Continue Mean	Discontinue Mean	Discriminate Weight	Importance	Relative Importance
Awareness	8.75	2.50	1.00	5.25	4
Knowledge	6.25	4.00	4.69	10.55	8
Weak Interest	6.50	4.25	-2.54	5.72	5
Strong Interest	4.25	3.00	11.24	14.05	11
Weak Information	8.00	3.75	16.34	69.45	55
Strong Information	6.00	3.25	7.89	21.70	17
\bar{X} continued products = 247.38					
\bar{X} discontinued products = 131.10					

These results indicate that the function makes no assignment error. Presumably, this function could be used to categorize new sets of data for the same time period.

Individual tests were used to determine whether or not there was a significant difference between the means of the two sample groups' rate of growth.⁸

An example of the use of t-tests can be shown by assuming that Table 3-3 shows the rate of growth for the third-second week. The test values for the six variables are:

awareness	2.726	strong interest	4.404
knowledge	3.750	weak information	6.109
weak interest	2.896	strong information	6.123

Since the critical value for t is 3.143 at level of .02 with six degrees of freedom, therefore, the thesis is able to discriminate between continued and discontinued products by the levels of knowledge, strong interest and weak and strong information seeking activities. This conclusion is reached because the research is able to reject the hypotheses of the equality of means in all four cases.

A two-way analysis of variance analysis was performed on the mean rate of growth to determine whether there were significant differences due to the product predictor variables and also whether there were significant

TABLE 3-3

HYPOTHETICAL RATE OF GROWTH FOR
THE SIX PREDICTOR VARIABLES

Third-Second Week $\frac{W_3 - W_2}{W_2}$

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued	.85	.23	.65	.59	.14	.09
Products	.75	.27	.61	.51	.18	.09
	.63	.31	.89	.82	.12	.14
	.65	.29	.43	.49	.10	.12
Discontinued	.49	.18	.45	.33	(-.06)	.02
Products	.60	.19	.31	.21	.02	.03
	.57	.22	.34	.18	.0	.01
	.30	.13	.11	.24	(-.05)	(-.02)

differences due to the product predictor variables and also whether there were significant differences due to continuation or discontinuation of the seven products. This particular statistical tool was chosen since the data to be analyzed was in the form of a ratio. In this case the researcher had no knowledge as to whether the data would still fall into multivariate patterns. Therefore, by using the means of the two product groups, the researcher was able to reduce the problem to a univariate situation and hopefully test for the significance of the difference between the mean ratios of the predictor variables and the product groups.

This technique assumed the model

$$Y_{ij} = \mu + \alpha_i + \beta_j + \epsilon_{ij} \quad i = 1=2; \quad j = 1-6$$

where Y_{ij} was the mean rate of growth due to the i -th level of factor A (the continuation or discontinuation of the product) and the j -th level of factor B (the six products predictors). Where further α_1 is continuation of the product and α_2 is the discontinuation of the product. β_1 is the level of awareness, β_2 is the level of knowledge of product type, β_3 is the level of weak interest activities toward the product, β_4 is the level of strong interest activities toward the product, β_5 is the level of weak information seeking activities toward the product and β_6 is the

level of strong information seeking activities toward the product. μ is an overall mean effect, α_i is the effect due to the i -th level of factor A and β_j is the effect due to the j -th level of factor B. ϵ_{ij} 's are the errors which are assumed to be normally independently distributed with a mean 0 and variance σ^2 .

The results of the analysis of variance for the hypothetical example are in agreement with the t-tests. The results of Table 3-4 show that the means are significantly different between the six predictor variables. Also, the means between product groups are significantly different. Thus, the hypotheses can be used as predictive tools.

TABLE 3-4
ANOVA TABLE FOR RATES OF GROWTH OF THE
HYPOTHETICAL THIRD-SECOND WEEK

Source	d.f	SS	MS	F	C.V.F@ 2%
Products	1	.1386	.1386	19.25	8.25
Product Variables	5	.5105	.1021	14.18	12.13
Error	5	.0358	.0072		
	11	.6849			

FOOTNOTES

1. E. B. Weiss, "That Malarky About 80 Percent of New Products Failing," Advertising Age, XXXVI (August 2, 1965), 101.
2. Gordon Miracle, "Product Characteristics and Marketing Strategy," Journal of Marketing, XXIX (January, 1965), 18-24.
3. Everett M. Rogers with F. Floyd Shoemaker, Communication of Innovations (New York: The Free Press, 1971), pp. 104-105.
4. Edward Hassinger, "Stages in the Adoption Process," Rural Sociology, XXIV (March, 1959), 52-53.
5. William E. Cox, Jr. and Ernest F. Cooke, "Other Dimensions Involved in Shopping Center Preference," Journal of Marketing, XXXIV (October, 1970), 12-17.
6. A survey of 30 Des Moines homemakers was used to determine the buyer dimension. The distributor's and producer's dimensions were obtained from interviews with Des Moines retail and wholesale food executives.
7. Paul E. Green and Donald S. Tull, Research for Marketing Decisions (Englewood Cliffs, N.J.: Prentice-Hall, 1970), pp. 368-377. The reader might also consult
8. For a detailed explanation of the test see John R. Stockton, Introduction to Business and Economic Statistics (Cincinnati: Southwestern Publishing Co., 1966), pp. 251-264.
9. Maurice G. Kendall and Alan Stuart, The Advance Theory of Statistics, Volume III (New York: Hafner Publishing Company, 1966), pp. 1-54.

CHAPTER IV

PRESENTATION OF FINDINGS

The objective of Chapter IV is to present the findings of the study. The chapter is divided into three sections and follows the general outline of the hypotheses as presented in Chapter I. The first section will review the management decision with regards to the continuation or discontinuation of the seven products studied in this thesis. Section two will analyze the six hypotheses concerned with the level of the weekly percentages of the six predictor variables. The final section is concerned with the changes in the six variables' rate of growth as a prediction tool.

The Management Decision

The management review of the new products found that three of the seven products were considered to be a complete success at the thirteen weeks post introduction stage, one product showed signs of success as its sales level had doubled during the past six weeks, and three products were deemed by management to be non-successful

and were discontinued. It should be noted that the store manager was reluctant to discontinue one of the three unsuccessful products, because while its sales were small (less than two percent of products of a similar nature) the product was felt to be of a superior nature. Another one of the unsuccessful products was considered to be a failure by the wholesaler as well as by the retail management. In fact, while the retail manager had already decided in discontinuing the fabric softener, the store chosen for this study experienced the highest sales level of the 256 stores serviced by the food wholesaler.

The three products deemed to be complete successes were the floor cleanser, the furniture conditioner and the instant dessert. The other continued product was the snack food. The discontinued product which management was reluctant to discontinue because of its superior nature was the cooking oil. The fabric softener and "ready to eat meal in a can" were the other products discontinued.

Management felt the reasons for the three products' lack of success were as follows

1. The cooking oil was produced by a small regional producer and had no introduction advertising campaign. The product was more expensive than other similar products and its

physical appearance was also different.

The supposedly superior quality could only be determined by use.

2. Both the fabric softener and the "ready to eat meal in a can" were expensive and not felt to be superior to other product offerings.

Weekly Percentages of the Six Variables as Prediction Tools

The percentage levels of the six predictor variables for the four weeks studied are shown in Table 4-1 to Table 4-4. The tables, also contain a mean rating of both the continued products and discontinued products for each of the predictive variables.

As mentioned in Chapter III the objective of discriminate analysis is to product a linear function that will discriminate between continued products from discontinued products.¹ Weights are assigned to the variables such that the ratio of the difference between the means of the two groups to the standard deviation within groups is maximized. The linear discriminate function can be expressed as:

$$Z = w_1x_1 + w_2x_2 + \dots + w_6x_6$$

where $x_1 \dots x_6$ represent the independent variables (in this case awareness, knowledge, interest and information seeking activities) and $w_1 \dots w_6$ represent the

TABLE 4-1

SECOND WEEK LEVELS OF THE SIX PREDICTOR VARIABLES

(Percentage of consumer sample possessing indicated attributes)

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued Products						
Dessert	36	34	30	14	16	4
Furniture conditioner	38	26	20	10	6	2
Snack food	14	10	12	4	6	2
Food cleanser	<u>24</u>	<u>18</u>	<u>16</u>	<u>14</u>	<u>12</u>	<u>0</u>
Mean rating	28	22	19.5	10.5	10	2
Discontinued Products						
Fabric softener	22	8	8	6	4	2
Meal in can	20	10	4	4	0	0
Cooking oil	<u>18</u>	<u>8</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>
Mean rating	20	8.67	4.67	3.33	1.33	.67

TABLE 4-2

THIRD WEEK LEVELS OF THE SIX PREDICTOR VARIABLES

(Percentage of consumer sample possessing indicated attributes)

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued Products						
Dessert	48	36	24	16	12	6
Furniture conditioner	46	36	18	14	6	2
Snack food	20	20	12	8	20	2
Floor cleanser	<u>40</u>	<u>38</u>	<u>20</u>	<u>10</u>	<u>22</u>	<u>0</u>
Mean rating	38.5	32.5	18.5	12	15	2.5
Discontinued Products						
Fabric softener	24	20	10	2	4	4
Meal in can	18	18	14	6	6	0
Cooking oil	<u>16</u>	<u>12</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>
Mean rating	19.33	16.67	8.67	2.67	3.33	1.33

TABLE 4-3

FOURTH WEEK LEVELS OF THE SIX PREDICTOR VARIABLES

(Percentage of consumer sample possessing indicated attributes)

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued Products						
Dessert	52	36	28	16	26	12
Furniture conditioner	46	46	24	12	22	6
Snack food	32	32	12	12	8	6
Floor cleaner	<u>36</u>	<u>36</u>	<u>26</u>	<u>12</u>	<u>14</u>	<u>4</u>
Mean rating	41.5	41	20	13	17.5	7
Discontinued Products						
Fabric softener	38	36	14	6	12	6
Meal in can	34	34	20	8	10	6
Cooking oil	<u>24</u>	<u>24</u>	<u>10</u>	<u>2</u>	<u>2</u>	<u>0</u>
Mean rating	32	31.33	14.67	5.33	8	4

TABLE 4-4

FIFTH WEEK LEVELS OF THE SIX PREDICTOR VARIABLES

(Percentage of consumer sample possessing indicated attributes)

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued Products						
Dessert	50	50	26	14	18	2
Furniture conditioner	50	50	24	12	20	4
Snack food	36	36	18	12	16	8
Floor cleanser	<u>44</u>	<u>40</u>	<u>20</u>	<u>6</u>	<u>18</u>	<u>8</u>
Mean rating	45	44	22	11	18	5.5
Discontinued Products						
Fabric softener	40	40	16	6	10	0
Meal in can	32	32	14	10	8	4
Cooking oil	<u>32</u>	<u>32</u>	<u>14</u>	<u>6</u>	<u>8</u>	<u>0</u>
Mean rating	34.67	34.67	14.67	7.33	8.67	1.33

discriminate coefficients or weights to be applied to the independent or predictor variables. Z represents the product's point score. Based on the point score, it should be possible to predict continued and discontinued products.

Mosteller and Wallace have proposed a method for determining the relative importance of the independent variables. The value of the relative importance index measures the contribution of each variable to the difference in the average point scores between the two groups ($\bar{Z}_C - \bar{Z}_D$), in which \bar{Z}_C refers to average mean score of the continued products and Z is the discontinued products.

Given that one mean value is exactly at the average of the continued group and another at the average of the discontinued group, then the difference in score is a measure of the importance (Y_i) of the variables, indicating the contribution it makes to the total difference in continued versus discontinued point scores.

$$Y_i = w_i \bar{x}_{iC} - w_i \bar{x}_{iD} = w_i (\bar{x}_{iC} - \bar{x}_{iD})$$

where w_i is the discriminate weight for the variable under consideration while \bar{x}_{iC} is the mean score of the continued products and \bar{x}_{iD} is the mean score of the discontinued sample.²

Second Week Findings

From the information given in Table 4-1, the linear discriminate function for the second week was

$$Z = -1.0075x_1 + 2.9025x_2 - 4.0875x_3 + .945x_4 + .285x_5 + 7.30x_6$$

If x_1 is made an unity value the equation becomes

$$Z = x_1 - 2.89x_2 + 4.06x_3 - .938x_4 - 2.83x_5 - 7.25x_6$$

where x_1 is awareness of the new product, x_2 is knowledge of its product type, x_3 is having a weak interest in the product, x_4 is having a strong interest in the product, x_5 is undergoing weak information seeking activities concerning the product and x_6 is undergoing strong information seeking activities concerning the new product.

The fact that four of the six predictor variables are negative should not be alarming. This was caused by the among group and between group interrelationship of the variables.³ Also, it must be noted that the relative importance of x_4 , x_5 and x_6 is only 15% of the total.

Thus, one can see from Table 4-5 that weak interest made the greatest contribution in discriminating between the two groups. Its importance value, 60.21, may be interpreted as the contribution this variable makes toward overall product continuation. Knowledge was the second greatest contributor even though its discriminate weight was negative. No other variable had a relative importance of greater than

10%, thus, one can conclude that knowledge and weak interest were the two most important predictors of product continuation at the second week past introduction.

The significance of this discriminate function can be evaluated by using Fisher's 1936 test. Fisher took the variance \bar{z} from the difference of the observed mean values where $\text{Var } \bar{z} = \frac{16.41 - 5.57}{5(91.0075)} = 2.15$. This produced the variance of a single value. The variance of the difference of two means, one of four and the other of three numbers, is $\frac{7}{12}$ of this, namely 1.25, giving a standard error of 1.18. The observed difference of the means, 10.84, is nine times as great as the standard error and we conclude that the discriminate is likely to be effective.

The probability of misclassification is easy to estimate. The standard deviation of \bar{z} is $\sqrt{2.15} = 1.47$ and the distance between the $\bar{z}_D + \bar{z}_C$ means is 10.84. One half of this is 5.42 and $5.42/1.47 = 3.69$ which is significant at .02.⁴

Nevertheless, while the function has been found to be statistically significant, it should also be able to provide a useful tool as an assignment for predicting product continuation on the basis of the six variables used in this thesis. Thus, if the six predictor variables scores are placed into the discriminate equation and a \bar{z} value is

TABLE 4-5

MEAN VALUES OF PREDICTOR VARIABLES, DISCRIMINATE
WEIGHTS, AND IMPORTANCE VALUES; SECOND WEEK

Variables	Continue Mean	Dis- continue Mean	Discriminate Weight	Importance	Relative Importance
Awareness	28.00	20.00	1.00	8.00	6%
Knowledge	22.00	8.67	-2.89	38.52	31%
Weak Interest	19.50	4.67	4.06	60.21	48%
Strong Interest	10.50	3.33	- .94	6.74	5%
Weak Infor- mation Seeking	10.00	1.33	- .28	2.43	2%
Strong Infor- mation Seeking	2.00	.67	-7.25	9.64	8%
$\bar{z}_C = 16.41$		$\bar{z} = 5.57$			
Discriminate Value = 10.99					

TABLE 4-6

SECOND WEEK RESULTS OF ASSIGNMENT TESTS

z_{Dessert}	12.88	$z_{\text{Fabric softener}}$	10.10
$z_{\text{Futniture conditioner}}$	18.48	$z_{\text{Meal in can}}$	3.59
$z_{\text{Snack food}}$	13.83	$z_{\text{Cooking oil}}$	3.00
$z_{\text{Floor cleanser}}$	20.41		
Predicted			
	Continued	Discontinued	Total
Actual	Continued	4	4
	Discontinued	$\frac{0}{4}$	$\frac{3}{7}$
	Total	4	7

determined for each product, the products can be assigned to the continued or discontinued category on the basis of their being closer to $\bar{x}_C = 16.41$ or $\bar{x}_D = 5.57$. Where \bar{x}_C and \bar{x}_D represent the average means of the continued and discontinued product. This was done for the second week figures with the results shown in Table 4-6.

The results shown in Table 4-6 illustrate that the second week discriminate function made no assignment error. Presumably, this function could be used to categorize new sets of data on products after only two weeks of introduction to predict continuation or not.

Second Week - Summary

The second week discriminate function was seen to have been both significant at the .02 level and useful as a tool for classifying products from unknown groups to their proper group. Two variables were found to be more important, weak interest and knowledge, at this point in weak two as a means for differentiating between the two groups.

Third Week Findings

From the information presented in Table 4-2, the linear discriminate function for the third week was

$$\bar{x} = -.0407x_1 - .5230x_2 + 2.7852x_3 - 1.0022x_4 - 1.9787x_5 - 7.4785x_6.$$

Table 4-7 shows the mean value of the predictor variables, the discriminate weights and the importances values for the third week. Once again weak interest makes the greatest contribution in discriminating between the two product groups. However, knowledge is no longer the second greatest contributor as weak information seeking activities now account for 30% of the difference between the two groups. Strong interest, strong information seeking activities and knowledge are the next in order of importance. Awareness is very unimportant as a predictor tool for the third week.

Once again by using Fisher's 1936 test the significance of the third week's discriminate function can be established.

$$\text{Var } \bar{z} = \frac{674.29 - 112.28}{5 (.0407)} = 2761.72$$

$$\text{Var } (\bar{z}_C - \bar{z}_D) = \text{Var } \bar{z} (1/4 + 1/3) = 1610.91$$

$$\bar{x}_D - \bar{x}_C = 40.14$$

Thus, the observed difference of the two means, 562.01, is 14 times greater than the standard error and since the standard deviation of \bar{z} is $\sqrt{2761.72} = 52.5$ and one half the distance between the two means is 281.005, we can conclude that function is significant at the .01 level ($\frac{281.005}{\sqrt{2761.72}} = 5.35$).

TABLE 4-7

MEAN VALUES OF PREDICTOR VARIABLES, DISCRIMINATE
WEIGHTS, AND IMPORTANCE VALUES; THIRD WEEK

Variables	Continue Mean	Dis- continue Mean	Discriminate Weight	Importance	Relative Importance
Awareness	38.50	19.33	1.00	19.17	1%
Knowledge	32.50	16.67	12.85	203.42	11%
Weak Interest	18.50	8.67	-68.43	672.67	35%
Strong Interest	12.00	2.67	24.62	229.70	12%
Weak Infor- mation Seeking	15.00	3.33	48.62	657.40	30%
Strong Infor- mation Seeking	2.50	1.33	183.75	214.99	11%
$\bar{z}_C = 674.29 \quad \bar{z}_D = 112.28$					
Discriminate Value = 393.29					

TABLE 4-8

THIRD WEEK RESULTS OF ASSIGNMENT TESTS

\bar{z} Dessert	948.14	\bar{z} Fabric softener	575.42
\bar{z} Furniture	280.76	\bar{z} Meal in can	-269.28
\bar{z} Snack food	992.70	\bar{z} Cooking oil	33.34
\bar{z} Floor cleanser	475.54		
Predicted			
	Continued	Discontinued	Total
Actual	Continued	3	1
	Discontinued	$\frac{1}{4}$	$\frac{2}{3}$
	Total	4	$\frac{3}{7}$

Table 4-8 shows that the discriminate function for the third week while being significant at even the .01 level was not a perfect predictor of product groups. One possible explanation is offered here as a reason for the third week's discriminate function failure to provide a perfect prediction of product grouping. This explanation, however, has not been substantiated by additional research. It pertains to the high mean value given to the discontinued fabric softener. This high mean value is directly attributable to the level 4 for the strong knowledge variable. Since the discriminate weight for this factor is 183.75, this factor is one of the most important factors, assuming equal mean differences for the six variables. However, this abnormally high mean value for this product could have been caused by what Rogers terms the non-compatibility of this product's use with existing norms for the use of other fabric softeners.⁵ The fabric softener studied in this experiment required a different type of application than the other softeners available on the market. It is felt, that this compatibility factor could have been significant enough for the consumer to seek out additional information on the product.

Third Week Summary

The third week discriminate function was seen to have been significant at the .01 level but effective as a predictive tool on only five of seven products. However, a possible explanation was offered to account for this inability to predict product grouping. If the level of strong information seeking activities for the product under question is reduced to the level of the other products of the same group, the function will correctly predict all seven products correctly. (In the future weeks, the strong information activities of the other two products of this group, increase above the zero level as can be expected for all new products thereby reducing the possibility for future errors of this type.) The relative importance of the six variables for the third week has three distinctive groupings. Weak interest and weak information seeking were both over the thirty per cent level, strong interest, strong information seeking and knowledge account for ten to twelve per cent and awareness accounted for only one per cent.

Fourth Week Findings

The discriminate function for the fourth week was

$$Z = -.3003x_1 - .4245x_2 + .3960x_3 + .4895x_4 + .2478x_5 +$$

.1993x₆ which becomes $Z = -x_1 - 1.41x_2 + 1.32x_3 + 1.63x_4 + .83x_5 + .66x_6$ when x_1 is made an unity value.

Five of the six predictor variables are deemed to be relatively important as shown in Table 4-9. Weak interest, however, was not the most important as it was for the second and third week. Knowledge, which was second for the second week and a member of the second grouping for the third week, had the highest relative importance percentage. Strong interest was just slightly less important. It is not important that the means for both groups are negative; this is a result of the design of the discriminate function. This function is designed to give higher values to the desired group (the continued group, in this case) and lower values to the undesired group. It is, also, interesting to note that a negative sign doesn't necessarily mean that the reverse of the two variables would imply a higher probability of success. A negative sign can, also, be caused, as noted earlier, by the interaction among and between the variables. With regard to the case at hand, it seems highly unlikely that both total lack of awareness and knowledge will indicate a greater potential for the continuation of the product in question. Nevertheless, although it will soon be shown that the discriminate function for this fourth week is the least significant of the four

TABLE 4-9

MEAN VALUES OF PREDICTOR VARIABLES, DISCRIMINATE
WEIGHTS, AND IMPORTANCE VALUES; FOURTH WEEK

Variables	Continue Mean	Dis- continue Mean	Discriminate Weight	Importance	Relative Importance
Awareness	41.50	32.00	-1.00	9.50	18%
Knowledge	41.00	31.33	-1.41	13.63	26%
Weak Interest	20.00	14.67	1.32	7.04	13%
Strong Interest	13.00	5.33	1.63	12.50	24%
Weak Infor- mation Seeking	17.50	8.00	.83	7.89	15%
Strong Infor- mation Seeking	7.00	4.00	.66	1.98	4%
$\bar{z}_C = -32.575 \quad \bar{z}_D = -38.843$ Discriminate Value = -35.709					

TABLE 4-10

FOURTH WEEK RESULTS OF ASSIGNMENT TESTS

z_{Dessert}	-29.96	$z_{\text{Fabric softener}}$	-46.58
$z_{\text{Furniture conditioner}}$	-37.40	$z_{\text{Meal in can}}$	-30.24
$z_{\text{Snack food}}$	-31.12	$z_{\text{Cooking oil}}$	-39.72
$z_{\text{Floor cleanser}}$	-31.82		
Predicted			
		Continued	Discontinued
Actual	Continued	3	1
	Discontinued	$\frac{1}{4}$	$\frac{2}{3}$
	Total	4	3
		Total	
		7	

tested, this is not necessarily the result of the negative awareness and knowledge weights.

The Fisher test produced a standard error of 1.56 which was nearly 25% of the observed difference of the two means. The function was significant only at the .20 level which was not considered to be significant for this study.

$$\text{Var } \bar{z} = \frac{-32.575 - (-38.843)}{5(.3003)} = 4.1744$$

$$\text{Var } (\bar{z}_C - \bar{z}_D) = \text{Var } \bar{z} (1/4 + 1/3) = 4.1744 (7/12) = 2.435$$

$$\sigma \bar{z}_C - \bar{z}_D = 1.56$$

$$\frac{1/2 (6.268)}{\sqrt{4.17}} = 1.54$$

This function, also, proved useful for predicting only five of the seven products' correct classifications. (Table 4-10) An explanation of this random behavior was that the fourth week was the week prior to July 4th week end and that this might have caused an undue amount of interest in a "ready meal" since the housewife might have wanted to conserve some time over that period. Six of the ten people who displayed a weak interest in the "meal in can", which is considered to be the probable cause for the failure of the function as a prediction tool, were contacted at a later date by the researcher. Two of these people felt that the holidays might have made them more aware of

products of this nature. The remaining four stated that the holidays in no way influenced their awareness of the new product.

Fourth Week Summary

The fourth week actually produced very insignificant results and the author, after accounting for the activities of that week and possible explanations for its lack of significance, feels justified in not deriving any results from this week's activity. At most, the only valid conclusion that can be drawn from an analysis of this week's activity is that no positive tool can be derived to predict product continuation or discontinuation.

Fifth Week Findings

The discriminate function for the fifth week was $Z = -5.1765x_1 - 21.088x_2 + 30.1535x_3 + 4.0180x_4 + 56.2518x_5 + 2.00x_6$ which becomes $Z = -x_1 - 4.07x_2 + 5.83x_3 + .78x_4 + 10.87x_5 + .39x_6$ when x_1 was reduced to an unity value. As shown in Table 4-11 weak information seeking activities followed by weak interest make the two greatest contributions to discriminating between the two groups. It should likewise be noted that awareness and knowledge once again had negative discriminate weights. However, as in the previous week this was not felt to be the result of non-

TABLE 4-11

MEAN VALUES OF PREDICTOR VARIABLES, DISCRIMINATE
WEIGHTS, AND IMPORTANCE VALUES; FIFTH WEEK

Variables	Continue Mean	Dis- continue Mean	Discriminate Weight	Importance	Relative Importance
Awareness	45.00	34.67	-1.00	10.33	5%
Knowledge	44.00	34.67	-4.07	37.97	19%
Weak Interest	22.00	14.67	5.83	42.73	22%
Strong Interest	11.00	7.33	.78	2.86	1%
Weak Infor- mation Seeking	18.00	8.67	10.87	101.42	52%
Strong Infor- mation Seeking	5.50	1.33	.39	1.63	1%
$\bar{z}_C = 110.57 \quad \bar{z}_D = 10.23$					
Discriminate Value = 60.50					

TABLE 4-12

FIFTH WEEK RESULTS OF ASSIGNMENT TESTS

\bar{z} Dessert	105.44	\bar{z} Fabric softener	3.86
\bar{z} Furniture conditioner	114.74	\bar{z} Meal in can	15.70
\bar{z} Snack food	108.82	\bar{z} Cooking oil	11.02
\bar{z} Floor cleanser	113.26		
Predicted			
	Continued	Discontinued	Total
Actual	Continued	4	0
	Discontinued	$\frac{0}{4}$	$\frac{3}{3}$
	Total	4	3

awareness and non-knowledge being positive predictors of product continuation.

The two other evaluations of the five week's discriminate function, also, showed it to be significant. The Fisher test found the difference in means to be almost seventy times as great as the standard error and that the function was significant at the .01 level. The function's assignment value was similarly, seven for seven. (Table 4-12)

$$\text{Var } \bar{x} = \frac{110.57 - 10.23}{5 (5.1765)} = \frac{100.34}{25.88} = 3.88$$

$$\text{Var } (\bar{x}_C - \bar{x}_D) = \text{Var } \bar{x} (1/4 + 1/3) = 3.88 (7/12) = 2.26$$

$$\bar{x}_C - \bar{x}_D = 1.5$$

$$\frac{1/2 (100.34)}{\sqrt{3.88}} = \frac{50.17}{1.97} = 25.47$$

Fifth Week Summary

The fifth week's results were unsurpassed in any category by any of the other week's function. It is felt that this is only natural as the predictive values should increase as time passes. The fact that the four continued products point value ranged from 105 to 114 and the point value of the discontinued products from 3 - 15, tends to support the predictive efficiency of this function.

That this week's results were so significant seems

even more significant, in view of the fact that the same relative importance has been attached to the six variables as in the first three weeks studied. Weak interest, weak information seeking make the two greatest contributions in the fifth week, in an average of the second, third and fifth week and in the average of all four weeks. The reason the fourth week was dropped in the one group was to determine if the results of that week would distort the combined findings. They did not.

Summary of Weekly Percentage Tests

The discriminate function for three of the four weeks was found to be significant. In two of the four weeks the function correctly predicted the product grouping for all seven products and in the other two weeks it correctly predicted five out of seven. Two possible explanations were offered for this non-perfect prediction pattern.

An examination of the relative importances (Table 4-13) of the six variables for the four week period, shows that three variables, weak interest, weak information and knowledge of product type, are the most important contributors to the discriminate function. The others were not felt to be contributors.

TABLE 4-13

SUMMARY OF THE RELATIVE IMPORTANCE PERCENTAGES
(Parentheses indicate weekly rank)

Variable	2nd Week	3rd Week	4th Week	5th Week	4 Week Average	2nd, 3rd 5th Week Average
Awareness	(4) 6	(6) 1	(3)18	(4) 5	(5) 7.5	(6) 4.0
Knowledge	(2)31	(4.5)11	(1)26	(3)19	(3)21.7	(3)20.3
Weak Interest	(1)48	(1)35	(5)13	(2)22	(1)29.5	(1)35.0
Strong Interest	(5) 5	(3)12	(2)24	(5.5) 1	(4)10.5	(5) 6.0
Weak Infor- mation Seeking	(6) 2	(2)30	(4)15	(1)52	(2)24.8	(2)28.0
Strong Infor- mation Seeking	(3) 8	(4.5)11	(6) 4	(5.5) 1	(6) 6.0	(4) 6.7

Rate of Growth of the Six Variables
as Prediction Tools

The rates of growth for the three time periods of this experiment are shown in Tables 4-14 to 4-16. As indicated in Table 4-17, the t-test analysis found that only two variables, awareness for the third-second week and knowledge for the fourth-third week, were significant at the .02 level. Two other growth rates, awareness and strong interest both for the fourth-third week, were significant at the .10 level. The remaining fourteen variables were not deemed significant, since the .10 level is the normal maximum test for significance.

TABLE 4-14

RATE OF GROWTH FOR THE SIX PREDICTOR VARIABLES

Third - Second Week $(\frac{W_3 - W_2}{W_2})$

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued Products						
Dessert	.33	.06	(-.20)	.14	(-.25)	.50
Furniture conditioner	.21	.38	(-.10)	.40	.00	.00
Snack food	.43	1.00	.00	1.00	2.33	.00
Floor cleaner	.67	1.11	.25	.29	2.67	.00
Discontinued Products						
Fabric softener	.09	1.50	.25	(-.67)	.00	1.00
Meal in can	(-.10)	.80	2.50	.50	2.67	.00
Cooking oil	(-.11)	.50	.00	.00	.00	.00

TABLE 4-15

RATE OF GROWTH FOR THE SIX PREDICTOR VARIABLES

$$\text{Fourth - Third Week } \left(\frac{W_4 - W_3}{W_3} \right)$$

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued Products						
Dessert	.08	.39	.17	.00	.54	1.00
Furniture conditioner	.00	.28	.33	(-.14)	2.67	2.00
Snack food	.60	.60	.00	.50	(-.60)	2.00
Floor cleaner	(-.10)	(-.05)	(-.20)	.20	(-.36)	4.00
Discontinued Products						
Fabric softener	.58	.80	.40	2.00	2.00	.50
Meal in can	.89	.89	.43	.33	.67	4.00
Cooking oil	.50	1.00	4.00	4.00	4.00	.00

TABLE 4-16

RATE OF GROWTH FOR THE SIX PREDICTOR VARIABLES

$$\text{Fifth - Fourth Week } \left(\frac{W_5 - W_4}{W_4} \right)$$

	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Continued Products						
Dessert	(-.04)	.00	.07	(-.13)	(-.31)	(-.83)
Furniture conditioner	.09	.09	.00	.00	(-.09)	(-.33)
Snack food	.13	.13	.50	.00	2.00	.33
Floor cleaner	.22	.11	.25	(-.50)	.29	1.00
Discontinued Products						
Fabric softener	.05	.11	.14	.00	(-.17)	(-1.00)
Meal in can	(-.06)	(-.06)	(-.30)	.25	(-.20)	(-.33)
Cooking oil	.33	.33	.40	2.00	3.00	.00

TABLE 4-17

t-TEST SCORES FOR THE RATE OF GROWTH FOR THE SIX PREDICTOR VARIABLES

Time period	Awareness	Knowledge	Interest		Information Seeking	
			Weak	Strong	Weak	Strong
Third-Second	(-3.5236)	.7652	.9436	(-1.4251)	(-.2543)	.6600
Fourth-Third	2.4392	3.5288	1.5215	2.1825	.5766	(-.5817)
Fifth-Fourth	.05340	.4401	(-.5789)	1.5410	.3731	(-1.0793)
Critical Values of t are:						
	.20 = 1.476	.10 = 2.015	.05 = 2.571	.02 = 3.365	.01 = 4.032	

These results are in agreement with the analysis of variance tests, as only during the fourth-third week was there found to be a significant (.10) difference due to the continuation or discontinuation of the seven products. No significant differences were found due to the predictor variables. See Tables 4-18 to 4-20.

Thus, evidence has been presented which tends to support the null hypothesis that the rates of growth of the six variables studied cannot be used to predict the continuation or the discontinuation of the product. It should be noted, however, that this finding is based on what is admittedly a small sample population. This small sample size was beyond the control of the researcher as a major contention of the thesis was that only products of a similar nature should be studied in comparison with each other. Nevertheless, the fact that awareness was significant at .01 in the first time period and at the .10 level for the second period should not be overlooked. Another possible explanation for these results could be found by considering the bases upon which the rate of growth ratios were built. For a continued product, if the innovation experienced a high initial acceptance, it is more difficult to experience a high rate of growth due to the initial higher base. While the discontinued product might never experience a

TABLE 4-18

ANOVA TABLE FOR RATES OF GROWTH
OF THE THIRD-SECOND WEEK

Source	d.f	SS	MS	F	C.V.F@ 10%	C.V.F@ 2%
Products	1	0	0	0	4.06	8.25
Predictive Variables	5	1.27	.254	1.6	3.45	12.13
Error	5	.77	.154			
	11	2.04				

TABLE 4-19

ANOVA TABLE FOR RATES OF GROWTH
OF THE FOURTH-THIRD WEEK

Source	d.f	SS	MS	F	C.V.F@ 10%	C.V.F@ 2%
Products	1	2.55	2.55	5.	4.06	8.25
Predictive Variables	5	2.93	.58	1.	3.45	12.13
Error	5	2.53	.51			
	11	8.01				

TABLE 4-20

ANOVA TABLE FOR RATES OF GROWTH
OF THE FIFTH-FOURTH WEEK

Source	d.f	SS	MS	F	C.V.F@ 10%	C.V.F@ 2%
Products	1	.044	.044	.34	4.06	8.25
Predictive Variables	5	.757	.151	1.16	3.45	12.13
Error	5	.651	.130			

high rate of growth due to the initial higher base. While the discontinued product might never experience a high level of acceptance and thus any subsequent chance may cause a high degree of change in the growth rate. Thus, the comparison of the mean rates of growth could be an invalid test.

FOOTNOTES

1. For a more complete discussion of how to work linear discriminate problems, the reader should consult Maurice G. Kendall, A Course in Multivariate Analysis. (London: Charles Griffin and Company, Ltd., 1965), pp. 144-170.
2. Frederick Mosteller and David S. Wallace, "Inference in an Authorship Problem," Journal of the American Statistical Association, MVIII (June, 1963), 275-309.
3. Paul E. Green and Donald S. Tull, Research for Marketing Decisions. (Englewood Cliffs, N.J.: Prentice-Hall, 1970), p. 376.
4. Kendall, pp. 149-150.
5. Everett M. Rogers with F. Floyd Shoemaker, Communication of Innovations. (New York: The Free Press, 1971), pp. 145-151.

CHAPTER V

SUMMARY AND CONCLUSIONS

The objective of this chapter is to review the research project from its inception to its conclusion. The first section of this chapter will examine the objectives of the study. The second portion focuses on the empirical findings of the investigation. The final section sets forth the major implications of the study, its limitations and notes several areas for future research.

Objectives of the Study

Over \$300 billion will be spent on new product innovation in the 1973 fiscal year. Yet, over 70 per cent of this cost will go to products that will not be successful in the market place. Nowhere is this problem of new product introduction more prevalent than in the retail food industry. As long ago as 1966, the ex-Secretary of Agriculture, Orville Freeman, stated, "Each year about 5,000 new products are offered to stores that already carry 8,000 different items."¹ Business Week has estimated that of the

120,000 supermarket products introduced during the 1970's roughly 100,000 will bomb out² or a study by Advertising Age which predicted that 80 per cent of new supermarket products will fail as they will not meet sales goals.³ Nevertheless, even in view of the above information, the retail food manager of today still must rely on an analysis of the new product's initial thirteen week's sales data before making a decision on whether to continue to stock the product in question or discontinue it.

Thus, the stated purpose of this research project was to be able to provide the retail food manager with a means of predicting which of the products distributed through his retail food outlet should be eliminated from his product line at a point in time far earlier than the usual analysis of thirteen weeks sales data. Instead of reviewing the initial three months sales results, it was hypothesized that knowledge of the level of consumer adoption process variables, as well as knowledge of the rate of growth of these variables, could be used to predict management's decision to continue or discontinue a new product at a point in time earlier than in present use today. The point in time chosen for this study was five weeks after product introduction. While admittedly this was an arbitrary decision, it was chosen so as to make a significant

reduction in the amount of time needed to make the continuation decision.

The consumer adoption variables chosen for study were awareness of the new product, knowledge of its product type, weak and strong interest in the product and weak and strong information seeking activities toward the product. These variables were determined to occur before the consumer makes a decision to adopt or reject the new product.

This research study measured the levels of activity for these six predictor variables against seven new products introduced in the Des Moines, Iowa market during the summer of 1972. The seven products studied were determined to be of similar nature in both terms of consumer product classification and in level of newness. In so far as these products were of a similar nature, it was hypothesized that they should possess similar characteristics with regards to the level of activity occurring in the six predictor variables. A telephone survey was conducted of 1200 customers of a selected retail food store in Des Moines to determine the level of activity in the adoption process variables for each of the seven products. The two specific null hypotheses studies were

1. The knowledge of the level of consumer adoption process variable within an earlier period

of time, makes no difference in management's ability to identify products, which, according to its criteria, should be continued relative to those which should be discontinued.

2. The knowledge of the rate of growth in consumer adoption process variables within an earlier period of time, makes no difference in management's ability to identify products which, according to its criteria, should be continued relative to those which should be discontinued.

Empirical Findings

The approach to analyzing the data was twofold. First, linear discriminate analysis was used to test if the weekly percentages for the second through fifth week after introduction of the six predictor variables chosen were able to discriminate between the continued and discontinued products. Second, the rate of growth hypothesis was tested by means of eighteen independent t-tests. Also, two-way analyses of variance were performed on the mean rates of growth between the continued and discontinued groups by the six predictor variables for the same time period as the earlier tests.

Linear discriminate analysis was able to discriminate

between the continued and discontinued products by using the weekly percentage levels of the six variables. During the fifth week, the discriminate function was found to be significant at the .01 level and was able to correctly assign all seven new products to their proper group.

Data from the second, third and fourth weeks was also analyzed. This was an attempt to see if an earlier time period could produce significant results. While the second week's function was found to be significant at the .02 level and correctly predict the outcome of all seven products, the observed difference in the means of the two product groups was only nine times the week's standard error. The fact that the fifth week's mean difference was seventy times greater than its standard error supported the notion that the fifth week is able to provide more conclusive evidence as to the continuation of the product.

The functions for the other two weeks were believed to have been influenced by extraneous variables. Nevertheless, they were still able to discriminate between the two groups and predict five of the seven product grouping correctly.

Three of the six adoption process variables chosen were found to exercise a great deal of influence on predicting the continuation of the new product. These three

variables were weak interest in the product, weak information seeking activities toward the product and knowledge of the product type.

Evidence was presented which tended to support the null hypothesis that the knowledge of the rate of growth of the six variables studied can not be used to predict the continuation or the discontinuation of the product. It should be noted, however, that this finding is based on what is admittedly a small sample population. This small sample size was beyond the control of the researcher as a major contention of the thesis was that only products of a similar nature should be studied in comparison with each other.

Implications of the Research

It was shown that for at least one classification or products at one point in time and in one geographic location, a linear discriminate function of six adoption process variables could be used to predict product continuation or discontinuation before meaningful sales data was available. Prior to this time the adoption process has been used as a post-operative tool to explain what had happened concerning an innovation. Now the early phases of this process have been shown to be useful as a predictive

tool as well.

It might be well to consider if sales data at the end of the fifth week could have predicted the same results. In this particular case, sales results would not have predicted the ultimate product groupings. First, for all products in general, retail sales data is usually very small for the initial month after introduction. Granted the wholesaler will experience high initial sales as retailers first begin to stock the item. However, any further sales will only result as retailers seek to restock their inventory. This is accomplished only after the consumer passes through the early stages of the adoption process and as past studies have indicated this is not a rapid occurrence.

In this particular case, two products experienced sales for the fifth week which were not indicative of their ultimate classification. One continued product sold less than two cases during the fifth week. This product did not begin to experience sufficient sales results until the ninth week. However, the model presented in this research was able to correctly predict its continuance on the basis of the high level of activity in the interest and information seeking activities of the consumers toward the product. Another product experienced "good" sales results during the fifth week but its sales began to decline in the later

weeks. The model at five weeks correctly predict its discontinuance at the thirteenth week. It is interesting to note that not only did the model correctly predict two product's ultimate result different than their sales data would indicate, but it predicted them in both of the product groups.

Thus, this thesis has presented a model which in this instance was able to correctly predict at five weeks after introduction of a new product the ultimate outcome of managements decision to continue or reject it after a review of thirteen weeks sales data.

This thesis is, also, of use to the manufacturer and middlemen, since the ultimate success of their new products depends upon the retailer's decision to stock the product in question. Therefore, it is possible that this model can serve as valuable aid to these other members of the channel, since they too would like to be able to discontinue an unsuccessful offering at an earlier point in time.

The financial burden of new product introduction falls on the manufacturer and it is within his interest to likewise determine as early as possible how retailer's will evaluate his offerings. The fact, test marketing is designed to assess consumers reaction to a new product and the

retailer's willingness to continue to stock is inferred from such tests.

It is conceivable, then, that a manufacturer could use the measurements of the six predictor variables used in this thesis as an alternative to his present use of sales data in analyzing test market results. By establishing a series of retail locations, the manufacturer will be able to examine consumer reaction to the various marketing mixes with which the new product may be introduced. The model presented here will offer the advantages of early knowledge of product continuance on discontinuance based on evidence which has been found to be more conclusive than initial sales data.

However, before drawing any conclusions from the above findings to other product classifications or geographic locations, the reader should consider two limitations of the study. First, this study was able to study a limited number of new products of the same classification. This resulted in a low number of degrees of freedom being available for determining the significance of the statistical tests. Secondly, the study assumed that there was a common homogeneity between the households selected for interviewing for each of the four weeks. While there is no present evidence to refute this assumption, the reader

should consider this in drawing his conclusion.

Thus, this research study may have posed more questions than it has answered - if this is correct the researcher will consider the undertaking a worthwhile and rewarding experience. Nevertheless, some of the questions that must now be looked at include:

1. If the resources were available to the researcher, would the final different results if more products were used in the sample size? The increasing of the sample size would enable the researcher to have an increased number of degrees of freedom in making the statistical tests.
2. Could a different set of variables produce a significant improvement to the model? This study contended that the activities of the first two stages of the adoption process included awareness, knowledge, interest and information seeking. What would be the results if it were possible to measure the activity that the early rural sociologists referred to as evaluation or the activity of liking or preference as proposed by Lavidge and Steiner. If such attitudes could be quantified, they might

produce different results.

3. This model studied only one particular class of products. Before universal conclusions can be developed it should consider some other product classes. An especially interesting question would concern its adaptability to durable goods.
4. While this model considered only one retail location, it does appear that the model can be used at other locations, as well as a national predictive tool, rather than as a tool for an individual store manager.

This present study may be of great value if the empirical findings can be used successfully in other markets.

FOOTNOTES

1. Orville Freeman, This Week, June 26, 1966, 2.
2. Business Week, March 4, 1972, p. 73.
3. Theodore Angelus, "Why Do Most New Products Fail," Advertising Age, XL (March 24, 1969), 85.

APPENDIX A

Census Tracts of

Polk County, Iowa

Des Moines, Iowa

Selected Stores Trading Area

APPENDIX A

CENSUS TRACTS OF POLK COUNTRY, IOWA; DES MOINES, IOWA

Selected Stores Trading Area

	Polk Co.	Des Moines	Selected Store Trading Area
RACE			
All persons	286,101	200,587	19,170
White	272,983	188,179	19,130
Negro	11,916	11,425	40
Percent Negro	4.2	5.7	.2
AGE BY SEX			
Male, all ages	136,234	93,958	9,558
Under 5 years	12,756	8,539	998
3 and 4 years	4,965	3,300	382
5 to 9 years	14,413	9,291	1,232
5 years	2,760	1,798	236
6 years	2,874	1,833	258
10 to 14 years	14,665	9,464	1,257
14 years	2,816	1,838	220
15 to 19 years	12,914	9,015	881
16 years	2,746	1,798	211
17 years	2,567	1,724	175
18 years	2,677	1,988	165
19 years	2,266	1,746	103
20 to 24 years	10,478	7,968	513
20 years	2,140	1,647	84
21 years	1,905	1,486	86
25 to 34 years	17,644	11,745	1,444
35 to 44 years	15,585	10,117	1,217
45 to 54 years	15,341	10,680	912
55 to 59 years	6,296	4,569	360
60 to 64 years	5,366	4,024	269
65 to 74 years	6,891	5,421	329
75 years and over	3,895	3,126	146
Female, all ages	149,867	108,629	96,174
Under 5 years	12,193	8,246	945
3 and 4 years	4,808	3,180	388
5 to 9 years	13,569	8,778	1,188
5 years	2,472	1,641	222
6 years	2,552	1,664	207
10 to 14 years	14,083	9,186	1,136
14 years	2,725	1,804	207
15 to 19 years	13,775	9,902	839
15 years	2,686	1,773	222
16 years	2,583	1,696	182
17 years	2,569	1,727	167
18 years	2,968	2,279	159
19 years	2,969	2,427	109

APPENDIX A--Continued

	Polk Co.	Des Moines	Selected Store Trading Area
20 to 24 years	13,231	10,105	689
20 years	2,810	2,250	118
21 years	2,790	2,171	141
25 to 34 years	18,866	12,445	1,600
35 to 44 years	16,515	10,913	1,184
45 to 54 years	16,684	12,040	913
55 to 59 years	7,246	5,572	335
60 to 64 years	6,419	5,042	256
65 to 74 years	9,855	8,171	369
75 years and over	7,431	6,229	183
RELATIONSHIP TO HEAD OF HOUSEHOLD			
All persons	286,101	200,587	19,115
In households	278,187	194,123	19,133
Head of household	93,415	68,586	5,342
Head of family	72,739	50,658	4,872
Primary individual	20,676	17,848	471
Wife of head	64,118	43,628	4,500
Other relative of head	115,666	77,443	9,051
Not related to head	5,488	4,546	169
In group quarters	7,414	6,464	42
Persons per household	2.98	2.83	3.57
TYPE OF FAMILY AND NUMBER OF OWN CHILDREN			
All families	72,739	50,658	4,872
With own children			
under 18 years	40,874	26,938	3,179
Number of children	92,639	60,307	7,616
Husband-wife families	64,118	43,628	4,490
With own children			
under 18 years	36,102	23,128	2,928
Number of children	82,168	51,841	7,013
Percent of total			
under 18 years	84.3	81.0	88.2
families with other			
mail head	1,405	1,072	76
With own children			
under 18 years	470	335	36
Number of children	932	690	81
families with			
female head	7,216	5,958	306
With own children			
under 18 years	4,302	3,475	215

APPENDIX A--Continued

	Polk Co.	Des Moines	Selected Store Trading Area
Number of children	9,539	7,776	522
Percent of total under 18 years	9.8	12.2	6.6
Persons under 18 years	97,488	63,981	79,403
MARITAL STATUS			
Male, 14 years old and over	97,216	68,502	6,263
Single	24,439	17,796	1,384
Married	66,859	45,844	4,603
Separated	932	776	34
Widowed	2,565	2,037	108
Divorced	3,363	2,825	169
Female, 14 years old and over	112,747	82,223	6,555
Single	26,231	19,272	1,194
Married	67,707	46,439	4,659
Separated	1,371	1,174	54
Widowed	13,492	11,187	438
Divorced	6,815	5,275	264
All housing units	98,325	72,349	5,552
Vacant - seasonal migratory	28	12	6
All year-round housing units	98,297	72,337	5,546
TENURE, RACE, AND VACANCY STATUS			
Owner occupied	65,000	45,408	4,705
Cooperative and condominium	90	85	9
White	62,823	43,380	4,688
Negro	2,017	1,906	7
Renter occupied	28,412	23,098	638
White	26,657	21,388	634
Negro	1,579	1,542	1
Vacant year-round	4,882	3,831	203
For sale only	750	514	58
Vacant less than 6 mos.	613	408	47
Median price asked	\$16,100	\$12,100	4,500
For rent	2,616	2,171	45
Vacant less than 2 mos.	1,803	1,459	27
Median rent asked	594	589	85
Other	1,516	1,146	100

APPENDIX A--Continued

Race	Polk Co.	Des Moines	Selected Store Trading Area
LACKING SOME OF ALL PLUMBING FACILITIES			
All units	4,418	3,319	385
Owner occupied	1,394	798	230
Negro	106	76	-
Renter occupied	2,336	2,017	81
Negro	219	203	-
Vacant year-round	688	504	74
For sale only	23	10	7
For rent	427	373	17
COMPLETE KITCHEN FACILITIES AND ACCESS			
Lacking complete kitchen facilities	2,091	1,538	149
Access only through other living quarters	95	85	2
ROOMS			
1 room	2,294	2,195	17
2 rooms	4,287	3,868	61
3 rooms	9,296	8,001	308
4 rooms	20,778	15,851	1,357
5 rooms	28,670	20,965	2,199
6 rooms	17,000	11,624	1,169
7 rooms	8,684	5,517	1,459
8 rooms	4,797	2,716	145
9 rooms or more	2,491	1,600	70
Median	4.9	4.8	5.0
All occupied housing units	93,415	68,506	5,243
PERSONS			
1 person	17,997	15,554	433
2 persons	28,192	21,227	1,355
3 persons	15,679	11,184	959
4 persons	14,281	9,395	1,103
5 persons	9,172	5,827	760
6 persons or more	8,094	5,319	733
Median, all occupied units	2.5	2.4	3.2
Median, owner occupied units	2.9	2.7	3.3
Median, renter occupied units	2.0	1.9	3.1
Units with roomers, boarders, or lodgers	2,185	1,875	62

APPENDIX A--Continued

Race	Polk Co.	Des Moines	Selected Store Trading Area
PERSONS PER ROOM			
1.00 or less	87,815	64,514	4,694
1.01 to 1.50	4,676	3,313	549
1.51 or more	924	579	100
Units with all plumbing facilities - 1.01 or more	5,304	3,820	586
VALUE			
Specified owner occupied units	58,851	42,052	3,939
Less than \$5,000	1,320	933	173
\$5,000 to \$7,499	3,498	2,776	343
\$7,500 to \$9,999	6,374	5,390	455
\$10,000 to \$14,999	15,098	12,678	907
\$15,000 to \$19,999	14,120	10,729	1,228
\$20,000 to \$24,999	8,851	5,002	549
\$25,000 to \$34,999	6,465	3,014	240
\$35,000 to \$49,999	2,332	986	38
\$50,000 or more	793	544	11
Median	\$16,100	\$14,700	15,275
CONTRACT RENT			
Specified renter occupied units	27,690	23,017	575
Less than \$30	389	292	17
\$30 to \$39	496	422	22
\$40 to \$59	2,598	2,313	70
\$60 to \$79	5,256	4,698	118
\$80 to \$99	4,973	4,500	92
\$100 to \$149	8,400	6,821	150
\$150 to \$199	3,566	2,423	30
\$200 to \$249	511	397	3
\$250 or more	398	370	1
No cash rent	1,073	781	72
Median	\$98	\$94	91

APPENDIX B

Telephone Questionnaire

Telephone Interviewing Procedures

Telephone Data Recording Procedures

Telephone Questionnaire

1. Have you heard of a new product called _____
which was recently introduced in the Des Moines area?
Yes or No
2. Do you know what type of product _____ is?
(If the shopper asks for help, tell her Wonder would be
a bread and Folgers would be a coffee.) _____
If you get a no to both question 1 and 2, you should
end the interview.
3. a. Do you have any desire to try this new product?
Yes or No If no, go to #4
b. If yes, have you already tried the product?
Yes or No
c. Do you plan to purchase this product within the
next seven days? Yes or No
4. a. Have you talked to any friends, some store personnel
or read anything about this new product? Yes or No
b. If yes, what was the source or to whom did you talk
to? _____
c. Did you seek out this information? Yes or No

Thank you for your co-operation

Telephone Interviewing Procedures

1. Interviewer will identify herself as being from Drake University Business Research Center.
2. Interviewer will ask to speak to the household's food shopper.
3. All duplication of households will be removed prior to making the sample list.
4. A maximum of three calls will be placed to a given household.
5. Telephone calls will be made only during the following hours:

Morning	9:15 a.m. - 11:30 a.m.
Afternoon	1:30 p.m. - 3:45 p.m.
Evening	7:00 p.m. - 8:00 p.m.

No calls will be made over the weekend or July 3rd or 4th.

6. All disconnected numbers will be referred to the phone company for a new listing. If the new listing remains within the selected market area, attempts will be made to reach the new number. If the party has moved out of the area, a new number will be chosen as per prior instructions.
7. Consecutive calls to the same household will always

be made at different times.

8. If the interviewer is unable to reach a household within three attempts, that household will be permanently dropped from the sample.
9. Each household initially selected for the survey will be given a respondent number for purposes of identification. Respondent numbers will range from 1 to 1200.

Telephone Data Recording Procedures

The data for each of the six predictor variables will be analyzed as follows:

1. The data will be kept in terms of percentage of households who answer the predictor question in the affirmative.
2. A yes answer to question 1 will indicate awareness of the product.
3. A knowledge of general product family type (e.g., Epic being listed as a new type of coffee, a new brand of instant coffee or simply as being a coffee will be sufficient. To be listed as a new food product or a new drink will not be sufficient.) must be indicated to be considered to have a knowledge of the product type.
4. An affirmative answer to 3a will indicate a weak intent to purchase.
5. An affirmative answer to 3b or 3c will indicate a strong intent to purchase.
6. An affirmative answer to 4a will indicate weak information seeking activities toward the product.
7. An affirmative answer to 4c will indicate strong information seeking activities toward the product.

8. A total of 50 households will be contacted for each product for each week of the test.
9. The outcome of elimination or continuation of the product will be management's decision after 13 weeks.

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