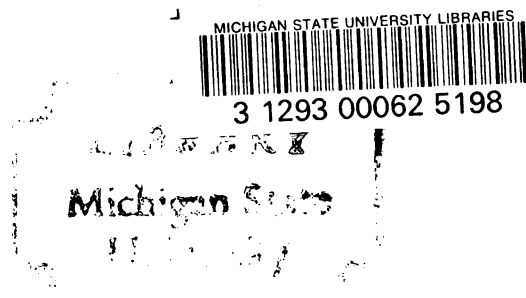




THESIS



This is to certify that the

thesis entitled

A NORMATIVE MODEL FOR RETAIL STORE SELECTION  
IN THE MANUFACTURER'S DISTRIBUTION CHANNEL DESIGN  
--A GOAL PROGRAMMING APPROACH--

presented by

Cherl Young Kim

has been accepted towards fulfillment  
of the requirements for

Ph.D degree in Marketing

*Forrest S. Carter*

Major professor

Date 8/19/81



RETURNING MATERIALS:  
Place in book drop to  
remove this checkout from  
your record. FINES will  
be charged if book is  
returned after the date  
stamped below.

DEC 07 1989

A NORMATIVE MODEL FOR RETAIL STORE SELECTION  
IN THE MANUFACTURER'S DISTRIBUTION CHANNEL DESIGN  
--A GOAL PROGRAMMING APPROACH--

By

Cherl Young Kim

A DISSERTATION

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

DOCTOR OF PHILOSOPHY

Department of Marketing and Transportation  
Administration

1981



## ABSTRACT

### A NORMATIVE MODEL FOR RETAIL STORE SELECTION IN THE MANUFACTURER'S DISTRIBUTION CHANNEL DESIGN --A GOAL PROGRAMMING APPROACH--

By

Cherl Young Kim

6/17/60

Business firms are dependent upon the effective and efficient use of distribution channels through which products flow to reach the ultimate consumers. Therefore, a manufacturer must develop those normative distribution channels which maximize the firm's profits and consumer satisfaction in his potential market. The objective of this research is to develop and demonstrate the use of a normative model for retail store selection in the manufacturer's distribution channel design. This study follows the manufacturer's channel design backward from the consumer market according to the marketing concepts.

A goal programming model for evaluating the alternative retail stores available for distribution of a product is formulated and tested to achieve the manufacturer's multiple and often conflicting channel objectives to the fullest extent possible in the complex marketing distribution system. Through better analysis, this model for optimum retail store selection can help a manufacturer to optimize the allocation of his limited resources among the available retail store alternatives.

In this research, six broad categories of manufacturer's retail channel objectives are economic, market, behavioral, adaptive, store

image, and ad hoc objectives, where eleven specific objectives can be derived from the literature review. These objectives can be subjectively ranked according to their importance in the manufacturer's retail distribution, and this priority structure provides the basis for his selection criteria. Hence, the potential market, defined by the manufacturer, is appropriately segmented to better understand the consumer shopping behavior in each homogeneous market segment. Then, the identified retail store alternatives for his product can be evaluated to select the optimal retail stores, based on the degree to which they contribute to the accomplishment of predetermined objectives.

The model assumes that different levels of sales volume or demand for each retail store alternative are fixed and, that the manufacturer's business environment is stable during the planning period. Additional assumption is that the manufacturer's total channel design can be optimally developed by expanding the retail stores selected in this model. Also, in order to apply the goal programming approach, management has the ability to satisfy its requirements for assigning goal priorities and estimate model parameters.

The model provides three principal types of quantified information for better decision making: (1) identification of the optimal allocation of limited resources, (2) the degree of goal attainment provided within given inputs, (3) the degree of goal attainment provided by changes in various model parameters, especially goal priorities and goal levels. Also, goal programming is shown to provide valuable insights into points of conflict among the manufacturer's multiple channel objectives specified in this model. Moreover, goal programming results can be used to show trade-offs, such as the cost/benefit

implications of critical channel objectives.

The major findings and conclusions of the research are:

1. Goal programming helps define the decision environment of a manufacturer's retail store selection in unambiguous terms for better planning and management.
2. Goal programming ensures that all key retail channel objectives are considered according to their priorities each time a decision structure is evaluated.
3. Goal programming helps various decision makers at different levels in management to establish goal priorities consistently.
4. Goal programming provides a systematic procedure with which to evaluate the retail stores alternatives for a manufacturer's optimum selection.
5. Goal programming helps a manufacturer to utilize his limited resources more effectively and efficiently, while identifying the optimum decision.
6. Goal programming has great flexibility which allows a manufacturer to improve his decision making by various sensitivity analyses, resulting in model reformulations.

Generally, this research indicates that the zero-one goal programming model is appropriate for use in a manufacturer's retail store selection for his channel modification.

© Copyright by  
Cherl Young Kim  
1981

To My Mother

## ACKNOWLEDGMENTS

The completion of this research is never the function of one individual. The author wishes to thank the many individuals who influenced the completion of this dissertation.

The dissertation committee that guided the research contributed greatly from the development of the proposal to the final completion of the dissertation. The Chairman of the Committee was Dr. Forrest S. Carter, Professor of Marketing and Transportation, who provided guidance, assistance and encouragement which were very welcome and greatly appreciated.

The two other members of the Committee were Dr. Donald A. Taylor, Chairman of the Department of Marketing and Transportation, and Dr. M. Bixby Cooper, Professor of Marketing and Transportation. Dr. Taylor provided assistance countless times during the course of the entire doctoral program. Dr. Cooper provided valuable insights and observations during all phases of the research.

I am grateful to Dr. Sang M. Lee, Chairman of the Management Science Department at the University of Nebraska, who helped me in using his own goal programming algorithm. A substantial debt is also owed to Seung H. Lee, a doctoral candidate in management science at the University of Nebraska, who assisted me in the programming of the data for analysis.

Numerous friends and colleagues also aided my completion of this

study. Especially, my gratitude extends to Hae U. Rii for her valuable cooperation who typed this dissertation.

Finally, support, encouragement, and patience have been offered by my mother with continued love and confidence throughout the doctoral program. Without her help, it could not have been completed.

## TABLE OF CONTENTS

LIST OF TABLES	. . . . .	iii
LIST OF FIGURES	. . . . .	v
CHAPTER		
I. INTRODUCTION	. . . . .	1
Quantitative Analyses for Selection of the Optimum Distribution Channel	. . . . .	4
Scope of the Research Problem	. . . . .	5
Purpose of the Research	. . . . .	9
Limitations of the Research	. . . . .	10
Contribution of the Research	. . . . .	11
Order of the Presentation	. . . . .	12
II. REVIEW OF THE LITERATURE	. . . . .	14
Channel Selection Criteria for the Manufacturer's Channel Design	. . . . .	15
Overview of the Existing Quantitative Channel Design Models	. . . . .	40
Mathematical Models	. . . . .	41
Simulation Models	. . . . .	45
Goal Programming	. . . . .	47
III. MODEL DEVELOPMENT	. . . . .	54
Model Design	. . . . .	55
Identification of the Retail Store Alternatives	. . . . .	58
Segmentation of the Manufacturer's Potential Market	. . . . .	59



Formulation of the Goal Programming Model	62
Determination of Model Objectives, Priorities and Weights	62
Definition of the Decision Variables and Needed Constants	69
Formulation of the Goal Constraints	71
Development of the Objective Function	80
Summary of the Model	82
IV. MODEL TESTS	89
Research Design	90
An Illustrative Case Analysis	94
Test I: Initial Analysis	114
Test II: Sensitivity Analyses	119
A Change in Priority Structure	119
A Change in Weight Assignment	126
Changes in Resources or Goal Levels	133
Changes in Technological Coefficients	138
V. SUMMARY AND CONCLUSIONS	146
Conclusions	148
Future Research	151
BIBLIOGRAPHY	

## LIST OF TABLES

### TABLE

2-1	Criteria for Selecting a Channel Member . . .	18
2-2	Methods of Channel Cooperation as Listed by E. B. Weiss . . . . .	28
2-3	Hypothesized Components and Subcomponents of Retail Store Image . . . . .	37
3-1	The Retail Store Patronage-Product Classification Mix . . . . .	61
4-1	Research Flow Chart . . . . .	92
4-2	Information Sources for the Specific Values of the Technological Coefficients . . . . .	93
4-3	Consumer Market Data . . . . .	98
4-4	Retail Management Data . . . . .	101
4-5	Manufacturer's Management Data . . . . .	103
4-6	The Predicted Characteristics of Each Retail Store Alternative in This Research . . . . .	105
4-7	Manufacturer's Predicted Values for the Upper or Lower Limits of Each Goal (Goal Constants) . . . . .	107
4-8	Manufacturer's Initial Priority Structure . . . . .	109
4-9	Manufacturer's Initial Weight Assignment . . . . .	110
4-10	The Initial Model Formulation . . . . .	111
4-11	The Values of the Solution Variables . . . . .	115
4-12	The Goal Achievements . . . . .	116
4-13	Manufacturer's Revised Priority Structure . . . . .	121

# TABLE

4-14	The Values of the Solution Variables by Priority Changes . . . . .	122
4-15	The Goal Achievements by Priority Changes . .	123
4-16	Manufacturer's Revised Weight Assignment . .	126
4-17	The Values of the Solution Variables by Weight Changes (Short-run) . . . . .	127
4-18	The Goal Achievements by Weight Changes (Short-run) . . . . .	128
4-19	The Values of the Solution Variables by Weight Changes (Long-run) . . . . .	130
4-20	The Goal Achievements by Weight Changes (Long-run) . . . . .	131
4-21	The Values of the Solution Variables by Goal- level Change (Short-run) . . . . .	134
4-22	The Goal Achievements by Goal-level Change (Short-run) . . . . .	135
4-23	The Values of the Solution Variables by Goal- level Change (Long-run) . . . . .	136
4-24	The Goal Achievements by Goal-level Change (Long-run) . . . . .	137
4-25	Manufacturer's Revised Technological Coefficients of Marketing Information . . . . .	139
4-26	The Values of the Solution Variables by Technological Coefficient Changes (Short-run) .	140
4-27	The Goal Achievements by Technological Coefficient Changes (Short-run) . . . . .	141
4-28	Manufacturer's Revised Technological Coefficients of Retail Distribution Control . . . . .	142
4-29	The Values of the Solution Variables by Technological Coefficient Changes (Long-run) .	142
4-30	The Goal Achievements by Technological Coefficient Changes (Long-run) . . . . .	144

## LIST OF FIGURES

### FIGURE

1-1	Normative Model of the Channel Design through the Optimum Retail Distribution . . . .	8
2-1	Interorganizational Behavior Framework . .	25
2-2	Goal Programming Flow Diagram . . . .	51
3-1	Flow Chart of Goal Programming Model Development . . . . .	57
3-2	The Retail Store-Market Segment Combination Matrix . . . . .	62
4-1	Market Segmentation of the Potential Market .	95

## CHAPTER I

### INTRODUCTION

How to make effective and efficient use of distribution channels, through which products flow to reach the ultimate consumer, is one of the most critical decisions facing a manufacturer. A channel of marketing distribution can be defined as a collection of organizational units, either internal or external to the manufacturing firm, which performs the functions involved in marketing a product.\* The manufacturer's marketing performance is directly related to the marketing performance of the distribution channel. Consequently, the manufacturer's objective is to obtain the best possible performance of the marketing functions in the distribution channel at the lowest total cost. To achieve this goal of optimum performance, the manufacturer must design or select a channel or channels of distribution to be used for marketing a product. Such a channel that generates maximum profits and consumer satisfaction per dollar of product cost can be called a normative channel.<sup>1</sup>

The manufacturer must perform three basic tasks in the

---

\*Whenever "product" is used anywhere in this paper, it can be considered to include "product line."

<sup>1</sup>Louis P. Bucklin, A Theory of Distribution Channel Structure (Berkeley, California: Institute of Business and Economic Research, University of California, 1966).

distribution channel design: (1) select the appropriate channel structure, (2) choose the intermediaries to be used and establish policies with regard to channel members, and (3) devise information and control systems to insure that performance objectives are met.<sup>2</sup> Channel structure affects: (1) control over the performance of functions, (2) speed of delivery and communication, and (3) cost of operations.<sup>3</sup> After the channel selection has been made in the channel design, the ever-changing nature of the business environment makes it necessary for the manufacturer to monitor and evaluate the performance of the marketing channel continuously. When performance goals are not met in the channel of distribution selected, management must evaluate possible channel alternatives which have the potential for creating sales or reducing costs, to make products widely available and accessible to the market. Then justifiable changes in channel composition and in the relative importance of alternative channels should be implemented in order to obtain the optimum distribution channel design. In this channel design, the manufacturer has to struggle with what is ideal and what is available for the optimum channel selection. Thus, the manufacturer's distribution channel design is a marketing strategy which evolves in response to several influencing factors such as changes in consumer needs, markets, products, competitive situations, the economic climate, and the government's role in the business environment. David A. Revzan states: "The

---

<sup>2</sup>Bert C. McCammon, Jr. and Robert W. Little, "Marketing Channels: Analytical Systems and Approaches," Science in Marketing edited by George Schwartz (New York: John Wiley and Sons, Inc., 1965), p. 354.

<sup>3</sup>Louis W. Stern, "Channel Control and Interorganizational Management," Marketing and Economic Development edited by Peter D. Bennett (Chicago: American Marketing Association, 1965), p. 655.

channel is the managerial battlefield in which marketing strategy and marketing tactical activities of each business unit either succeed or fail."<sup>4</sup>

Even though channels of distribution have to be carefully selected to become more productive and efficient, the distribution channel has been recognized as "one of the least managed areas of marketing"<sup>5</sup> and perhaps of management as a whole. The scholarly study of marketing channels is relatively limited. McCammon and Little hypothesize that this neglect of the study of channels is a result of three basic factors. First, marketing scholars have been interested primarily in the theory of the firm rather than in the firm's relationship to other enterprises. Second, marketing channels are difficult to study because of the complexities involved. Third, although early studies in the field of marketing were concerned with institutions and functions, the managerial approach adopted in the 1950's has placed less emphasis on distribution channel systems.<sup>6</sup>

---

<sup>4</sup>David A. Revzan, Wholesaling in Marketing Organization (New York: John Wiley and Sons, Inc., 1961), p. 155.

<sup>5</sup>Reavis Cox and Thomas F. Schutte, "A Look at Channel Management," Marketing Involvement in Society and the Economy edited by Philip McDonald (Chicago: American Marketing Association, 1969), p. 105.

<sup>6</sup>McCammon and Little, op. cit., pp. 321-22.

Quantitative Analyses for Selection of  
the Optimum Distribution Channel

Marketing channel decisions which are among the most complex and challenging decisions facing management, are of vital importance to business firms because they determine the means by which end users of products will obtain access to those products. Without access to products at the place and time needed, consumers will not be able to effect transactions in the market. When consumers needs are not being met, consumers will be forced to seek alternative need-satisfying sources from competitors. This sort of failure can be disastrous to the manufacturer if allowed to continue in business.

Given this importance of channel decisions, much evidence exists to demonstrate that little attention has been paid by business executives to optimizing channel decisions. In 1960, McVey's article, "Are Channels of Distribution What the Textbooks Say?" advanced the argument that, for most business firms, the channel design progresses slowly over time with little conscious planning.<sup>7</sup> This contention is supported by Lambert, whose research reveals that distribution channel selection by business firms is often a "hit-or-miss" or "trial and error" proposition.<sup>8</sup> Furthermore, Lambert found that other marketing channel decisions are often made with limited information and analysis. Finally, perusal of recent marketing literature reveals that little

---

<sup>7</sup>Phillip McVey, "Are Channels of Distribution What the Textbooks Say?" Journal of Marketing, Vol. 24, No. 1 (January 1960), pp. 61-64.

<sup>8</sup>Douglas M. Lambert, The Distribution Channels Decision (New York: National Association of Accountants, 1978).



effort has been expended by either marketing academicians or business executives in developing a formal methodology for making optimum distribution channel decisions.

These findings are somewhat surprising, considering the rapid advancement and widespread applications of quantitative methods to other marketing decisions. For example, logistical decisions and promotion decisions such as advertising and sales force decisions have been subjected to a number of quantitative methods, ranging from simple linear programming and stochastic models to extremely complex simulations.<sup>9</sup>

#### Scope of the Research Problem

As previously stated, many channels of distribution were not selected with the ideal or most profitable system. Rather, they were developed in response to problems or changes in the marketplace, with little effort and limited study to improve marketing channel decisions.

The overall challenge to the manufacturer is to design a normative distribution channel system. This complex distribution channel problem may be analyzed in a series of steps which includes appropriate feedback. In this planning process, the manufacturer's channel design will be viewed backward from consumer market in a managerial context.

As in all marketing activities, the focus or starting point in

---

<sup>9</sup>Philip Kotler, Marketing Decision Making: A Model Building Approach (New York: Holt, Rinehart and Winston, Inc., 1971).

designing the distribution channel is the ultimate consumer. Knowledge about what consumers need, where they buy, why they buy from certain outlets, when they buy, and how they buy is critical. Therefore, the manufacturer's task of designing a distribution channel involves determining the most profitable and effective way to reach the market that he wants to serve. Such a determination is possible only after an understanding of consumer behavior, based on the marketing concept, has been achieved.

A manufacturer who has determined the potential market for his specific product according to the consumer evaluation, should proceed to formulate distribution channel objectives. These objectives are necessary to optimize the allocation of limited resources among the various distribution channels within the firm's given constraints. The manufacturer must use his best subjective judgement on these multiple and often conflicting objectives for the firm's complex and interrelated channels of distribution. Specifically, he must rate the importance of each objective and build the priority structure of these objectives in any specified situation to design the optimum distribution channel for his product.

Under the channel strategy developed from the above channel objectives, a manufacturer should next begin to determine which retail stores will provide the best access to potential consumers of the manufacturer's product. The retail stores selected are those which offer differential competitive advantages in the market. In retail stores, sales are primarily made to end users in the consumer market.

A manufacturer should identify the available retail store alternatives for distribution of his product in a competitive market. Then,

he should evaluate the degree to which they contribute to accomplishing the predetermined distribution channel objectives of the business firm. Of course, the manufacturer must select the retail stores which optimally satisfy these channel objectives to the greatest extent.

This selection of the retail stores allows a manufacturer to utilize the most effective and efficient distribution channels between the manufacturing firm and the optimum retail stores, based on the marketing functions needed by the firm. Finally, the manufacturer should measure and evaluate the performance of the distribution channels in order to be able to respond to the dynamic changing market environment with channel change or channel modification.

Figure 1-1 shows a theoretical and analytical model that provides a planning decision process for the manufacturer's channel design. This model, if followed, will lead to the evolution of a normative channel. Having limited this research problem to the manufacturer's selection of the optimum retail stores, three steps highlighted in this figure outline a procedure to develop a normative model for selecting the optimum retail stores in the manufacturer's distribution channel design.

In summary, this research will focus on how a manufacturer can improve his decisions in regard to selecting the retail stores which will give his specific product better access to its potential market. By selecting the optimum retail stores which satisfy the predetermined objectives best, the manufacturer can achieve differential competitive advantages in the market.

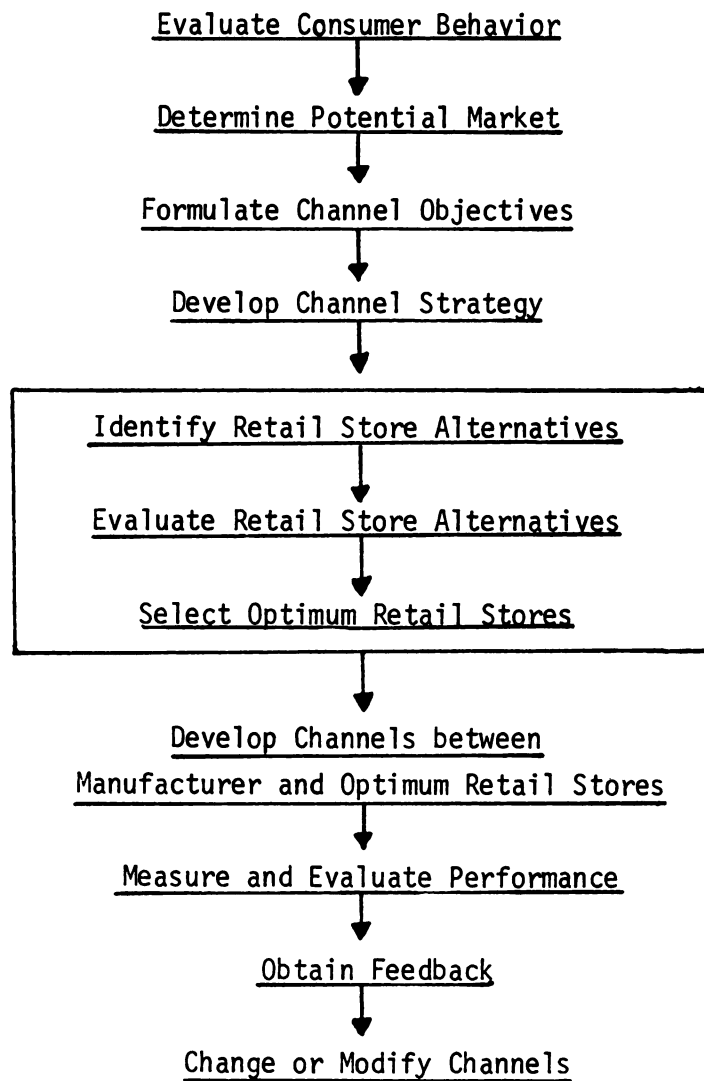


Figure 1-1 Normative Model of the Channel Design through the Optimum Retail Distribution

## Purpose of the Research

The purpose of the research is to develop a normative model for retail store selection in the manufacturer's distribution channel design and to demonstrate its use. In this research, a goal programming approach is applied to improve the manufacturer's selection decision among retail store alternatives through better analysis. The model optimizes the allocation of limited management resources among the retail stores that best satisfy a set of management's channel objectives. Goal programming is the one of the most promising techniques for the decision maker who wants to achieve a set of objectives\* to the fullest possible extent in spite of the conflicting interests, incomplete information, and limited resources which are often encountered in the complex environment of retail distribution.

By requiring the manufacturer to identify his distribution channel objectives and to prioritize them on the basis of their importance, the goal programming model will optimize the manufacturer's retail store selection in terms of the degree to which his distribution channel objectives are achieved, within the constraints of his particular business operation. This research includes the analysis of consumers' store preferences for the manufacturer's product as well as the available retail stores within a potential market and their behavioral relationships with the manufacturer.

In addition to the development and testing of the goal

---

\*Because the terms "objective" and "goal" are used interchangeably in the literature of goal programming, for the purpose of this research they will be considered to be synonymous.

programming model, a variety of goal priority structures and weight arrangement will be investigated in order to demonstrate the model's flexibility as a management tool. The flexibility is needed since different decision makers in management have differing sets of subjective evaluations on goal priorities and weights. Due to the uncertainties of management's predictions, the goal levels or the available resources will be revised to demonstrate how the model can provide insights into various cost/benefit trade-offs. These trade-offs are imperative to satisfy the firm's distribution channel objectives because of the firm's given constraints. Finally, changes in the estimated technological coefficients, which serve as the model parameters, will be made to check the effects of differences in management's evaluations.

### Limitations of the Research

The development of the research and the construction of the model are based upon the following assumptions:

1. This study deals only with the demand satisfaction aspects of alternative retail stores without considering their demand creation aspects.
2. During the decision-making period in which the manufacturer selects the retail stores, his marketing mix strategies and the firm's environmental factors can be considered to be stable, without radical changes.
3. The effective and efficient channels, which connect a manufacturer with the optimum retail stores within the total

channel system, can be extended without changing or affecting the optimum retail store selection.

Also, the research may be limited by the requirements of the goal programming model--management's ability to formulate goal programming and linearity in all the relationships among the decision variables in the model.

In this research, only the available retail store alternatives for the sale of consumer shopping goods are evaluated primarily for manufacturer's channel modification. Channel adoption and channel creation are not addressed since designing a completely new channel or creating new retail stores is rarely attempted by most firms in the complex marketing channel environment.

Moreover, the simulated data included in the model are assumed to be a valid representation of one particular manufacturer's business environment at the time of the optimum retail store selection. Therefore, the data should be useful in demonstrating the ability of the goal programming model to improve the manufacturer's distribution channel decisions.

### Contribution of the Research

The primary contribution of this research is the procedure for analysis of retail stores in the manufacturer's distribution channel design provided by the goal programming model. A manufacturer can follow the procedure outlined to make more accurate comparisons of retail store alternatives prior to their selection. In short, this

1



approach makes the complexity of marketing channel systems more manageable. In addition, this model can be implemented in various business situations by reformulating it with new channel objectives and/or by revising the input data from time to time. So the model is flexible enough to take into account modified circumstances in the changing business environment.

Perhaps, this research may stimulate more applications of advanced quantitative methods to distribution channel decisions. This should, in turn, result in better decision making. It is hoped that academicians and business practitioners will direct more of their efforts to understanding the complexities of marketing channel decisions through modeling for continuous planning.

### Order of the Presentation

Chapter II is a review of the literature related to a normative model of the manufacturer's distribution channel design. The first objective of this chapter is to identify the manufacturer's general, multiple, and often conflicting, channel objectives. These objectives induced from the literature review can be utilized to analyze and evaluate his retail store alternatives for the optimum selection. A second objective is to determine the appropriate quantitative research method to develop the optimum distribution channel design. As the appropriate quantitative methodology for this research, goal programming is reviewed.

Chapter III deals with model development. A specific analytical

goal programming model to optimize retail store selection is formulated. The model includes identification of the retail store alternatives available to the manufacturer and segmentation of the potential consumer market for his product.

To demonstrate the use of the research model developed in Chapter III, Chapter IV provides the research procedure to generate the relevant data and presents the test findings in an illustrative case study. Furthermore, it examines the differences in results which are caused by changes of the model parameters in the real and complex retail distribution. These changes are in priorities of the objectives, the weights, the goal levels or available resources, and the technological coefficients in the model.

In Chapter V, the findings of the research are summarized and concluding statements, emphasizing the managerial application of the goal programming to real businesses, are developed. Recommendations for further research are also included.

## CHAPTER II

### REVIEW OF THE LITERATURE

This chapter presents a conceptual foundation on which to build the research model and to choose the appropriate research method. The development of a normative model for retail store selection in the manufacturer's distribution channel design requires a review of the related literature, which can be covered in two sections: channel selection criteria for the manufacturer's channel design and overview of the existing quantitative channel design models.

The first section surveys the various manufacturer's distribution channel objectives. In this research, these objectives will be used as the criteria to evaluate the available retail store alternatives for the optimum selection in the manufacturer's channel design. The second section examines mathematical models and simulation models of the distribution channel design. For this research, the goal programming approach is explained in this section.

Channel Selection Criteria for  
the Manufacturer's Channel Design

Through the appropriate evaluation process, management can select the optimum distribution channel for its product to reach its potential market. Generally, there are three broad categories of channel selection activities involved in designing channels of distribution:

1. Channel adoption occurs when the firm initially decides on a preferred route to market from among available channel alternatives. Channel adoption typically occurs only once in a product's life but may occur often in an innovative firm that frequently adds products.
2. Channel modification is defined as the process of continual reevaluation, adjustment, and change within a channel over the life of the product. Channel modification happens repeatedly for both products and firms.
3. Channel creation is development from the ground up of a channel where no alternative previously existed. Channel creation typically involves designing new institutions or using existing institutions in a new manner.<sup>10</sup>

Mallen has identified five factors that must be analyzed closely by the channel designer:

1. The selected target markets
2. The rest of his marketing mix: price, product, promotion, physical distribution, etc.

---

<sup>10</sup>Glenn C. Walters, Marketing Channels (Santa Monica, California: Goodyear Publishing Co., 1977), p. 171.

3. His company's resources
4. Competition and other external forces
5. Current and anticipated distribution structure in his industry.<sup>11</sup>

This list should be expanded to include economic considerations in the form of distribution cost trade-off analysis. Through this analysis for selecting channels of distribution, a manufacturer may choose to perform all of the marketing functions internally or to have one or more of the functions performed by "external" channel members.

Discussing the evaluation of distribution channel effectiveness, Revzan states that such evaluations should take into consideration the various objectives of each channel level's view as well as the overall marketing view of the total distribution channel system. He describes the principal objectives from the manufacturer's point of view:

1. To determine the contribution of the channel alternatives to the achievement of the company's overall marketing program, in quantitative and qualitative units;
2. To determine, more specifically, the direct and indirect relationship between channel alternatives and the degree of market penetration of the company's product lines, area by area;
3. To determine the contribution of the channel alternatives to consumer recognition and acceptance of the company's sales promotional campaigns;

---

<sup>11</sup>Bruce Mallen, "Functional Spin-off: A Key to Anticipating Change in Distribution Structure," Journal of Marketing, Vol. 37, No. 3 (July 1973), pp. 18-25.

4. To determine the contribution of the channel to the company's complete knowledge of the characteristics of the market it serves;
5. To determine the contribution of the channel to the company's favorable or unfavorable cost/profit position, product line by product line, and market area by market area; and
6. To determine the contribution of each channel alternative to the degree of aggressiveness of the company's marketing program.<sup>12</sup>

These manufacturer's corresponding objectives must be stated in specific operational terms which can be used to evaluate the existing channel alternatives to select the best channels of distribution.

Lambert has developed a list of general criteria to evaluate the performance of channel alternatives (see Table 2-1). These general criteria must be supplemented by specific statements concerning what the manufacturer desires to achieve with respect to each aspect of the channels' performance in distribution.<sup>13</sup>

Corstjens and Doyle have considered the following constraints useful in optimizing the manufacturer's allocation of resources among a set of alternative distribution channels:

1. Capacity constraint which imposes an upper bound on potential output;
2. Control constraints which reflect behavioral relations among members of channel;

---

<sup>12</sup>Revzan, op. cit., p. 219.

<sup>13</sup>Lambert, op. cit., p. 37.

Table 2-1 Criteria for Selecting a Channel Member

- 
1. Size of Prospective Channel Member--Sales--Financial Strength
  2. Sales Strength
    - Number of Salesmen
    - Sales and Technical Competence
  3. Product Lines
    - Competitive Products
    - Compatible Products
    - Complementary Products
    - Quality of Lines Carried
  4. Reputation
    - Leadership
    - Well-Established
  5. Market Coverage
    - Geographic Coverage--Outlets per Market Area
    - Industry Coverage
    - Call Frequency or Intensity of Coverage
  6. Sales Performance
    - Performance with Related Lines
    - General Sales Performance
    - Growth Prospects
  7. Management
  8. Advertising and Sales Promotion
  9. Sales Compensation
  10. Acceptance of Training Assistance
  11. Transportation Savings
  12. Inventory
    - Kind and Size
    - Inventory Minimums--Safety Stocks
    - Reductions in Manufacturer Inventories
  13. Warehousing
    - Supplied in Field
    - Ability to Handle Shipments Efficiently
  14. Lot Quantity Cost--Willingness to Accept Our Ordering Policies
- 

Source: Douglas M. Lambert, The Distribution Channels Decision (New York: National Association of Accountants; and Hamilton, Ontario: The Society of Management Accountants of Canada, 1978), p. 37.

3. System inflexibilities constraints which limit the amount of adaption and discretion a manufacturer has over any channel system;
4. Technical constraints such as nonnegativity requirements to ensure practical solutions to the optimization problem;
5. Ad hoc constraints due to any specific company situations.

Subject to these constraints on the decision variables, a manufacturer's objective function is to maximize his profits for the optimum values. In addition to the economic objective, some of these constraints show other objectives for a manufacturer to achieve in his given business environment.<sup>14</sup>

Specially, to evaluate the retail store alternatives for the optimum selection in the manufacturer's channel design, retail store image objectives can be considered. These store image objectives help a manufacturer to position his product where his potential consumers prefer to shop and/or purchase it.

Currently, retailers are placing more emphasis on their retail store image research in an attempt to gain a differential advantage over the competition in their market segments. However, a manufacturer must conduct retail image studies in order to match more closely the alternative retail store's image with the image of his product. This can be accomplished by predicting his potential consumer's preference for some of the attributes common to both images. As a result, through the most profitable and effective ways in retail distribution, he can

---

<sup>14</sup>Marcel Corstjens and Peter Doyle, "Channel Optimization in Complex Marketing Systems," Management Science, Vol. 25, No. 10 (October 1979), pp. 1014-25.



obtain better access to his potential market.

Management must evaluate the available distribution channel alternatives in order to select the optimum channel which will achieve its multiple, and often conflicting, objectives within the complex marketing channel environment. Consequently, the manufacturer's channel objectives serve as the operational criteria for selection of the optimum retail stores, to present the desired marketing profile to the potential consumers and maximize the firm's profit. Channel objectives for retail store evaluation in the manufacturer's channel design can be described in the following broad terms:

- A. Economic Objectives
- B. Market Objectives
- C. Behavioral Objectives
- D. Adaptive Objectives
- E. Store Image Objectives
- F. Ad hoc Objectives

These generalized channel objectives must be stated in terms of the specific operational goals for a manufacturer to achieve in his retail distribution system.

Now, each of the six channel objectives will be discussed in more detail as follows:

#### A. Economic Objectives

Since the firm is pursuing profits, economic criteria are important. In channel distribution each channel alternative will produce different levels of sales and costs which affect the manufacturer's profitability and growth.

Channel members, the independent business units which constitute the manufacturer's marketing distribution system, are highly interrelated. Therefore, to achieve maximum profits, the manufacturer's distribution decisions should be made on the basis of the total channel system. In recent years, the emphasis has been on viewing distribution activities as an integrated system.<sup>15</sup>

Distribution costs come from one or more of the marketing functions that channel members perform in the process of distribution. These functions are pervasive and include buying, selling, transporting, sorting, grading, financing, bearing market risks, and providing marketing information.<sup>16</sup> These functions, which must be performed by someone in the channel, have three things in common: they use up scarce resources, they can often be performed better through specialization for economies of scale, and they are shiftable. Hence, a manufacturer may spin-off the needed marketing functions to the external channel members, if they can perform these functions more efficiently and effectively than he can.<sup>17</sup> If a manufacturer is going to choose the channel that will result in the highest return to the company, he must consider the costs of performing the distribution functions internally and then compare them to the total cost plus the margins paid to have them performed externally, for the same sales volume within his limited

---

<sup>15</sup>Donald J. Bowersox, "Physical Distribution Development, Current Status and Potential," Journal of Marketing, Vol. 33, No. 1 (January 1969), pp. 63-70.

<sup>16</sup>Fred E. Clark, Principles of Marketing (New York: The Macmillan Company, 1923), p. 11.; Robert Bartels, Marketing Theory and Metatheory (Homewood, Ill.: Richard D. Irwin, Inc., 1970), pp. 166-75.

<sup>17</sup>Mallen, op. cit., p. 24.

financial distribution budget. In this analysis, distribution cost trade-offs are unavoidable.

### B. Market Objectives

The manufacturer is deeply concerned with ensuring that his product is available to a high proportion of the potential market. An increasing number of companies believe that long-run profitability is associated with achieving a dominant market share.<sup>18</sup>

Weber explains why the firm's actual sales sometimes fall short of its potential sales through market structure profile analysis. One of the possible reasons is distribution gaps which are the absence of or inadequate distribution to or within the relevant market. Distribution gaps are of three types: coverage gaps, intensity gaps, and exposure gaps. A distribution coverage gap exists when a firm does not distribute the product line, or individual product thereof, in all geographic regions where it is desired. A distribution intensity gap exists when a firm's entire product line, or individual product thereof, is distributed in an inadequate number of outlets within a geographic region where the firm does not have distribution coverage. A distribution exposure gap exists when a firm's entire product line, or individual product thereof, has poor or inadequate shelf-space, location, displays, and so forth within outlets where the firm does have distribution coverage for the product.<sup>19</sup>

---

<sup>18</sup>Robert D. Buzzell, Bradley T. Gale, and Ralph G. M. Sulton, "Market Share--A Key to Profitability," Harvard Business Review (January-February 1975), pp. 97-106.

<sup>19</sup>John A. Weber, "Market Structure Profile Analysis and Strategic Growth Opportunities," California Management Review, Vol. 20, No. 1 (Fall 1977), pp. 34-46.

A manufacturer will establish market objectives by determining degree of market competitiveness and the level of convenience needed by potential consumers. This convenience level can be ascertained by studying their shopping patterns relative to the product or brand in question. These market objectives can be expressed in several ways: geographic coverage, in terms of the extent of territorial coverage; market coverage, as the total number of potential consumers actually reached; and market exposure, related to how many sales outlets are sought by the firm.

Market exposure objectives come from the degree of distribution intensity desired by the firm. Three types of market exposure objectives apply to channel selection: intensive distribution, selective distribution, and exclusive distribution. Intensive distribution occurs when the firm attempts to place its product in every available outlet. Intensive distribution provides the firm with the largest possible market. In selective distribution, the firm places its product in a limited number of outlets within a defined geographical area. This selection may be made on the basis of cooperativeness, financial strength, progressiveness, future development possibilities, or sales ability. A policy of exclusive distribution is in effect when the firm places its product in the hands of only one outlet in a specified geographic area. In exclusive distribution, the product goes to the highest quality outlet but the market coverage is restricted to some extent.

### C. Behavioral Objectives

The behavioral relationships within the channel as a behavioral system have received increasing attention from various researches in recent years. Their emphasis is on how behavioral interactions among channel members affect the conduct and efficiency of the channel. Unfortunately, these behavioral aspects have not yet been integrated into the normative channel design.

An overall framework for viewing interorganizational behavior is illustrated in Figure 2-1.<sup>20</sup> Businesses differ in their limited resources and goals to perform marketing functions. Frequently, through the process of specialization, they align themselves with channel members into a organized marketing channel. As a result, each firm becomes dependent upon others in the channel system to accomplish its objectives. This mutual dependence lays the foundation for three types of behavior: conflict, cooperation, and control.

Channel conflict is a state or situation in which one channel member perceives another channel member as an adversary engaged in behavior designed to destroy, thwart, or gain resources at the expense of the perceiver.<sup>21</sup> Channel conflict occurs in three forms: (1) horizontal conflict or competition which takes place among firms on the same level of distribution, (2) intertype conflict that occurs between two competing or alternative channel systems, and (3) vertical

---

<sup>20</sup> Donald J. Bowersox, M. Bixby Cooper, Douglas M. Lambert, and Donald S. Taylor, Management in Marketing Channels (New York: McGraw-Hill Book Company, 1980), p. 66.

<sup>21</sup> Adsel I. El-Ansary and Robert A. Robicheaux, "A General Model for Understanding Channel Member Behavior," Journal of Retailing, Vol. 51, No. 4 (Winter 1975-76), p. 20.

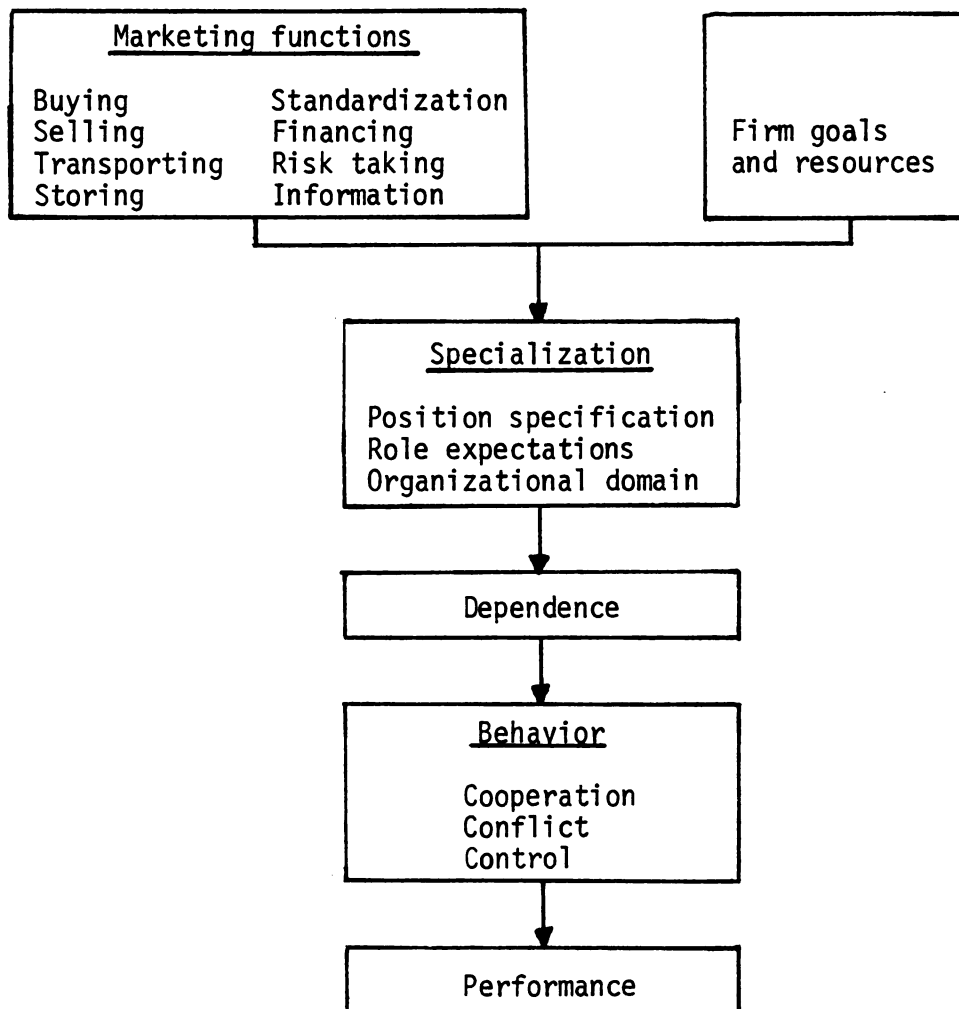


Figure 2-1 Interorganizational Behavior Framework

Source: Donald J. Bowersox, M. Bixby Cooper, Douglas M. Lambert, and Donald S. Taylor, Management in Marketing Channels (New York: McGraw-Hill Book Company, 1980), p. 66.

conflict which refers to competition among different levels of a marketing channel.

Channel cooperation is defined as a state or condition of willingness on the part of members to coordinate their activities in an effort to help all members achieve superordinate goals.<sup>22</sup> Channel cooperation exists on a voluntary basis or as a result of conflict resolution by the channel leader.

Channel control is the ability of one member of a marketing channel for a given product (or brand) to stipulate marketing policies to other channel members.<sup>23</sup> Channel control results from channel leadership; i.e., it is achieved via the exercise of authority and/or other sources of power.

Mallen has hypothesized that between member firms of a marketing channel there exists a dynamic field of conflicting and cooperating objectives, and that if the conflicting objectives outweigh the cooperating ones, the effectiveness of the channel will be reduced and efficient distribution impeded.<sup>24</sup> He concludes that a distribution channel will be most effective under conditions of optimum cooperation leading to consumer and profit satisfaction through increased channel efficiency.

Weiss has developed an impressive, though admittedly incomplete,

---

<sup>22</sup>Ibid., p. 21.

<sup>23</sup>Louis W. Stern, "The Concept of Channel Control," Journal of Retailing, Vol. 43, No. 2 (Summer 1967), pp. 14-20.

<sup>24</sup>Bruce Mallen, "A Theory of Retailer-Supplier Conflict, Control, and Cooperation," Journal of Retailing, Vol. 39, No. 2 (Summer 1963), pp. 24-32.

list of cooperation methods (see Table 2-2).<sup>25</sup> Paradoxically, many of these instruments of cooperation are also weapons of control to be used by the channel leader. However, this is not so strange if one keeps in mind that control is subdued conflict and a form of cooperation.

Recently, increasing interest and attention have been given to the study and measurement of power in the distribution channel.<sup>26</sup> El-Ansary and Stern have attempted to measure power using, direct measures of control over marketing strategy variables in the channel relation, and indirect measures of dependence and sources of power.<sup>27</sup> El-Ansary has also developed a model for power-dependence relationships in the distribution channel based on Emerson's model.<sup>28</sup> Hunt and Nevin have attempted to measure power in a franchise vertical marketing system by using a modified version of El-Ansary's methodology. Their findings indicated that the franchise system had an identical power

---

<sup>25</sup>Edward B. Weiss, "How Much of a Retailer is the Manufacturer?" Advertising Age, Vol. 29, No. 29 (July 1958), p. 68.

<sup>26</sup>Louis P. Bucklin, "A Theory of Channel Control," Journal of Marketing, Vol. 37, No. 1 (January 1973), pp. 39-47.; James L. Heskett, Louis W. Stern, and Frederick J. Beier, "Bases and Uses of Power in Interorganization Relations," in Vertical Marketing Systems edited by Louis P. Bucklin (Glenview, Ill.: Scott Foresman and Company, 1970), pp. 75-93.; Robert W. Little, "The Marketing Channel: Who Should Lead This Extra-Corporate Organization?" Journal of Marketing, Vol. 34, No. 1 (January 1970), pp. 31-38.; Adsel I. El-Ansary and Robert A. Robicheaux, "A Theory of Channel Control: Revisited," Journal of Marketing, Vol. 38, No. 1 (January 1974), pp. 2-7.

<sup>27</sup>Adsel I. El-Ansary and Louis W. Stern, "Power Measurement in the Distribution Channel," Journal of Marketing Research, Vol. 9, No. 1 (February 1972), pp. 47-52.

<sup>28</sup>Adsel I. El-Ansary, "A Model for Power-Dependence Relations in the Distribution Channel," in Relevance in Marketing edited by Fred C. Allvine (Chicago: American Marketing Association Fall Conference Proceedings, 1971), pp. 200-3.



Table 2-2 Methods of Channel Cooperation as Listed by E. B. Weiss

1. Cooperative advertising allowances
2. Payments for interior displays including shelf-extendors, dump displays, "A" locations, aisle displays etc.
3. P.M.'s for salespeople
4. Contests for buyers, salespeople, etc.
5. Allowances for a variety of warehousing functions
6. Payments for window display space, plus installation costs
7. Detail men who check inventory, put up stock, set up complete promotions, etc.
8. Demonstrators
9. A "swell" allowance on certain canned foods
10. Label allowance
11. Coupon handling allowance
12. Free goods
13. Guaranteed sales
14. In-store and window display material
15. Local research work
16. Mail-in premium offers to consumer
17. Pre-ticketing
18. Automatic reorder systems
19. Delivery costs to individual stores of large retailers
20. Studies of innumerable types, such as studies of merchandise management accounting
21. Payments for mailings to store lists
22. Liberal return privileges
23. Contributions to favorite charities of store personnel
24. Contributions to special store anniversaries
25. Prizes, etc., to store buyers when visiting showrooms--plus entertainment, of course
26. Training retail salespeople
27. Payments for store fixtures
28. Payments for new store costs or for more improvements, including painting
29. An infinite variety of promotion allowances
30. Special payments for exclusive franchises
31. Payments of part of salary of retail salespeople
32. Deals of innumerable types
33. Time spent in actual selling on retail floor by manufacturer, salesmen
34. Inventory price adjustments
35. Mention of store name in manufacturer's advertising

Source: Edward B. Weiss, "How Much of a Retailer is the Manufacturer?" Advertising Age, Vol. 29, No. 29 (July 1958), p. 68.

structure.<sup>29</sup>

Especially in the manufacturer's retail distribution, the following major areas for cooperations from the alternative retail stores are emphasized in the prior researches:

(1) Displaying Shelf-space

Each supplier of a retail store is competing for shelf-space with all other possible suppliers of the store. The manufacturer may set an objective in terms of how much sales space and percent of shelf facings are needed to produce a stipulated share of the industry space.<sup>30</sup> Hence, availability within the retail store is an important short-run objective, especially for the seasonal consumer products.

Cairns has analyzed the relationship between the manufacturers of consumer goods and their retailers through shelf-space allocation in retail stores. He describes that the manufacturer's sales of a product are, in large part, a function of the number of people to whom the product is exposed in retail stores.<sup>31</sup>

(2) Inventory Stock-out

Many manufacturers require their distributors to carry an ample representation of the manufacturer's line, with sufficient depth in stock to assure filling most consumers' orders without delay.

---

<sup>29</sup>Shelby D. Hunt and Joh R. Nevin, "Power in a Channel of Distribution," Journal of Marketing Research, Vol. 11, No. 2 (May 1974), pp. 186-93.

<sup>30</sup>Bert C. McCammon, Jr., "Perspectives in Distribution Programming," in Vertical Marketing Systems edited by Louis P. Bucklin (Glenview, Ill.: Scott, Foresman and Company, 1970), pp. 32-51.

<sup>31</sup>James P. Cairns, "Suppliers, Retailers, and Shelf-space," Journal of Marketing, Vol. 26, No. 3 (July 1962), pp. 34-36.

Obviously, the manufacturer must back up the distributor's stock with a reserve stock at convenient locations in order to satisfy unusually large orders or emergency demands. As a channel objective, to minimize stock-outs, the manufacturer needs to determine what are the optimal relationships between his distributors' inventories and the total sales volume for the product category. If the manufacturer arbitrarily imposes a safety-stock requirement that is too stringent, the policy becomes a source of conflict between the firms. Therefore, a more reasonable policy for minimum stock-outs is to require a standard safety-stock, based on the sales experience of the average outlet, and then work out adjustments based on individual trade area requirements.<sup>32</sup>

Dalrymple has presented the formula which solves the problem of selecting safety-stock levels and economic order quantities in order to provide more realistic reserves for controlling retail inventories.<sup>33</sup> And Walter and Grabner have explored in their retail stock-out model a method of determining consumer reaction to retail stock-out situations. They have also demonstrated how varying responses to stock-outs on any one particular item can be translated into an economic cost to the retailer.<sup>34</sup>

---

<sup>32</sup>Richard M. Hill, Ralph S. Alexander, and James G. Gross, Industrial Marketing, 4th ed. (Homewood, Ill.: Richard D. Irwin, Inc., 1957), p. 266.

<sup>33</sup>Douglas J. Dalrymple, "Controlling Retail Inventories," Journal of Retailing, Vol. 40, No. 1 (Spring 1964), pp. 9-14.

<sup>34</sup>C. K. Walter and John R. Grabner, "Stock-out Cost Models: Empirical Tests in a Retail Situation," Journal of Marketing, Vol. 39, No. 3 (July 1975), pp. 56-60.

### (3) Marketing Information

Manufacturers need a great deal of marketing information for better planning, execution, and control. Harper puts it this way: "To manage a business well is to manage its future; and to manage the future is to manage information."<sup>35</sup>

Especially, a manufacturer seeks valuable marketing information from the retail stores who closely serve the potential consumer and who better understand their needs and wants in the competitive market. These available data have to be accurately presented to the decision maker for channel design, because they are related to final consumers, product, channel members, market competitiveness, environmental factors, etc. With the retail stores cooperating by supplying information, management may identify specific market opportunities and perform more efficient and effective channel operation, or better adapt itself to the ever-changing and challenging marketing environment.

Also, communication between channel members provides the means by which the work of channels is coordinated. In fact, inadequate communication or miscommunication is often a major stimulator as well as an outcome of deep-rooted and dysfunctional channel conflict.<sup>36</sup>

### (4) Retail Stores' Cooperative Distribution Expenditures

The cooperation expected from channel members is as important to channel selection as the assistance given to these members by the

---

<sup>35</sup>Marion Harper, Jr., "A New Profession to Aid Management," Journal of Marketing, Vol. 25, No. 1 (January 1961), p. 1.

<sup>36</sup>El-Ansary and Robicheaux, op. cit., p. 24.

manufacturer.<sup>37</sup> For example, many manufacturers expect their distributors to extend credit to customers, install equipment, perform repairs, warrant merchandise, and make deliveries. Also important to channel selection is how well or efficiently the distributors perform these tasks through speedy operations.

In particular, the amount of promotion needed at the retail level to produce the desired sales for a specific product is discussed by Boyd and Massy.<sup>38</sup> The manufacturer needs to be assured that the management of his retail stores gives his product a fair share of promotional activities.

As there are methods of cooperation, so there are methods of control. A manufacturer, as a channel leader, may use his dominating power through promotional, legal, negative and suggestive ways for better coordination and less conflicts in his retail distribution channels.<sup>39</sup>

#### D. Adaptive Objectives

Unanticipated environmental changes may lead a manufacturer to replace the existing channel, modify it by replacing only part of the channel, or develop a multi-channel system.<sup>40</sup> Although it is

---

<sup>37</sup>Roger M. Peyson, "Selecting and Evaluating Distribution," Business Policy Study, No. 116 (New York: National Industrial Conference Board, 1965), p. 93.

<sup>38</sup>Harper W. Boyd, Jr. and William F. Massy, Marketing Management (New York: Harcourt Brace Jovanovich, 1972), p. 169.

<sup>39</sup>Mallen, op. cit., pp. 31-32.

<sup>40</sup>A. L. McDonald, Jr., "Do Your Distribution Channels Need Reshaping?" Business Horizons, Vol. 7, No. 2 (Summer 1964), pp. 29-38.



conceivable that the total channel could be replaced or redesigned, it is generally accepted that channel modification takes place more frequently than channel replacement.

McCammon offers several reasons for barriers to evolutionary change, including institutional solidarity in resistance to change, organizational rigidity leading to incremental responses to innovation, and anti-innovation entrepreneurial values of small business managers.<sup>41</sup> Despite these reluctances to change, the distribution structure for consumer goods is expected to undergo major changes in the future. Davidson forecasts the following changes in the manufacturer's strategic managerial decisions to accelerate and intensify:

1. Rapid growth of vertical marketing systems
2. Intensification of intertype competition
3. Increasing polarity of retail trade
4. Acceleration of institutional life cycles
5. The emergence of the free-form corporation as a major competitive reality in distribution
6. The expansion of nonstore retailing<sup>42</sup>

Similarly, the analyses of specific structural changes presented by McCammon and Bates,<sup>43</sup> by Sturdivant,<sup>44</sup> and by Oxenfeldt and Kelly<sup>45</sup>

---

<sup>41</sup>Bert C. McCammon, Jr., "Alternative Explanations of Institutional Change and Channel Evolution," in Toward Scientific Marketing edited by Stephen A. Greyser (Chicago: American Marketing Association, 1963), pp. 477-90.

<sup>42</sup>William Davidson, "Changes in Distributive Institutions," Journal of Marketing, Vol. 34, No. 1 (January 1970), p. 7.

<sup>43</sup>Bert C. McCammon, Jr. and Albert D. Bates, "The Emergence and Growth of Contractually Integrated Channels in the American Economy," in Marketing and Economic Development edited by Peter D. Bennett (Chicago: American Marketing Association, 1965), pp. 496-515.

also suggest the development of planned strategies for manufacturers to adapt itself to these evolutions.

Adaptive objectives in a manufacturer's channel distribution involve the level of flexibility necessary to meet the changing competitive and distributional challenges, as well as other business environmental changes.<sup>46</sup> The manufacturer's flexibility can be defined as the amount of his adaptation in and discretion over any channel system. The manufacturer responds to a changing market environment by institutional change, the reallocation of functions and changes in channel member relationships.<sup>47</sup>

The trend toward accelerated changes in retail distribution, which can be seen in American shopping behaviors, is likely to continue in the future. Those changes are expected in technological innovations, store operations, customer services, etc.<sup>48</sup> To respond to this dynamic business environment, a manufacturer may need a certain level of flexibility in retail distribution for better strategic planning.

---

<sup>44</sup>Fred Sturdivant, "Determinants of Vertical Integration," in Toward Scientific Marketing edited by Stephen Greyser (Chicago: American Marketing Association, 1963), pp. 491-506.

<sup>45</sup>Alfred Oxenfeldt and Anthony Kelly, "Will Successful Franchise Systems Ultimately Become Wholly-Owned Chains?" Journal of Retailing, Vol. 44 (Winter 1968-69), pp. 69-85.

<sup>46</sup>Corstjens and Doyle, op. cit., p. 1015.

<sup>47</sup>Joseph P. Gultiman, "Planned and Evolutionary Changes in Distribution Channels," Journal of Retailing, Vol. 50, No. 2 (Summer 1974), pp. 79-91.

<sup>48</sup>Leo Bogart, "The Future of Retailing," Harvard Business Review, Vol. 51 (November-December 1973), pp. 16-28.



### E. Store Image Objectives

A manufacturer would position his product where his potential consumers prefer to shop and/or purchase his goods. To satisfy this objective, a manufacturer tries to make retail stores' image more congruent with the image of his product as perceived by the potential consumers in his target market.

Leed, in reviewing retail image studies, has stated that researchers have placed a greater emphasis upon the definitional problems of store image than upon the implications and operationalization of the concept.<sup>49</sup> As a result, the concept of retail image has been approached from varying perspectives by researchers using different methodologies.

Martineau has defined store image as "the way in which the store is defined in the shopper's mind, partly by its functional qualities and partly by an aura of psychological attributes."<sup>50</sup> On the other hand, after conducting several comprehensive retail image studies, May has described retail image as a set of dimensions whose presence and importance differ from store to store as well as between individuals.<sup>51</sup>

Numerous authors have offered their suggestions about what dimensions form a store image.<sup>52</sup> Probably, the most detailed conceptualization of retail image to date was advanced by Kunkel and Berry

---

<sup>49</sup>T. W. Leed, "Another Look at Image Studies," Journal of Food Distribution Research, Vol. 7, No. 1 (February 1976), pp. 113-15.

<sup>50</sup>Pierre Martineau, "The Personality of the Retail Store," Harvard Business Review, Vol. 36 (January-February 1958), pp. 47-55.

<sup>51</sup>Eleanor May, "Practical Applications of Recent Retail Image Research," Journal of Retailing, Vol. 50, No. 4 (Winter 1974-75), p. 19.

with the hypothesized components and subcomponents in Table 2-3.<sup>53</sup>

A review by Lindquist of 26 empirical and theoretical studies of retail store selection resulted in a list of the following attributes, which were mentioned in at least 25% of the studies.<sup>54</sup>

<u>Attributes of Retail Store Image</u>	<u>Scholarly Mentions</u>
Merchandise Selection or Assortment	42%
Merchandise Quality	38%
Merchandise Pricing	38%
Locational Convenience	35%
Merchandise Styling, Fashion	29%
Service, General	27%
Salesclerk Service	27%

While it does contain a caveat, Lindquist's report of the results suggests that this relative frequency of mention is a "valuable indicator" of the most important attributes of retail store image.

May has undertaken a significant investigation of management applications of retail image research in the categories of "Gathering

---

<sup>52</sup>George Fisk, "A Conceptual Model for Studying Customer Image," Journal of Retailing, Vol. 17, No. 4 (Winter 1961-62), pp. 1-8.; Robert F. Kelly and Ronald P. Stephenson, "Semantic Differential: An Information Source for Designing Retail Patronage Appeals," Journal of Marketing, Vol. 16, No. 4 (October 1967), pp. 43-47.

<sup>53</sup>John H. Kunkel and Leonard L. Berry, "A Behavioral Conception of Retail Image," Journal of Marketing, Vol. 32, No. 4 (October 1968), pp. 21-27.

<sup>54</sup>Jay D. Lindquist, "Meaning of Image," Journal of Retailing, Vol. 50, No. 4 (Winter 1974-75), pp. 29-38.

Table 2-3 Hypothesized Components and Subcomponents of  
Retail Store Image

Components	Subcomponents
1 Price of Merchandise	<ul style="list-style-type: none"> <li>a Low price</li> <li>b Fair or competitive prices</li> <li>c High or noncompetitive prices</li> <li>d Values, except with specific regard to premiums, such as stamps, or quality of merchandise</li> </ul>
2 Quality of Merchandise	<ul style="list-style-type: none"> <li>a Good or poor quality of merchandise</li> <li>b Good or poor department(s), except with respect to assortment, fashion, etc.</li> <li>c Stock brand names</li> </ul>
3 Assortment of Merchandise	<ul style="list-style-type: none"> <li>a Breadth of merchandise</li> <li>b Depth of merchandise</li> <li>c Carries a brand I like</li> </ul>
4 Fashion of Merchandise	
5 Sales Personnel	<ul style="list-style-type: none"> <li>a Attitude of sales personnel</li> <li>b Knowledgeability of sales personnel</li> <li>c Number of sales personnel</li> <li>d Good or poor service</li> </ul>
6 Locational Convenience	<ul style="list-style-type: none"> <li>a Location from home</li> <li>b Location from work</li> <li>c Access</li> <li>d Good or poor location</li> </ul>
7 Other Convenience Factors	<ul style="list-style-type: none"> <li>a Parking</li> <li>b Hours store is open</li> <li>c Convenience with regard to other stores</li> <li>d Store layout with respect to convenience</li> <li>e Convenience (in general)</li> </ul>

Table 2-3 (cont'd)

Components	Subcomponents
8 Services	a Credit b Delivery c Restaurant facilities d Other services (gift consultants, layaway plans, baby strollers, escalators, etc.)
9 Sales Promotions	a Special sales, including quality or assortment of sales merchandise b Stamps and other promotions c Fashion shows and other special events
10 Advertising	a Style and quality of advertising b Media and vehicles used c Reliability of advertising
11 Store Atmosphere	a Layout of store b External and internal decor of store c Merchandise displays d Customer type e Congestion f Good for gifts, except with respect to quality, assortment, or fashion of merchandise g "Prestige" store
12 Reputation on Adjustments	a Returns b Exchange c Reputation for fairness

Source: John H. Kunkel and Leonard L. Berry, "A Behavioral Conception of Retail Image," Journal of Marketing, Vol. 32, No. 4 (October 1968), p. 25.

General Information," "Determining Action Programs to Improve Present Performance," "Determining Action Programs for the Future," and "Appraisal of Action." Typical objectives that she pursues in the first category are: company image differences among units of a large diverse retailer, and the value of a store's image both to patrons and non-patrons. Concerning present performance improvement, May investigates such areas as: isolation of critical service elements, measurement of store service elements, measurement of store service levels, provision for merchandising, promotional and sales support strategies to achieve a better market share, and determination of the image of a product at one store versus another store. With respect to future action programs, she analyzes how image research can help in such areas as: site selection for the new store, identification of the store image that is needed to attract enough consumers and to make enlarged space profitable, determination of which competitors are "complementors" and which are "supplementors" of the store in question. In the "Appraisal of Action" section of her study, May examines the impact on a men's clothing firm of using a national advertising campaign for the first time. She also measures the reach and believability of advertising designed to build a new image for a supermarket chain.<sup>55</sup>

#### F. Ad hoc Objectives

Each manufacturer knowing his company's specific situation, may develop the ad hoc objectives to accomplish in his particular channel

---

<sup>55</sup>Eleanor G. May, "Management Applications of Retail Image Research," A Marketing Science Institute Working Paper (September 1973), pp. 25-62.

distribution. This situation may be related to potential consumers, product, management, market competition, or financial considerations, all of which affect the manufacturer's selection of a distribution channel. For instance, a company which experiences seasonal consumer demand for its product, may want to stabilize its sales over the year. And another company in a poor financial position may want to achieve the objective of early cash recovery from the market.

#### Overview of the Existing Quantitative Channel Design Models

Both mathematical and simulation models of distribution channel design have been developed. The mathematical models involve precise equations to analyze and evaluate channel relationships. These models offer the potential of determining optimal channel designs as well as suggesting the impact of any channel design modifications, but mathematical sophistication and elegance are required for their development. Simulation models, or so-called input-output models, require a mathematical description of logical channel relationships. Simulations are beneficial in evaluating different channel alternatives through direct experiments with a model of a real system, but they do not identify the optimal channel designs.

## Mathematical Models

Mathematical optimization models are rare. Balderston has developed a model to analyze the communication flows in a channel structure. He first generates a channel with no intermediaries. The total cost of the direct channel for communication is  $TC = qSC$ , where  $q$  is the constant communication cost per link,  $S$  is the number of suppliers, and  $C$  is the number of customers. When an intermediary is introduced into the channel structure,  $TC = q(S + C)$ . The middleman in this structure extracts profits equal to  $SC - (S + C)$ . Given the economic profit of the middleman, Balderston hypothesizes that middlemen will continue to enter the channel structure until the economic profit is eliminated. The optimal number of wholesalers is expressed as  $W_0 = SC/S+C$ .<sup>56</sup>

According to Balderston, the optimum structure of the market may not stabilize at the optimum profit. This is due to; "(a) the shape of the function relating the wholesaler group's economic profits to the number of wholesalers and (b) the shape and position of the relation between the entrant's market share and the number of wholesalers." Modifications to the model have been suggested: partial segmentation of the network, variable costs of communication links, and multiple products. Balderston concludes that the channel communication model becomes more complex as each modification is considered.

Baligh and Richartz have extended the communications channel

---

<sup>56</sup>F. C. Balderston, "Communication Networks in Intermediate Markets," Management Science, Vol. 4 (1958), pp. 154-71.

model developed by Balderston. They observe that the elementary problem facing the firm is the choice of channels through which to buy or sell the product. Given certain optimum control variables, they state the general form of functional channel relationships. Utilizing specific channel structures, Baligh and Richartz develop a mathematical formula to analyze channel choice.<sup>57</sup>

The conceptual model developed by Baligh and Richartz has been expanded by Naert. He modifies the communication function to include consumer advertising. He observes that product mark-up is passive when producer sales are maximized; however, mark-up is active when producer profit is maximized.<sup>58</sup>

The quantitative models discussed above illustrate the complexities of the channel system. The models require additional research before they can be operationalized by the channel manager.

Balderston has presented another mathematical approach to the channel efficiency design problem. This approach requires identifying and fixing: (1) the initial commodity array and the final array; (2) the definition of sets of business entities (manufacturers, wholesalers with stocks, etc.) involved in necessary activities; (3) the specification of distribution sequences in which various sets of entities will be linked together; and (4) the specification of activities which will be examined. With the elements fixed, he considers a set of firms in the

---

<sup>57</sup>Hemly H. Baligh and L. E. Richartz, Vertical Marketing Structures (Boston: Allyn and Bacon, Inc., 1967).

<sup>58</sup>Philippe A. Naert, "Optimizing Consumer Advertising, Intermediary Advertising, and Markup in a Vertical Market Structure," Management Science, Vol. 18, No. 4, Part II (December 1971), pp. 99-101.



channel  $(S_1, S_2, \dots, S_n)$  and a set of functions to be performed in the channel  $(F_1, F_2, \dots, F_n)$ . Within a matrix framework, channel alternatives are defined in terms of firms and functions. The set of firms has given functional capacities  $(E_1, E_2, \dots, E_n)$ . Each channel activity  $A_i$  has associated with it an unknown level of activity  $x_i$  and a net revenue  $c_i$ . Thus, Balderston hypothesizes that the channel design problem can be formulated as a linear program where:  $\text{Max } V = cx$  subject to  $A_x \leq E$  and  $x \geq 0$ .<sup>59</sup>

According to Balderston, the basic problems with the linear programming approach are the scale of operation and the independence of the adjustment technology. He further observes that his channel intermediaries model approach and his linear programming approach apparently fail to resolve "how much marketing service, and of what kinds, is it desirable for the channel system to deliver to the ultimate users of the products it handles, and how do the quantities and qualities of such service affect the amount of commodity output which will pass through the channel?"

The most quoted study of Artle and Berglund analyzes a single-channel decision by linear programming with profit and cost as criteria, to determine the optimal system. The study shows that the channel choice is sensitive to the relative sales effectiveness of each channel. However, their oversimplified model suffers from a number of questionable assumptions--fixed distances between manufacturers and retailers in a town, a single product, and fixed distances between retailers in a

---

<sup>59</sup>F. C. Balderston, "Design of Marketing Channels," Theory in Marketing edited by Reavis Cox, Wroe Alderson, and Stanley J. Shapiro (Homewood, Ill.: Richard D. Irwin Inc., 1964), pp. 176-89.

town.<sup>60</sup>

Corstjens and Doyle have presented a model to solve the most significant channel decisions in the multiple-channel system--the manufacturer's choice of channels, the number of outlets to operate within each channel and the pricing structure between channels. This model assumes the constant demand and cost functions, expressed in terms of elasticities to maximize manufacturer's profits. Then, a number of operational constraints were considered for optimizing the above decisions, integrating behavioral perspective in channels. But this model is subject to several weaknesses: (1) the rare availability of data to estimate the parameters in the demand and cost function and (2) the limitations of sophisticated non-linear programming (the set of polynomials has to be posynomial and all the constraints have to be the "less than" type).<sup>61</sup>

Bucklin<sup>62</sup> and Montgomery and Urban<sup>63</sup> have sketched extensions to the former analyses but both have left their models in embryonic states. Also the complexity of these general models prevents their practical applications.

Little work has been done on the problem of distribution

---

<sup>60</sup>R. Artle and Sture Berglund, "A Note on Manufacturers' Choice of Distribution Channels," Management Science, Vol. 5, No. 4 (July 1959), pp. 460-71.

<sup>61</sup>Corstjens and Doyle, op. cit., pp. 1014-25.

<sup>62</sup>Louis P. Bucklin, "Management of the Channel," Managerial Analysis in Marketing edited by Sturdivant, et al. (Glenview, Ill: Scott, Foresman and Company, 1970), pp. 620-62.

<sup>63</sup>David Montgomery and Glenn Urban, Management Science in Marketing (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1960), pp. 203-42.

intensity. Bucklin and Ellis have developed a simple empirical model for a manufacturer of clothing to use in determining the optimum number of retailers he should employ in a given market area.<sup>64</sup> Hartung and Fisher have synthesized a Markov model and non-linear programming techniques to determine the optimal number of auto service stations in any particular metropolitan area.<sup>65</sup>

#### Simulation Models

Few channel simulation models have been developed. However, Forrester has simulated various parts of a firm's marketing channels, stressing the interrelationships in the channels of distribution.<sup>66</sup>

Balderston and Hoggart have developed a large-scale simulation of channel structure in the West Coast lumber industrial market without specifically dealing with the problem of distribution strategy.<sup>67</sup> Amstutz's simulation model of a distribution channel system includes internal and external factors to assess the effects of changes in marketing strategy. This model considers consumer behavior as the input

---

<sup>64</sup>L. P. Bucklin and R. G. Ellis, "On Optimizing the Number of Distributors," Working Paper, No. 25 (Berkeley, California: Institute of Business and Economic Research, University of California, 1968).

<sup>65</sup>Philip H. Hartung and James L. Fisher, "Brand Switching and Mathematical Programming in Market Expansion," Management Science, Vol. 11, No. 10, Series B (August 1965), pp. 231-43.

<sup>66</sup>J. W. Forrester, "Industrial Dynamics," Harvard Business Review, Vol. 36, No. 4 (July-August 1958), pp. 37-66.

<sup>67</sup>F. E. Balderston and A. C. Hoggart, Simulation of Market Processes (Berkeley, California: Institute of Business and Economic Research, University of California, 1962).

to channel demand.<sup>68</sup> However, an extensive data base is required to initialize the parameters for its application with the computer time and storage requirements. Kotler quotes a simulation of alternative distribution strategies by Vialle whose model details have never been published.<sup>69</sup>

The simulation models of channel design described represent a logical mathematical extension of the system concept in marketing and, thus, they complement the work of earlier theories. They are still in the experimental stage and do not generate an optimal solution for channel distribution.

In conclusion, this review of previous research on the quantitative models for distribution channel design shows that the channel selection problem in this research has not yet been solved by any of the quantitative methods mentioned. It may be because these methods cannot deal with the multiple, and often conflicting, objectives a manufacturer wants to accomplish in the firm's complex and interrelated marketing channels. In other words, the manufacturer's optimum channel design may not be obtained without satisfying these numerous objectives best in the appropriate way.

---

<sup>68</sup>A. E. Amstutz, Computer Simulation of Competitive Market Response (Cambridge, Mass.: M.I.T. Press, 1967).

<sup>69</sup>Kotler, op. cit.

## Goal Programming

One of the most promising techniques for decision analysis to achieve multiple objectives to the fullest possible extent is goal programming, which is a special extension of linear programming. This technique overcomes the following limitations of the conventional linear programming, to handle complex reality:

1. Linear programming has only one unidimensional objective as the major weakness.
2. Linear programming assumes that all constraints with equal importance must be satisfied for the optimal solution.
3. Linear programming requires concrete information, which is often very hard to obtain.

Goal Programming was originally introduced by Charnes and Cooper, as a tool for resolving infeasible linear programming problems.<sup>70</sup> This concept has been further developed by Ijiri and Lee.<sup>71</sup>

Goals set by management are often achievable only at the expense of other goals. In addition, many goals cannot be measured on a same-unit basis. Thus, there is a need to establish a hierarchy of importance among the conflicting goals so that lower-order goals are considered only after the higher-order goals are satisfied or have reached the point beyond which no further improvements are desirable. Therefore,

---

<sup>70</sup>A. Charnes and W. W. Cooper, Management Models and Industrial Applications of Linear Programming, 2 volumes (New York: John Wiley and Sons, Inc., 1961).

<sup>71</sup>Sang M. Lee, Goal Programming for Decision Analysis (Philadelphia, Pa.: Auerbach Publishers, Inc., 1972).

if management can provide an ordinal ranking of goals in terms of their contributions to the organization, and if all the relationships of the model are linear, then the problems can be solved by goal programming.

In goal programming, instead of trying to maximize or minimize the objective criterion directly, as in linear programming, the deviations among the goals and what can be achieved within the given set of constraints are to be minimized. In the simplex algorithm of linear programming, such deviations are called "slack" variables, but in goal programming they take on a new significance. This type of variable is, therefore, represented in two dimensions, as positive and negative deviations from each goal or subgoal. The objective function then becomes the minimization of these deviations based on the relative importance or priority assigned to them.

The solution of any linear programming problem is based on the cardinal value such as profit or cost. The distinguishing characteristic of goal programming is that it allows for an ordinal solution. The decision maker may be unable to obtain information about the value or cost of a goal or a subgoal, but often he can determine its upper or lower limits. Usually, the decision maker can determine the importance of attaining each of the desired goals or subgoals and can rank their priorities in an ordinal sequence. Obviously, it is not possible to achieve every goal to the extent desired. Thus, with or without goal programming, the decision maker attaches a certain priority to the achievement of a particular goal. The true value of goal programming, therefore, is its contribution to the solution of decision making problems involving multiple and often conflicting goals according to the decision maker's priority structure.

The general goal programming model can be mathematically expressed as:

$$\text{Minimize } Z = \sum_k \sum_i^m P_k (W_i^- d_i^- + W_i^+ d_i^+)$$

$$\text{Subject to } \sum_j^n a_{ij} X_j + d_i^- - d_i^+ = b_i \quad (i = 1, m)$$

$$X_j, d_i^-, d_i^+ \geq 0$$

In this model,  $P_k$  is the preemptive priority factor assigned to goal  $k$ ;  $W_i^-$  and  $W_i^+$  are the differential weights assigned to the deviations of goal  $i$  at a given priority level;  $d_i^-$  and  $d_i^+$  are the negative and positive deviations, respectively;  $X_j$  represents  $j$  variable involved in the goals;  $a_{ij}$  is the technological coefficient of  $X_j$  in goal  $i$ ; and  $b_i$  is the right-hand side value of goal  $i$  as either available resource or specified goal level.

The manager must analyze each one of the  $m$  goals considered in the model in terms of whether over- or underachievement of the goal is satisfactory. If overachievement is acceptable,  $d^+$  should be eliminated from the objective function. On the other hand, if underachievement is satisfactory,  $d^-$  should not be included in the objective function. If the exact achievement of the goal is desired, both  $d^-$  and  $d^+$  must be represented in the objective function.

The deviational variables  $d_i^+$  and  $d_i^-$  must be ranked according to their priorities, from the most important to the least important. In this way, the lower-order goals are considered only after the higher-order goals are achieved as desired. If goals are classified in  $k$  ranks, the priority factor  $P_j$  ( $j = 1, 2, \dots, k$ ) should be assigned to the deviational variables,  $d_j^+$  and  $d_j^-$ . The priority factors have the relationship

of  $P_1 > P_2 \dots > nP_k$ , which implies that multiplication by  $n$ , however large it may be, cannot make  $P_{j+1}$  greater than or equal to  $P_j$ . Of course, it is possible to refine goals even further by decomposing the deviational variables. To do this, additional constraints and additional priority factors are required.

One more step in the procedure to be considered is the differential weighting of those deviational variables at the same priority level, i.e., variables with the same  $P_j$  coefficient. The criterion to be used here is the minimization of the opportunity cost or regret. This implies that the coefficient of regret  $W_j$ , which is positive, must be assigned to the individual deviational variables on the same goal level. The coefficient  $W_j$  simply represents the relative amount of unsatisfactory deviation from the goal. Therefore, deviational variables on the same goal level must be commensurable, although deviations which are on different goal levels, need not be commensurable. For a diagrammatical representation of the flow process of the goal programming formulation refer to Figure 2-2.

The postoptimal sensitivity analysis is an analysis of the effects of parameter changes after determining the optimal solution. As such, it should be an important part of the goal programming solution, because there is usually some degree of uncertainty concerning the model parameters in real-world problems--i.e., the priority factor, technological coefficients and goal levels or available resources. If the optimal solution is relatively sensitive to changes in certain parameters, special efforts should be directed to forecasting the future values of these parameters. By the same token, if the optimal solution has very little sensitivity to changes in certain parameters,



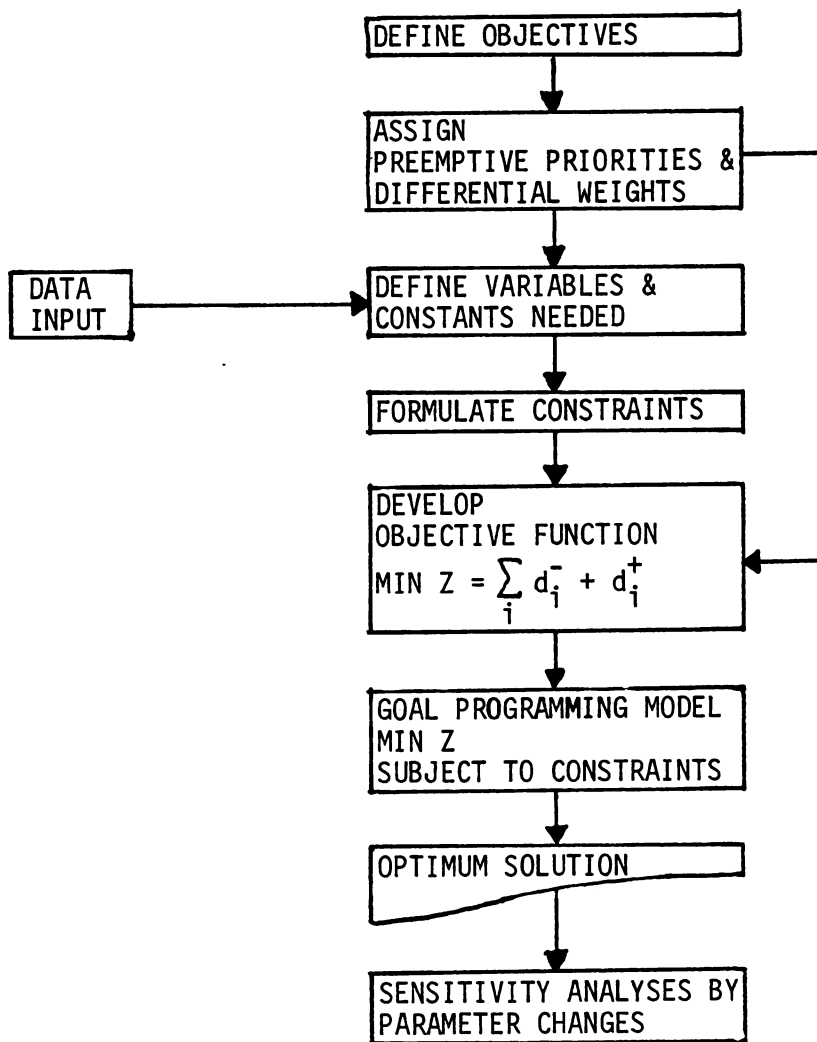


Figure 2-2 Goal Programming Flow Diagram

Source: Sang M. Lee, Goal Programming for Decision Analysis (Philadelphia, Pa.: Auerbach Publishers, Inc., 1972), p. 61.

it might be a waste of time and effort to try to estimate the values of parameters more accurately.

The dual solution procedure of goal programming has not been fully explored, although at least two working papers have been prepared on the subject. Consequently, the usual sensitivity analysis employed in linear programming cannot be applied to goal programming. However, one can perform a sensitivity analysis through various changes in the model parameters.

In many practical decision making problems with multiple, conflicting objectives, the decision variables make sense only if they assume nonfractional or discrete values. In addition, there are many specialized cases where the decision variables are only allowed to be either 0 or 1 (e.g., the project must be either accepted or rejected in its entirety for the capital budgeting program). Zero-one goal programming can be used to solve these problems, taking advantage of the constraints of the characteristics zero-one system.

The zero-one goal programming approach is based on the additive algorithm developed by Balas<sup>72</sup> and the backtracking procedure of Glover.<sup>73</sup> In this technique, all possible solutions are either explicitly or implicitly enumerated.<sup>74</sup> Thus, certain specific solutions are

---

<sup>72</sup>E. Balas, "An Additive Algorithm for Solving Linear Programs with Zero-one Variables," Operations Research, Vol. 13 (1965), pp. 517-45.; \_\_\_\_\_, "Direct Programming by the Filter Method," Operations Research, Vol. 15 (1967), pp. 915-57.

<sup>73</sup>F. Glover, "Multi-phase Dual Algorithm for the Zero-one Integer Programming Problems," Operations Research, Vol. 13, No. 6 (1965), pp. 879-919.

<sup>74</sup>Ellwein, "A Flexible Enumeration Scheme for Zero-one Programming," Operations Research, Vol. 22 (1974), pp. 144-50.

evaluated, and then a logic is used to eliminate them explicitly. This is accomplished by systematically adding or deleting variables to current solutions to check whether or not further improvement is possible. At the point where no further improvement is possible, the solution is "fathomed." A backtracking procedure is then initiated to evaluate other combinations. This process is repeated until it is ascertained that every possible solution combination has been evaluated, either explicitly or implicitly. The optimum solution is identified as the one with the best solution set among those solutions that are explicitly evaluated.

## CHAPTER III

### MODEL DEVELOPMENT

This chapter is devoted to developing an analytical goal programming model to optimize the retail store selection in the manufacturer's distribution channel design. For maximum firm's profit and consumers' satisfaction, this normative model is based upon the multiple and often conflicting objectives for a manufacturer to accomplish in his potential market for the distribution of his specific product.

The topic of the research has been introduced in Chapter I, and in Chapter II, the relevant research has been reviewed to induce the general channel objectives. In considering model development, the following four sections are presented: model design, identification of the available retail store alternatives, segmentation of the manufacturer's predetermined potential market for his specified product, and formulation of the goal programming model. The first section provides the model assumptions and the flow chart of model development which serves as the framework. The next two sections describe the other prerequisite steps to model formulation. The last section, in which the goal programming model is developed, follows a sequence of four steps: (1) determination of model objectives and preemptive priorities with differential weights, (2) definition of the decision variables and the needed constants, (3) formulation of the goal constraints, and (4) development

of the objective function. At the end of this chapter, the developed model is summarized. In the next chapter, this developed model will be tested with parameter changes, to demonstrate the use of this model.

### Model Design

A model is a representation of reality which has an underlying rationale that is meaningful to the decision maker who uses it. This model, mainly for channel modification, is based on the rationale that without channel creation, alternative retail stores are available to the manufacturer, and that by their performing the particular marketing functions required to satisfy potential consumers, he can improve the efficiency of distribution of his consumer shopping goods. It follows that each existing retail store alternative can be evaluated in terms of its relative contribution toward meeting predetermined retail channel objectives. Once a direct relationship is established between each specific objective and the alternative stores' specific contributions to it, then it is possible to set priorities for objectives criteria and determine an optimal allocation of the manufacturer's limited resources. An optimal allocation is considered to be one that allows these limited resources to go first to those contributions that are most important and only afterward to the others of less importance in meeting the total objectives for the manufacturer's retail channel distribution.

As mentioned in Chapter I, the following assumptions are needed to constrain this research problem to the development of a normative

model for the manufacturer's selection of the optimal retail stores by which to distribute his product:

1. No demand creation activities of the retail stores will be considered, but rather their demand satisfaction activities.
2. During the planning period for the manufacturer's retail store selection, his marketing mix strategies and given environmental factors will be predicted to be stable.
3. In this manufacturer's process of channel design from his consumer market backward, the optimum retail stores selected can be extended to the total effective and efficient channel design between a manufacturer and the potential market, without changing or affecting the optimum retail store selection from this model.

Also, the research methodology to be used in this study, goal programming, has the following requirements for model development:

1. The manufacturing firm's management must be able to formulate its distribution channel objectives and assign its priorities accurately within the given operational constraints of its specific business environment.
2. The manufacturing firm's management should less uncertainly be able to estimate all parameters required to develop this goal programming model with better prediction.
3. All relationships among the decision variables must be linear in nature in order to use the goal programming model.

Figure 3-1 illustrates the flow chart for development of this goal programming model. Each step is discussed in depth in the following sections.

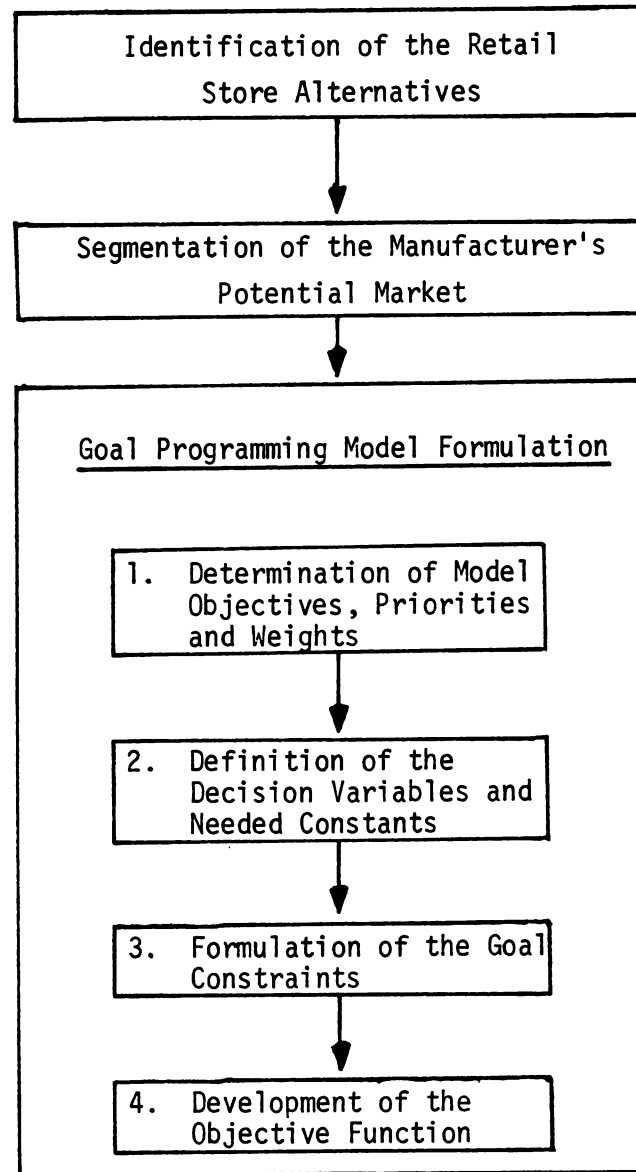


Figure 3-1 Flow Chart of Goal Programming Model Development

### Identification of the Retail Store Alternatives

Having determined the potential market for his specific product, based on an understanding of consumer behavior, the manufacturer should identify the comparable store alternatives for his retail distribution. After his channel strategy is developed, this first step of the retail store selection process is the most important step toward making the manufacturer's product widely available and accessible to his potential market.

A number of options are presumed to be available to the manufacturer. But, in most cases, not all retail store alternatives are known when the marketing channel decisions are made. Consequently, these decisions sometimes prove to be less than optimal later when more alternatives are known. Then a change or modification in channel selection may be necessary. Therefore, the manufacturer should make sure that he considers all the possible retail store alternatives to improve his complex and challenging channel decisions.

Because firms differ in their business situation, including relative market power, financial strength, and market demand, each firm usually faces a different set of retail store alternatives to evaluate for the optimal channel selection, especially in the channel of retail distribution. Available channels are, typically, the ones used heavily and successfully by competitors, but may include some others by which a manufacturer can reach the market he wishes to serve. Thus, a manufacturer should be continually aware of all the existing retail store alternatives through which he may obtain more efficient and effective



retail distribution in his potential market.

### Segmentation of the Manufacturer's Potential Market

As indicated earlier, this backward channel design is based on the marketing concept. Therefore, a manufacturer, as a channel designer, should understand consumer behavior, particularly in regard to shopping for and/or purchasing his product in the potential market. Valid information which represents consumer behavior, is required to make the optimal retail store selection.

In this model, rather than deal with individual consumers, individuals will be aggregated into several homogeneous segments which have similar consumer preferences. By this segmentation, each distinct and meaningful group of consumers will give a better picture of consumer behavior for the manufacturer's normative retail store selection.

There is no single, or right way to segment a market. A market can be segmented in a number of ways by introducing different variables and seeing which reveal the best market opportunities. Geographic, demographic, psychographic, and behavioristic variables are used in segmenting consumer markets. Sometimes the manufacturer has merely to test the many segmentation variables, singly and in combination, in order to discover an insightful way to view the market structure.

Enis and Paul have suggested that store loyalty as a segmentation criterion may be superior to the traditional methods of market segmentation at the retail level.<sup>75</sup> Bucklin has used consumer shopping

patterns to develop the retail store patronage-product classification mix, in which each retail segment shows how consumers perceive store-product combinations (see Table 3-1).<sup>76</sup>

It is reasonable to conclude that shopping behavior is one of the best bases to employ for this retail market segmentation.<sup>77</sup> For instance, the manufacturer could obtain information on the stores potential consumers shopped in on their last several occasions. This will show the potential consumers' recent retail store preferences. These data can be clustered to place individuals with similar shopping behavior into the same retail market segments. The behavior and judgments of the majority of members of each homogeneous shopping segment will be used in building this model.

After segmenting the potential market with the identified retail store alternatives, the retail store market segment combination matrix in Figure 3-2 can be used. This matrix will help a manufacturer to analyze the store shopping preferences and the store image evaluations of the potential consumers for his product, in the different market segments at each alternative retail store.

---

<sup>75</sup>Ben M. Enis and Gordon W. Paul, "'Store Loyalty' as a Basic for Market Segmentation," Journal of Retailing, Vol. 46, No. 3 (Fall 1970), pp. 42-56.

<sup>76</sup>Louis P. Bucklin, "Retail Strategy and the Classification of Consumer Goods," Journal of Marketing, Vol. 27, No. 1 (January 1963), pp. 53-54.

<sup>77</sup>Edgar A. Pessemier, "Store Image and Positioning," Working Paper (West Lafayette, Ind.: Kramert Graduate School of Management, Purdue University, 1979), p. 8.

Table 3-1 The Retail Store Patronage-Product Classification Mix

<div> <div>Categorization of Goods</div> <div>Categorization of Stores</div> </div>	Convenience	Shopping	Specialty
Convenience	Consumer prefers to buy the most readily available brand of product at the most accessible store.	Consumer selects purchase from among the assortment carried by the most accessible store	Consumer purchases a favorite brand from the most accessible store that has the item in store.
Shopping	Consumer is indifferent to the brand of product to be purchased but shops among different stores in order to secure better retail service and/or lower retail prices.	Consumer makes comparisons among both retail-controlled factors associated with the product (brand).	Consumer has a strong preference for a particular brand but shops among a number of stores to secure the best retail service and/or price for this brand.
Specialty	Consumer prefers to trade at a specific store but is indifferent to the brand of product purchased.	Consumer prefers to trade at a certain store but is uncertain as to which product to purchase and examines the store's assortment for the best buy.	Consumer has a preference for both a particular store and a specific brand.

Source: Louis P. Bucklin, "Retail Strategy and the Classification of Consumer Goods," Journal of Marketing, Vol. 27, No. 1 (January 1963), pp. 53-54

Retail Market Segments (i Market Segment)	Retail Store Alternatives (j Retail Store)			

Figure 3-2 The Retail Store-Market Segment Combination Matrix

### Formulation of the Goal Programming Model

Under the given assumptions, this section presents the generalized formulation of the model for the manufacturer's normative retail store selection. The steps in the goal programming model formulation depicted in Figure 3-1 will be followed to develop this model.

#### Determination of Model Objectives, Priorities and Weights

The general, multiple, and often conflicting objectives for the manufacturer's optimum retail store selection can be derived from the literature review. In this research, eleven specific objectives for

the manufacturer's store selection will be considered in the six broad retail channel objectives which follow.

#### A. Economic Objectives

As one of the mentioned assumptions, the optimum retail stores selected by this model lead to the best total marketing channel system between the manufacturer and his potential market which produces the maximum total profit. That is, if the chosen optimum retail stores perform some of the distribution functions needed by the manufacturer, the other necessary functions can optimally be spinned off among the other appropriate channel members between the manufacturer and this optimum retail stores. In this way, a manufacturer may maximize his total profit as a whole. Hence, greater sales and less cost at retail level will be the manufacturer's economic objectives in this model.

For this study, the manufacturer should determine which of his required distribution functions each alternative retail store can perform for his product in the potential market. These store's functions have to be sufficiently effective and efficient, based on his comparative evaluation criteria by means of the distribution cost trade-off analysis. Then, after developing the standard cost system for each needed marketing function, the manufacturer should allocate a different amount of assistance to each retail store alternative to support its various functions, taking into consideration each retailer's profit margin. Accordingly, in this normative model, the amount of the manufacturer's financial support allocated to each retail store should be same as the store's total standard costs for the functions it performs, minus its profit margin. Also, the manufacturer's total amount of

assistance to retail stores has to be limited to his financial budget for the optimum retail distribution.

Since this model deals only with the demand satisfaction aspects of retail stores, their demand creation activities will not be considered. In other words, each alternative retail store has a different level of fixed potential sales volume or demand at its own market sale price. Thus, any promotional discounts and/or allowances to each retail store will be regarded as one of its functional costs which is incurred by the manufacturer, without considering their effect on market demand.

#### B. Market Objectives

In this research, the manufacturer's market objectives will be of two types: maximum market coverage and maximum market exposure. Maximum market coverage is defined as the total number of target consumers reached by the manufacturer who seeks better access to his potential market. Maximum market exposure is measured in terms of the number of retail store outlets in the potential market under manufacturer's intensive distribution strategy.

Geographic coverage objective which concerns the extent of territorial coverage, will be excluded to avoid overlapping the above two objectives. Also, because the manufacturer will determine the geographic area as his potential market and will consider the available retail store alternatives for his product as one of the consumer shopping goods in this designated market territory, it can be induced that these alternative retail stores cover the whole manufacturer's potential market area defined.

### C. Behavioral Objectives

To develop this model, the manufacturer's behavioral objectives will be a higher level of cooperation from the retail stores and greater control over his retail distribution. For the objective related to conflict in the manufacturer's retail distribution, the only conflict may be the horizontal conflict between his retail stores, with limiting this research problem to the manufacturer's optimum retail store selection. In cases of horizontal channel conflict which, if unchecked, could hurt the efficiency of retail distribution, the manufacturer as the channel captain can reduce or control this type of conflict through maintaining the optimum degree of cooperation in and control over his retail distribution.

As a channel designer, the manufacturer looks for the maximum level of cooperation between the retail stores and his firm. This cooperation will increase the efficiency of his retail distribution which will, in turn, serve and satisfy the needs of his potential market. Therefore, through this cooperation process, the manufacturer expects to minimize dysfunctional channel conflict in his retail distribution. In this study, the following four areas of retail store cooperation described in the literature review are important considerations.

1. Maximum displaying shelf-space is required by the manufacturer to increase the availability of his product within each retail store.
2. The retail stores should maintain sufficient safety stock to minimize the number of manufacturer's retail inventory stock-outs.
3. The manufacturer needs a great deal of marketing information

from the retail stores carrying his product for better management of his retail distribution.

4. The large amount of retail stores' cooperative distribution expenditure for the manufacturer's product is expected, to provide more services to the potential consumers and to increase their promotion in his retail distribution.

Moreover, in order to achieve effective conflict management and, thus, improved coordination in the retail distribution system, a higher degree of control over the decisions and behavior of retail stores is required by the manufacturer. In this control process, the manufacturer, as the channel leader, uses his power bases to aid in overcoming the individual retail store's spontaneously variable behavior, which is caused by its own business goal. He also allocates the limited resources in the retail distribution system so as to enhance its viability.

#### D. Adaptive Objectives

As described earlier, dynamic and accelerating changes in retailing are expected in the future. The manufacturer's success in retail distribution depends to a great extent upon the firm's ability to adapt to these changes. Therefore, the manufacturer should maximize his flexibility to respond to changes in retail distribution to improve his distribution efficiency.

#### E. Store Image Objectives

The manufacturer should strive for congruence between the alternative retail store image and the image of his product. This congruence can be achieved by predicting at which retail store his potential



consumer prefers to shop for and/or purchase his product. After conducting this retail store image study, the manufacturer can better position his product in the retail stores, as a new aid to planning for more efficient distribution.

For this image analysis, the most salient attributes, common to both retail store image and the image of the manufacturer's product, have to be determined first. Then, the total level of the predicted image incongruence for each determinant attribute, based on the potential consumers' preference evaluation, should be minimized to obtain the most profitable and effective store selection in retail distribution.

#### F. Ad hoc Objectives

The particular ad hoc objectives may be developed by the manufacturer to solve specific problems in the company's business environment in order to improve retail distribution. In this model development, ad hoc objectives are not considered, but one of these objectives can be added to revise the model for use by a manufacturer who has this situation.

In summary, the following eleven specific objectives are considered in developing the normative model for retail store selection in the manufacturer's distribution channel design.

1. Maximum Sales Volume
2. Minimum Retail Distribution Cost
3. Maximum Market Coverage
4. Maximum Market Exposure
5. Maximum Displaying Shelf-space

6. Minimum Inventory Stock-out
7. Maximum Marketing Information
8. Maximum Retail Stores' Cooperative Distribution Expenditures
9. Maximum Retail Distribution Control
10. Maximum Retail Distribution Flexibility
11. Minimum Store Image Incongruence

So, there are eight maximizing objectives and three minimizing objectives for the manufacturer to develop his optimum retail store selection. During the planning period, the manufacturer should consider these objectives criteria, while predicting the expected growth or possible changes in his given business environment which is assumed to be relatively stable.

Some of the objectives above are in conflict. For example, the maximum market coverage and exposure objectives and the maximum sales volume objective tend to conflict with the minimum retail distribution cost objective, which represents the manufacturer's financial budget.

The preemptive priorities assigned to the above objectives criteria should be obtained from the management of a manufacturing firm. In addition, the manufacturer must determine the differential weights assigned to deviational variables of subgoals at the same priority level. In this model for the manufacturer's optimum retail store selection, the various weights can be assigned to subgoals of the predefined market segments on the same priority level. These weights represent the manufacturer's assessment of the attractiveness to each market segment for his differential competitive advantages in the market of his product.

### Definition of the Decision Variables and Needed Constants

Decision variables in this goal programming model are  $X_j$ , with  $j$  corresponding to an available retail store alternative for the manufacturer's product. In this zero-one goal programming model,  $X_j$  has the value of zero or one, which means the manufacturer's rejection or selection, respectively, of the  $j$  retail store.

The manufacturer, as a decision maker, should estimate the upper or lower limits of each goal in this goal programming model, while predicting his business environment more accurately. These limits indicate either his available resources or his goal levels for the planning period. These right-hand side values needed in this model are defined as follows:

$A_i$  = Desired sales volume in  $i$  market segment

$A$  = Total desired sales volume in the whole market

$B$  = Limited financial budget to support the retail stores

$C_i$  = Desired number of potential consumers to be reached in  $i$  market segment

$C$  = Total desired number of potential consumers to be reached in the whole market

$D^1$  = Total maximum number of retail store outlets

$D^2$  = Total minimum number of retail store outlets

or  $D$  = Desired number of retail store outlets

$E_i$  = Average desired level of predicted image incongruence between the manufacturer's product and retail stores in  $i$  market segment

$E$  = Average desired level of predicted image incongruence between the manufacturer's product and retail stores in the whole market

$F^1$  = Total desired square feet of displaying shelf-space

- $F^2$  = Total allowable number of inventory stock-outs  
 $F^3$  = Average desired amount of marketing information to be received from retail stores by the manufacturer  
 $F^4$  = Total desired expenditures by retail stores to cooperate with the manufacturer  
 $G$  = Average desired degree of the manufacturer's control over the retail stores to require compliance with his policies and practices  
 $H$  = Average desired level of the manufacturer's flexibility in retail stores to adapt to changes in his business environment

And the following technological coefficients representing the goal constraints in this goal programming model, are used as the needed constants:

- $S_i$  = Average purchasing volume per potential consumer in  $i$  market segment  
 $T_i$  = Number of potential consumers in  $i$  market segment ( $T_i$  equals proportion of potential consumers in  $i$  market segment multiplied by total number of potential consumers in the whole market)  
 $Q_{ij}$  = Average relative probability of potential consumers in  $i$  market segment shopping for and purchasing the manufacturer's product at  $j$  retail store (Each alternative retail store share of manufacturer's sales volume in each market segment)  
 $R_{jk}$  = Amount of financial needs of  $j$  retail store to perform  $k$  retail distribution function  
 or  $R_j$  = Total amount of financial needs of  $j$  retail store requested to the manufacturer  
 $M_{ij}$  = Average relative frequency of potential consumers in  $i$  market segment shopping in general at  $j$  retail store (Market share of each alternative retail store in each market segment by potential consumers' store preference)  
 $N_j$  = Number of outlets of  $j$  retail store  
 $I_{ijl}$  = Level of predicted image incongruence between the manufacturer's product and  $j$  retail store for  $l$  determinant image attribute in  $i$  market segment

- or  $I_{ij}$  = Total level of predicted image incongruence between the manufacturer's product and  $j$  retail store in  $i$  market segment
- $V_j$  = Square feet of displaying shelf-space in  $j$  retail store for the manufacturer's product
- $O_j$  = Average number of inventory stock-outs of the manufacturer's product at  $j$  retail store
- $Y_j$  = Average amount of marketing information to be received from  $j$  retail store by the manufacturer
- $Z_j$  = Expenditure of  $j$  retail store to cooperate with the manufacturer
- $L_j$  = Degree of the manufacturer's control over  $j$  retail store to require compliance with his policies and practices
- $K_j$  = Level of the manufacturer's flexibility within  $j$  retail store to adapt to changes in his business environment

#### Formulation of the Goal Constraints

In the goal programming model, the goal constraints represent the decision maker's planning parameters. The purpose of the model is to achieve all the goal levels as closely as possible. This is accomplished by minimization of either the negative ( $d^-$ ) or positive ( $d^+$ ) deviations from the specified goal levels, in accordance with certain assigned preemptive priority values and differential weights, in such a way that the set of goal constraints is always satisfied as nearly as possible.

The goal constraints included in the model under development fall into the aforementioned eleven categories of manufacturer's objectives, in order to achieve the desired goal level, depicted as the goal constant. Here, several goals, in turn, are expressed in terms of the number of the subgoal criteria determined by the manufacturer's

market segmentation.

Now, within these categories of the model objectives, the goal constraints are formulated to develop the normative model for retail store selection in the manufacturer's distribution channel design.

#### (1) Maximum Sales Volume

A manufacturer wants to maximize his product sales volume within his given production and/or distribution capacity in the potential market during this planning period. These goal constraints can be expressed by:

$$\sum_j S_i T_i Q_{ij} X_j - d_{1i}^+ + d_{1i}^- = A_i$$

$$\sum_i \sum_j S_i T_i Q_{ij} X_j - d_1^+ + d_1^- = A$$

In the first equation, a manufacturer seeks to sell more than his desired sales volume in each market segment ( $A_i$ ), while in the second equation, he looks for the maximum sales volume in the whole potential market. Total desired sales volume in the whole potential market ( $A$ ) is obtained by adding sales volume desired in each different market segment, i.e.,  $A = \sum_j A_i$ .

These equations are developed based on the manufacturer's potential sales volume in each market segment and each alternative retail store share of manufacturer's sales volume in each market segment ( $Q_{ij}$ ), where  $\sum_j Q_{ij} = 1$ . The potential sales volume in the individual market segment are equal to the average purchasing volume per potential consumer in each market segment ( $S_i$ ) multiplied by the number

of potential consumers in that market segment ( $T_i$ ).

## (2) Minimum Retail Distribution Cost

The cost to the manufacturer of supporting the various distribution activities of the retail stores must be limited to the financial budget ( $B$ ) available for his retail distribution in the planning period. This budget ceiling goal constraint can be expressed as:

$$\sum_j \sum_k R_{jk} X_j - d_2^+ + d_2^- = B$$

Here, the financial needs of each retail store required to perform the different retail distribution functions effectively and efficiently for a manufacturer ( $R_{jk}$ ) is allocated by the manufacturer's standard functional cost system.

Without identifying the various marketing functions of each retail store, the following constraint can be substituted for the above one:

$$\sum_j R_j X_j - d_2^+ + d_2^- = B$$

This constraint operates where the total amount of the financial assistance requested by each retail store to carry some of the manufacturer's marketing functions ( $R_j$ ) is considered instead.

## (3) Maximum Market Coverage

A manufacturer wants to make his product available and accessible to as many potential consumers as possible in his potential market. To achieve this maximum market coverage goal, the following two constraints

can be developed using the desired number of potential consumers, both in each market segment ( $C_i$ ) and in the whole potential market ( $C$ ):

$$\sum_j T_i M_{ij} X_j - d_{3i}^+ + d_{3i}^- = C_i$$

$$\sum_i \sum_j T_i M_{ij} X_j - d_3^+ + d_3^- = C$$

In addition to the number of potential consumers in each market segment ( $T_i$ ), the market share of each individual retail store in the different market segments, based on the store preferences of the potential consumers ( $M_{ij}$ ), should be predicted by understanding their buying behavior. In each market segment, the total relative frequency,  $\sum_j M_{ij}$  should be equal to 1.

#### (4) Maximum Market Exposure

In the manufacturer's potential market, he determines the number of the retail store outlets according to his distribution intensity strategy. The number of outlets of each retail store ( $N_j$ ) must be known. These goal constraints can be expressed in the following two equations:

$$\sum_j N_j X_j - d_{4,1}^+ + d_{4,1}^- = D^1$$

$$\sum_j N_j X_j - d_{4,2}^+ + d_{4,2}^- = D^2$$

The purpose of this dual constraint formulation is to facilitate specification of a goal criteria range for the manufacturer's market exposure between the maximum number ( $D^1$ ) and the minimum number ( $D^2$ ) of outlets of each retail store.



In order to achieve the manufacturer's intensive distribution, he may try to maximize the number of the retail store outlets in his potential market (D). In this case, the single equation can be stated as:

$$\sum_j N_j X_j - d_4^+ + d_4^- = D$$

#### (5) Maximum Displaying Shelf-space

The manufacturer requires the maximum amount of display shelf-space to increase the availability of his product to the potential consumers in each retail store. The total desired displaying shelf-space ( $F^1$ ) for maximum exposure to potential consumers can be accomplished by the following constraint:

$$\sum_j V_j X_j - d_5^+ + d_5^- = F^1$$

The total amount of displaying shelf-space in each retail store ( $V_j$ ) can be measured in square feet.

#### (6) Minimum Inventory Stock-out

The manufacturer expects that, if sufficient safety stock is carried by each retail store, only a minimum of inventory stock-outs ( $F^2$ ) will occur. These stock-outs could result in his losing potential consumers or causing them the inconvenience of making another trip. When the manufacturer knows the average number of inventory stock-outs of his product at each retail store during this planning period ( $O_j$ ), the constraint to achieve this goal can be expressed as follows:

$$\sum_j 0_j x_j - d_6^+ + d_6^- = F^2$$

### (7) Maximum Marketing Information

The manufacturer needs a great deal of marketing information for better management in his retail distribution channel. Retail stores that carry the manufacturer's product are in an excellent position to provide this information, because they closely serve his potential consumers. Marketing information provided to the manufacturer must be accurate if it is to be valuable to him in forecasting his market opportunities and in responding to market changes with better planning.

The amount of marketing information conveyed by each individual retail store to the manufacturer during this planning period ( $Y_j$ ) has to be evaluated on the basis of its degree of contribution to the manufacturer's management. The best way to measure this contribution is by using management's standardized subjective evaluation scale. Through this standardization process, the individual manager's bias in evaluation can be eliminated. To obtain the maximum amount of marketing information from each retail store ( $F^3$ ), the following goal constraint can be developed:

$$\sum_j Y_j x_j - d_7^+ + d_7^- = F^3 \sum_j x_j$$

In turn, this equation can be transformed as follows:

$$\sum_j (Y_j - F^3) x_j - d_7^+ + d_7^- = 0$$

## (8) Maximum Retail Stores' Cooperative Distribution Expenditures

The manufacturer desires the largest possible amount of retail stores' cooperative expenditures to benefit his product ( $Z_j$ ). These expenditures by retail stores provide more and better services to the manufacturer's potential consumers and increase the promotional activities for the product in his retail distribution ( $F^4$ ). This constraint can be expressed by:

$$\sum_j Z_j X_j - d_8^+ + d_8^- = F^4$$

where  $Z_j$  is the amount of expenditure by the  $j$  retail store to cooperate with the manufacturer.

## (9) Maximum Retail Distribution Control

The manufacturer as the channel captain wants to exercise the maximum level of control over his retail stores if he expects to have them comply with his policies and practices in his retail distribution. Through this control process, the manufacturer as a channel designer, attempts to reduce or control dysfunctional channel conflict and to obtain better cooperation in developing superordinate goals of his retail distribution.

The degree of the manufacturer's control over each alternative retail store ( $L_j$ ) can be measured by management's standardized subjective evaluation scale. To achieve the desired average degree of the control over the retail stores by the manufacturer ( $G$ ), the goal constraint can be formulated as follows:

$$\sum_j L_j X_j - d_9^+ + d_9^- = G \sum_j X_j$$

This equation can be transformed to the following one:

$$\sum_j (L_j - G) x_j - d_9^+ + d_9^- = 0$$

#### (10) Maximum Retail Distribution Flexibility

The manufacturer needs to maintain his maximum flexibility to adapt to the increasing competitive distributional challenges as well as other business environment changes in his retail distribution channel. The average degree of flexibility (H) on the part of the manufacturer can be achieved through the creation of the following constraint:

$$\sum_j K_j x_j - d_{10}^+ + d_{10}^- = H \sum_j x_j$$

where  $K_j$  is the level of the manufacturer's flexibility within the  $j$  retail store to adapt to dynamic environmental changes in retail distribution. This level of flexibility can be measured using management's standardized subjective evaluative scale. The equation above can also be stated as:

$$\sum_j (K_j - H) x_j - d_{10}^+ + d_{10}^- = 0$$

#### (11) Minimum Store Image Incongruence

The manufacturer wants the predicted image of his product to be congruent with the predicted image of the retail store held by his potential consumers in the retail distribution channel. Through image analysis, his product can be positioned where his potential consumers prefer to shop for and/or purchase it, based on their store preference.

Hence, total predicted image incongruence is the difference in measurements on the standardized subjective evaluation scale of each of the most salient attributes determined by potential consumers as applicable to both the retail store and the product ( $I_{ij1}$ ). This incongruence should be minimized, so that the manufacturer can obtain better access to his potential market. For this goal, the following two constraints can be developed with the desired level of the predicted image incongruence between them, both in each market segment ( $E_i$ ) and in the whole potential market ( $E$ ):

$$\sum_j \sum_l I_{ijl} x_j - d_{11i}^+ + d_{11i}^- = E_i \sum_j x_j$$

$$\sum_j \frac{\sum_i \sum_l T_i I_{ijl}}{\sum_i T_i} x_j - d_{11}^+ + d_{11}^- = E \sum_j x_j$$

In the second equation especially, the weighted average level of the predicted image incongruence between each alternative retail store and the manufacturer's product is used to better represent the whole potential market. In turn, the above two equations can be transformed, respectively, to the following:

$$\sum_j \left( \sum_l I_{ijl} - E_i \right) x_j - d_{11i}^+ + d_{11i}^- = 0$$

$$\sum_j \left( \frac{\sum_i \sum_l T_i I_{ijl}}{\sum_i T_i} - E \right) x_j - d_{11}^+ + d_{11}^- = 0$$

Without identifying those determinant attributes, a manufacturer

may develop the following two simple goal constraints, instead. In this case, the total level of the predicted image incongruence between them in general ( $I_{ij}$ ), as perceived by his potential consumers, is investigated.

$$\begin{aligned} \sum_j I_{ij} x_j - d_{11i}^+ + d_{11i}^- &= E_i \sum_j x_j \\ \sum_j \frac{\sum_i T_i I_{ij}}{\sum_i T_i} x_j - d_{11}^+ + d_{11}^- &= E \sum_j x_j \end{aligned}$$

These two equations, also, can be changed to the following two:

$$\begin{aligned} \sum_j (I_{ij} - E_i) x_j - d_{11i}^+ + d_{11i}^- &= 0 \\ \sum_j \left( \frac{\sum_i T_i I_{ij}}{\sum_i T_i} - E \right) x_j - d_{11}^+ + d_{11}^- &= 0 \end{aligned}$$

#### Development of the Objective Function

The objective function can be formulated with a wide variety of priority arrangements including differential weights, if necessary, so long as at least one of the deviational variables (either positive or negative) for each constraint is included. If overachievement is acceptable in the maximizing goal constraint,  $d^+$  can be eliminated from the objective function. On the other hand, if underachievement is satisfactory in the minimizing goal constraint,  $d^-$  can be excluded

from the objective function. Therefore, the objective function is intended to minimize the appropriate deviations from the goals in a lexicographic manner as dictated by the priority structure of the decision maker.

In the preemptive priority structure, the objectives are ranked by the decision maker in order of importance. The most important objective is achieved to the greatest possible degree before other objectives are sequentially considered. As low-ranking objectives are considered in order of decreasing importance, they are achieved as much as possible without worsening the previous level of achievement of any higher ranking objective.

In the differential weight assignment, the weights, as determined by the decision maker, are of the same order magnitude and the set of subgoals can be reduced into a single objective function. The weights represent a trade-off by the decision maker between the attainment of the respective subgoals.

In this model, the general objective function has the following form:

$$\text{Minimize } Z = \sum_n \sum_i P_n (W_i d_{ni}^+ + W_i d_{ni}^-)$$

where

$P_n$  = Manufacturer's preemptive priority assigned to the nth goal, such that there is no number n large enough to make  $nP_{n+1} \geq P_n$

$W_i$  = Manufacturer's differential weight assigned to deviational variables at the same priority level, based on his assessment of the attractiveness of the product to i market segment

$d_{ni}^+$  and  $d_{ni}^-$  = Positive and negative deviations from the  $n$ th goal in  $i$  market segment (the right-hand side value as either available resource or specified goal level), depending on overachievement or underachievement of the  $n$ th goal constraint, respectively

### Summary of the Model

The model development presented in this chapter is a realistic representation of the decision environment described in this study. However, it should be recognized that there could be any number of variations on the model, some of which might be more suitable for application than the model developed here, to improve the manufacturer's retail store selection. Indeed, additional constraints for better decision making in the manufacturer's specific business situation might have provided the model with greater sensitivity by reformulating it. Nevertheless, the primary concern of this first application of the goal programming approach to the manufacturer's distribution channel design is with the demonstration and development of the methodology.

This chapter illustrates the general methodology to apply the goal programming approach to developing a normative model for retail store selection in the manufacturer's distribution channel design. The complete summary of the model development that follows, along with the relevant data, will be used in Chapter IV to demonstrate the use of the model through various tests.

The output of this zero-one goal programming model is as follows:

$X_j = 0$  if the  $j$  retail channel is rejected  
 or  $X_j = 1$  if the  $j$  retail channel is accepted.



Also, the model output shows whether each goal is achieved or not and indicates the degree of each goal attainment.

A NORMATIVE MODEL FOR RETAIL STORE SELECTION  
IN THE MANUFACTURER'S DISTRIBUTION CHANNEL DESIGN  
 --A GOAL PROGRAMMING APPROACH--

Decision Variables

$X_j$  corresponds to the available  $j$  retail store alternative for distribution of the manufacturer's product. In the zero-one goal programming model,  $X_j$  has the value of either zero or one, which means the manufacturer's rejection or selection, respectively, of the  $j$  retail store.

Objective Function

$$\text{Minimize } Z = \sum_n \sum_i P_n (W_i d_{ni}^+ + W_i d_{ni}^-)$$

$P_n$  = Manufacturer's preemptive priority assigned to the  $n$ th goal, such that there is no number  $n$  large enough to make  $nP_{n+1} \geq P_n$

$W_i$  = Manufacturer's differential weight assigned to deviational variables at the same priority level, based on his assessment of the attractiveness of the product to  $i$  market segment

$d_{ni}^+$  and  $d_{ni}^-$  = Positive and negative deviations from the  $n$ th goal in  $i$  market segment (the right-hand side value as either available resource or specified goal level), depending on overachievement or underachievement of the  $n$ th goal constraint, respectively

## Goal Constraints

### 1. Maximum Sales Volume

$$\sum_j S_i T_i Q_{ij} X_j - d_1^+ + d_1^- = A_i$$

$$\sum_i \sum_j S_i T_i Q_{ij} X_j - d_1^+ + d_1^- = A$$

$S_i$  = Average purchasing volume per potential consumer in  $i$  market segment

$T_i$  = Number of potential consumers in  $i$  market segment  
( $T_i$  equals proportion of potential consumers in  $i$  market segment multiplied by total number of potential consumers in the whole market)

$Q_{ij}$  = Average relative probability of potential consumers in  $i$  market segment shopping for and purchasing the manufacturer's product at  $j$  retail store (Each alternative retail store share of manufacturer's sales volume in each market segment)

$A_i$  = Desired sales volume in  $i$  market segment

$A$  = Total desired sales volume in the whole market

### 2. Minimum Retail Distribution Cost

$$\sum_j \sum_k R_{jk} X_j - d_2^+ + d_2^- = B$$


---

$$\text{or } \sum_j R_j X_j - d_2^+ + d_2^- = B$$

$R_{jk}$  = Amount of financial needs of  $j$  retail store to perform  $k$  retail distribution function

or  $R_j$  = Total amount of financial needs of  $j$  retail store requested to the manufacturer

B = Limited financial budget to support the retail stores

### 3. Maximum Market Coverage

$$\sum_j T_i M_{ij} X_j - d_{3i}^+ + d_{3i}^- = C_i$$

$$\sum_i \sum_j T_i M_{ij} X_j - d_3^+ + d_3^- = C$$

$M_{ij}$  = Average relative frequency of potential consumers in  $i$  market segment shopping in general at  $j$  retail store  
(Market share of each alternative retail store in each market segment by potential consumers' store preference)

$C_i$  = Desired number of potential consumers to be reached in  $i$  market segment

$C$  = Total desired number of potential consumers to be reached in the whole market

### 4. Maximum Market Exposure

$$\sum_j N_j X_j - d_{4,1}^+ + d_{4,1}^- = D^1$$

$$\sum_j N_j X_j - d_{4,2}^+ + d_{4,2}^- = D^2$$

---


$$\text{or } \sum_j N_j X_j - d_4^+ + d_4^- = D$$

$N_j$  = Number of outlets of  $j$  retail store

$D^1$  = Total maximum number of retail store outlets

$D^2$  = Total minimum number of retail store outlets

or  $D$  = Desired number of retail store outlets

## 5. Maximum Displaying Shelf-space

$$\sum_j V_j X_j - d_5^+ + d_5^- = F^1$$

$V_j$  = Square feet of displaying shelf-space in  $j$  retail store for the manufacturer's product

$F^1$  = Total desired square feet of displaying shelf-space

## 6. Minimum Inventory Stock-out

$$\sum_j O_j X_j - d_6^+ + d_6^- = F^2$$

$O_j$  = Average number of inventory stock-outs of the manufacturer's product at  $j$  retail store

$F^2$  = Total allowable number of inventory stock-outs

## 7. Maximum Marketing Information

$$\sum_j (Y_j - F^3) X_j - d_7^+ + d_7^- = 0$$

$Y_j$  = Average amount of marketing information to be received from  $j$  retail store by the manufacturer

$F^3$  = Average desired amount of marketing information to be received from retail stores by the manufacturer

## 8. Maximum Retail Stores' Cooperative Distribution Expenditures

$$\sum_j Z_j X_j - d_8^+ + d_8^- = F^4$$

$Z_j$  = Expenditure of  $j$  retail store to cooperate with the manufacturer

$F^4$  = Total desired expenditures by retail stores to cooperate with the manufacturer

#### 9. Maximum Retail Distribution Control

$$\sum_j (L_j - G) X_j - d_9^+ + d_9^- = 0$$

$L_j$  = Degree of the manufacturer's control over  $j$  retail store to require compliance with his policies and practices

$G$  = Average desired degree of the manufacturer's control over the retail stores to require compliance with his policies and practices

#### 10. Maximum Retail Distribution Flexibility

$$\sum_j (K_j - H) X_j - d_{10}^+ + d_{10}^- = 0$$

$K_j$  = Level of the manufacturer's flexibility within  $j$  retail store to adapt to changes in his business environment

$H$  = Average desired level of the manufacturer's flexibility in retail stores to adapt to changes in his business environment

#### 11. Minimum Store Image Incongruence

$$\sum_j \left( \sum_i I_{ij1} - E_i \right) X_j - d_{11i}^+ + d_{11i}^- = 0$$

$$\sum_j \left( \frac{\sum_i \sum_l T_i I_{ijl}}{\sum_i T_i} - E \right) X_j - d_{11}^+ + d_{11}^- = 0$$


---

$$\text{or } \sum_j (I_{ij} - E_i) X_j - d_{11i}^+ + d_{11i}^- = 0$$

$$\sum_j \left( \frac{\sum_i T_i I_{ij}}{\sum_i T_i} - E \right) X_j - d_{11}^+ + d_{11}^- = 0$$

$I_{ijl}$  = Level of predicted image incongruence between the manufacturer's product and j retail store for l determinant image attribute in i market segment

or  $I_{ij}$  = Total level of predicted image incongruence between the manufacturer's product and j retail store in i market segment

$E_i$  = Average desired level of predicted image incongruence between the manufacturer's product and retail stores in i market segment

$E$  = Average desired level of predicted image incongruence between the manufacturer's product and retail stores in the whole market

#### \*Subscript Notations

i = Market segment

j = Alternative retail store

k = Retail distribution function

l = Determinant image attribute relevant to retail store and product

n. = Goal priority

## CHAPTER IV

### MODEL TESTS

In the previous chapter, the zero-one goal programming model was developed for retail store selection in the manufacturer's distribution channel design. This chapter will demonstrate how this formulated model can be applied in order to obtain a solution to the research problem that will be satisfactory to the manufacturer as a decision maker. This model is subject to the limits of the resource constraints and goal priority structure set by the firm's management.

In order to accomplish this demonstration, this chapter is divided into four sections: research design, an illustrative case study, test I--initial analysis, and test II--postoptimal sensitivity analyses. The first section provides the research procedure to obtain the relevant data for the developed model. The second section describes how the research data are simulated for model tests. In the third section, the initial solution with the given data is presented to demonstrate how goal programming solutions provide insights into the decision environment that often result in modifications of the model, based on the decision maker's new perspective on the problem. The fourth section demonstrates the flexibility of goal programming in dealing with parameter changes. This flexibility is illustrated by four modifications of the model: (1) a change in priority structure, (2) a change in weight

assignment, (3) changes in resources or goal levels, and (4) changes in technological coefficients. Here, the effect of these parameter changes will be analyzed.

### Research Design

As indicated before, a major advantage to the decision maker of using the goal programming model is that it is an iterative tool for the optimization of multiple and possibly conflicting objectives in a decision environment often characterized by limited resources. This description of goal programming is based on the fact that application of the model results in the best possible solution within any given set of constraints and goal priority structure; modify the goal constraints and/or priority structure in the model, and the solution itself undergoes modification. Therefore, where the model yields a solution that involves trade-offs due to the firm's decision structure and limited resources, the goal programming model allows judicious use to be made of this information by providing the decision maker with two options. He can redefine or requantify the firm's objectives and goal constraints as well as critically review and reorder its goal priorities in order to obtain a new solution more satisfying than the previous one. Thus, the model can undergo repeated reformulation until the decision maker obtains a solution: an acceptable allocation of limited resources for achieving a set of potentially conflicting objectives.

Goal programming solutions provide three principal types of information: (1) identification of the optimum resource allocation for



achieving all desired goals as nearly as possible, (2) the degree of goal attainment achieved under the given constraints and priority structure of the goals, and (3) the relative degree of goal attainment provided by parameter changes, such as those involving alternative goal priority structures and goal levels. In addition, goal programming solutions can provide valuable insight into the points of conflict within a given decision environment. Moreover, the postoptimal sensitivity analysis can show trade-offs such as the cost/benefit implications of altering planning objectives.

The analyses of the effects of parameter changes in this research, are particularly interesting because they can be utilized to help resolve goal conflicts among various levels of management in the firm to improve its retail distribution efficiency in the complex marketing channel distribution. When goal conflicts are not resolved, contradictory criteria often thwart the process of evaluation for the optimum retail store selection.

For the best actual application of the developed model for retail store selection in the distribution channel design, a manufacturer should satisfy the specified requirements of the goal programming model and meet the described assumptions. Only in this way can this analytical model for the normative backward channel design based on the marketing concept select the most profitable and efficient retail stores through which to distribute the manufacturer's product in his potential market. The research flow chart in Table 4-1 illustrates the research procedures to test the formulated model.

Table 4-1 Research Flow Chart

- Step 1. Determination of a manufacturer's product, which is the one of consumer shopping goods, as the research product.
- Step 2. Selection of a manufacturer's potential market for the above product as the research area.
- Step 3. Segmentation of this potential market into homogeneous market segments based on carefully chosen market segmentation criteria, such that the potential consumers in each market segment give better information on their store shopping preference for the manufacturer's product.
- Step 4. Identification of the available and accessible retail store alternatives for this manufacturer's product in the potential market.
- Step 5. Estimation of the specific values of the technological coefficients required in the model developed after collecting more precise data from the relevant sources of information by the appropriate research method (see Table 4-2).
- Step 6. Decision on the upper or lower limits of each goal as the goal constants which are either the manufacturer's available resources or goal levels for the planning period, while predicting his future business environment more accurately.
- Step 7. Provision of the manufacturer's preemptive priority structure for the eleven retail channel objectives in the developed goal programming model.
- Step 8. Assignment of the manufacturer's differential weights at the same priority level based on his assessment of the attractiveness of the product to each market segment.
- Step 9. Formulation of the initial model with the given data sets to test the developed research model.
- Step 10. Analysis of the first solution of the initial goal programming model for the manufacturer's optimum retail store selection.
- Step 11. Performance of the various postoptimal sensitivity analyses by changes in the model parameters--priority structure, weight arrangement, goal levels or available resources, and technological coefficients.

Table 4-2 Information Sources for the Specific Values of the Technological Coefficients

1. Consumer Survey in the Potential Market

- 1) Average purchasing volume per potential consumer in  $i$  market segment ( $S_i$ )
- 2) Number of the potential consumers in  $i$  market segment ( $T_i$ )
- 3) Average relative probability of the potential consumers in  $i$  market segment shopping for and purchasing the manufacturer's product at  $j$  retail store ( $Q_{ij}$ )
- 4) Average relative frequency of the potential consumers in  $i$  market segment shopping in general at  $j$  retail store ( $M_{ij}$ )
- 5) Total level of predicted image incongruence between the manufacturer's product and  $j$  retail store in  $i$  market segment ( $I_{ij}$ )

2. Retail Management

- 1) Number of outlets of  $j$  retail store ( $N_j$ )
- 2) Total amount of financial needs of  $j$  retail store requested to the manufacturer ( $R_j$ )
- 3) Square feet of displaying shelf-space in  $j$  retail store for the manufacturer's product ( $V_j$ )
- 4) Average number of inventory stock-outs of the manufacturer's product at  $j$  retail store ( $O_j$ )
- 5) Expenditure of  $j$  retail store to cooperate with the manufacturer ( $Z_j$ )

3. Manufacturer's Management

- 1) Average amount of the marketing information to be received from  $j$  retail store by the manufacturer ( $Y_j$ )
- 2) Degree of the manufacturer's control over  $j$  retail store to require compliance with his policies and practices ( $L_j$ )
- 3) Level of the manufacturer's flexibility within  $j$  retail store to adapt to changes in his business environment ( $K_j$ )

### An Illustrative Case Analysis

In this research, however, an illustrative case study for a hypothetical manufacturer, whose firm is assumed to satisfy the needed characteristics of the model and to follow the research design described, will be presented to demonstrate the use of the zero-one goal programming model for optimum retail store selection. As mentioned before, this model, with its specific retail distribution objectives, is one of many possible goal programming models for various business environments in retail distribution. Therefore, this experimental case example is satisfactory to test the ability of this goal programming model to improve the manufacturer's retail channel decisions, without violating the reality of his retail store selection problem.

The research problem at hand for the manufacturer involved in this illustrative case study will be posed by the simulated data for the initial goal programming model development. These pertinent information for the model parameters will be presented according to the sequential steps of the research design.

Hence, the hypothetical manufacturer in this case study would select the retail stores in which to market his product as one of the consumer shopping goods which has sufficient purchasing frequencies and/or volumes of target consumers in the determined potential market. The size of this potential market has to be big enough to be segmented in order to understand its consumer behavior. In this research, his market is segmented into four homogeneous market segments based on the degree of consumers' brand preference (high and low) and of consumers' store preference (high and low)(see Figure 4-1). It gives a better

picture of the potential consumers' store shopping preference for a manufacturer's product in each market segment, which can be briefly described with the following possible responses:

Market Segment I--I bought the special brand that my favorite store recommended.

Market Segment II--I looked around for the best special brand buy.

Market Segment III--I shopped around for the lowest price.

Market Segment IV--I selected one of several brands at my favorite store.

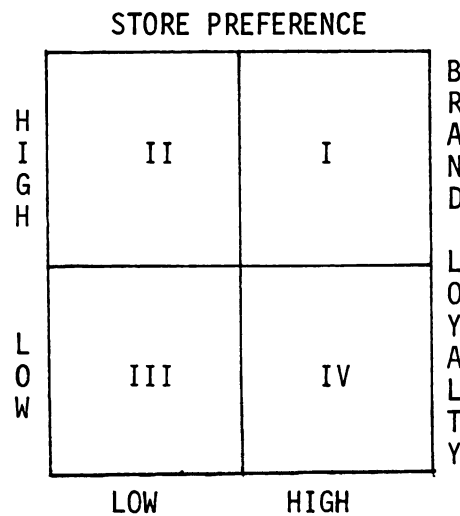


Figure 4-1 Market Segmentation of the Potential Market

The process of retail store selection for the manufacturer's distribution channel usually starts with determining the type of retail store to be used. Then, in case the manufacturer cannot use all of the existing retail stores within this determined type, due to his limited

resources, specific retail stores among them have to be selected. If the manufacturer can identify specific retail stores without considering their types, he can evaluate them directly for the optimum retail selection in his distribution channel design.

In this research, five different types of retail stores (designated as A - E) are considered as the available retail store alternatives for distribution of the manufacturer's product in the potential market described. They are the following:

1. A Retail Stores--Manufacturer-owned retail stores
2. B Retail Stores--Department stores
3. C Retail Stores--Discount stores
4. D Retail Stores--Independent retail stores
5. E Retail Stores--Other retail stores

To deal with the manufacturer's product in the potential market, the general characteristics of these alternative retail stores can be depicted as follows. Manufacturer-owned retail stores, which provide better services for the manufacturer's product, are more attractive to brand-loyal consumers. Department stores sell a wide variety of merchandise, especially consumer shopping goods, and try to increase their consumers' store loyalty. Discount stores give limited services but use relatively low prices as the main appeal to their consumers with emphasis on rapid turnover of merchandise. Independent retail stores are small business units specializing in meeting the needs and wants of a certain group of consumers by their stores' own distinctive business strengths. Finally, other retail stores are any stores besides the aforementioned, which do not treat the manufacturer's product as their major product.

Based on the characteristics of the market segments previously developed and these retail store alternatives, the following data for model parameters are simulated in this research. Referring back to Table 4-2 in the research design, the consumer market, the retail stores' management, and the manufacturer's management provide the relevant data to generate the specific values for the technological coefficients. The source data and the measurement units for each are shown in three following tables.

In Table 4-3, a market profile table and three matrices of market segments and retail stores are provided from the manufacturer's consumer market. This market profile shows the potential market size of each market segment, which is derived from the number of potential consumers ( $T_i$ ) and the average annual purchasing volume per consumer ( $S_i$ ) in each market segment. In moving from the first market segment to the fourth,  $T_i$  increases but  $S_i$  decreases. As a result, the total potential sales volume decreases from the first segment to the fourth segment.

First matrix describes in terms of relative probability which retail store the potential consumers in each market segment prefer to shop when purchasing the manufacturer's product. In this matrix,  $Q_{ij}$  is each alternative store's share of the manufacturer's sales volume in each market segment. Most of the manufacturer's brand-loyal consumers in the first and second market segments prefer manufacturer-owned retail stores first and department stores next. The price-conscious consumers in the third market segment mostly prefer to shop for and purchase the manufacturer's product at discount stores. Department stores have the dominant market share in the fourth market segment for heterogeneous shoppers who have store loyalty.

Table 4-3 Consumer Market Data

## Market Profile

Segment	$T_i$ (#) Number of the Potential Consumers	$S_i$ (\$) Average Annual Purchasing Volume Per Consumer	$T_i \times S_i$ (\$) Total Potential Sales Volume
I	10,000	400	4,000,000
II	20,000	350	7,000,000
III	30,000	300	9,000,000
IV	40,000	250	10,000,000
Whole Market	100,000	300	30,000,000

 $Q_{ij}$  (Relative Probability)

Each alternative retail store share of manufacturer's sales volume in each market segment ( $\sum_j Q_{ij} = 1$ )

Segment	STORE				
	A	B	C	D	E
I	.6	.3		.1	
II	.5	.2	.1	.1	.1
III			.7	.2	.1
IV		.6		.2	.2



Table 4-3 (cont'd.)

$M_{ij}$  (Relative Frequency)

Consumers' store shopping preference in each market segment  
 $(\sum_j M_{ij} = 1)$

Segment	STORE				
	A	B	C	D	E
I	.3	.6		.1	
II	.5	.2	.1	.1	.1
III			.4	.5	.1
IV		.5		.4	.1

$I_{ij}$  (Standardized Subjective Evaluation Scale)

Predicted image incongruence between the manufacturer's product and the alternative retail stores in each market segment  
 $(\sum_j I_{ij} = 0)$

Segment	STORE				
	A	B	C	D	E
I	0	-.2		.2	
II	-.3	-.2	.6	-.1	0
III			.8	-.5	-.3
IV		-.3		-.2	.5

The second matrix shows the relative frequency with which the potential consumers in each market segment shop at each alternative retail store in general ( $M_{ij}$ ). This value is shown as the consumers' store shopping preference. Brand-loyal and store-loyal consumers in the first market segment prefer department stores first and manufacturer-owned retail stores next. In the second market segment, brand-loyal consumers without store loyalty choose to shop at manufacturer-owned retail stores mostly. Most price conscious consumers in the third market segment prefer to shop at discount stores and independent retail stores. Store-loyal consumers without brand loyalty, the fourth market segment, would compare the wide variety of consumer shopping goods at their favorite department stores first and their independent retail stores second.

The third matrix shows the potential consumers' standardized evaluation of the image incongruence between the manufacturer's product and the alternative retail stores according to each market segment ( $I_{ij}$ ). Manufacturer-owned retail stores generally have favorable image evaluation from their brand-loyal consumers, when they buy the manufacturer's product. Department stores' image related to the manufacturer's product, is excellent to most of their consumers because they provide more and better services to build store loyalty. Discount stores have images which are the least congruent with the manufacturer's product due to the limited services provided for the product. Image congruence between the manufacturer's product and independent retail stores is evaluated favorably by their consumers, except those in the first market segment. The image of other retail stores is comparable to that of the manufacturer's product in the third or price-conscious market

segment, but other market segments.

In Table 4-4, the management of each alternative retail store provides data for five technological coefficients. They are the amount of financial support needed from the manufacturer ( $R_j$ ), the number of store outlets ( $N_j$ ), the size of displaying shelf-space ( $V_j$ ), the average number of stock-outs ( $S_j$ ), and the amount of cooperative expenditure for a manufacturer ( $Z_j$ ).

Table 4-4 Retail Management Data

Technological Coefficients	STORE				
	A	B	C	D	E
$R_j$ (\$) Financial Needs	90,000	60,000	30,000	70,000	20,000
$N_j$ (#) Number of Outlets	2	3	4	6	9
$V_j$ (Sq. Feet) Displaying Shelf-space	600	100	300	500	200
$O_j$ (#) Number of Stock-outs	1	2	8	4	16
$Z_j$ (\$) Cooperative Expenditure	50,000	40,000	10,000	30,000	20,000

Manufacturer-owned retail stores need the largest financial support from the manufacturer, followed by independent retail stores which deal mainly with the manufacturer's product. Discount stores, which provide limited services, have the least manufacturer's support.

Other retail stores, which do not treat the manufacturer's product as their major product, have the most store outlets and independent retail stores as the small business units second. On the other hand, the manufacturer-owned retail stores have the fewest store outlets in the designated potential market.

Because department stores deal with a variety of shopping goods, each product must share displaying shelf-space with the various competitors' products. Therefore, department stores offer the smallest displaying shelf-space for the manufacturer's product of all the retail store alternatives. Also, other retail stores, which are not the manufacturer's major dealers, furnish his product the next smallest displaying shelf-space. But manufacturer-owned retail stores and independent retail stores, which display the manufacturer's product as one of their main products, both allow a larger amount of shelf-space.

Of all the retail store alternatives, discount stores have the highest stock-out ratio per store outlet during this planning period, because they do not carry sufficient safety stock in order to reduce inventory carrying costs for their price appeals. Other retail stores have the second highest stock-out ratio per store outlet, because they do not carry the manufacturer's product as one of their main goods and therefore have only small inventories. Manufacturer-owned stores have the lowest stock-out ratio per store outlet, while department stores, which try to build store loyalty, have the second lowest.

All alternative retail stores are exceeded in their cooperative expenditures for the manufacturer's product by the amount of manufacturer's financial support of the stores. However, in much the same order as in the needed financial support, these stores spend their cooperative expenditures to the distribution of the manufacturer's product. Discount stores, however, cooperate financially least with the manufacturer, because their operations emphasize cost reduction.

Finally, the manufacturer's marketing information ( $Y_j$ ), control ( $L_j$ ), and flexibility ( $K_j$ ) within each retail store alternative are evaluated by the manufacturing firm's management, in Table 4-5. These subjective evaluations have to be consistent, without big differences among the various decision makers at different levels in management.

Table 4-5 Manufacturer's Management Data  
(Standardized Subjective Evaluation Scale)

Technological Coefficients	STORE				
	A	B	C	D	E
$Y_j$ Marketing Information	.8	.1	-.4	.3	-.8
$L_j$ Control	.4	-.3	.1	.2	-.4
$K_j$ Flexibility	.8	-.6	-.4	-.2	.4

As expected, manufacturer-owned retail stores provide the most useful marketing information, while department stores make the next most valuable contribution. But, the manufacturer obtains a less contribution of marketing information from discount stores and other retail stores that show less willingness to cooperate in distribution of the manufacturer's product.

Also, the manufacturer has the least control over other retail stores, which are not the manufacturer's major retail stores. Furthermore, department stores, which have their own strong management for store loyalty, are next least in the manufacturer's control. The manufacturer can control his own retail stores best.

Regarding the manufacturer's flexibility, manufacturer-owned retail stores and other retail stores have the highest ratings. But the others are relatively resistant to change in the manufacturer's adaption.

From these provided data, the specific descriptions of how each alternative retail store satisfies the manufacturer's determined goal criteria in this research can be induced (see Table 4-6). As intended for the heuristic demonstration of the developed model, this table shows the conflicting situations among the existing retail store alternatives which make different degrees of contribution to achieving the manufacturer's multiple channel objectives in retail distribution. For example, department stores, which have the largest sales volume and the best image congruence, do not allow a manufacturer to have large displaying shelf-space and flexibility. Discount stores, which have the least image congruence and the smallest cooperative distribution expenditures, have a relatively large sales volume and a large number

Table 4-6 The Predicted Characteristics of Each Retail Store Alternative in This Research

Goals Stores	Sales Volume	Number of Consumers	Financial Needs	Number of Outlets	Image Incongruence	Shelf- space	Inventory Stock-out	Marketing Information	Cooperative Expenditure	Control	Flexibility
A	3	4	1	5	3	1	5	1	1	1	1
B	1	2	3	4	1	5	4	3	2	4	5
C	2	3	4	3	5	3	2	4	5	3	4
D	4	1	2	2	2	2	3	2	3	2	3
E	5	5	5	1	4	4	1	5	4	5	2

\*Above order from 1 to 5 is ranked from the most to the least, respectively, in terms of the quantity or the degree.

of potential consumers for the manufacturer's product. Independent retail stores have the largest number of potential consumers but the sales volume of the manufacturer's product is fairly low.

Moreover, the manufacturer's management determines the upper or lower limits of each goal as goal constants which are either available resources or his goal levels for the planning period in Table 4-7. These values, in the specified measurement units, have to be predicted accurately for better planning in the firm's business environment.

For the initial formulation of the goal programming model, the first priority structure, shown in Table 4-8, is obtained from the manufacturer's management. This is a list of the manufacturer's retail channel objectives, in the order of their importance, which will be used to test the model for its ability to assist a decision maker in evaluating retail store alternatives. According to this table, economic objectives are assigned the highest goal priorities, while behavioral cooperation objectives are next highest. Market objectives are placed in the middle range of the priority setting. However, store image and adaptive objectives are assigned to the lowest priority levels. Because this priority structure emphasizes increased sales and reduced cost, it is reasonable to conclude that the manufacturer is heavily oriented toward short-run profitability in using retail stores to distribute his product.

There are three goal constraints expressed in terms of the market segmentation: sales volume, market coverage as the number of the potential consumers, and store image. For these goal constraints, differential weights are assigned to the five different subgoals at the same goal priority level, based on the manufacturer's assessment of his



Table 4-7 Manufacturer's Predicted Values for the Upper or Lower Limits of Each Goal (Goal Constants)

1. Lower Limit on the Expected Sales Volume in Each Market Segment (\$)

$A_1$ : 3,000,000

$A_2$ : 5,000,000

$A_3$ : 3,000,000

$A_4$ : 6,000,000

$A$  : 17,000,000

2. Financial Budget for the Retail Distribution Cost (\$)

$B$ : 200,000

3. Minimum Market Coverage in Each Market Segment (Number of Potential Consumers)

$C_1$ : 9,000

$C_2$ : 16,000

$C_3$ : 15,000

$C_4$ : 30,000

$C$  : 70,000

4. Allowable Total Market Exposure (Number of Retail Store Outlets)

$D$ : 10

5. Desired Total Displaying Shelf-space (Square Feet)

$F^1$ : 1,000

6. Allowable Total Number of Inventory Stock-outs

$F^2$ : 10

Table 4-7 (Cont'd.)

7. Desired Average Marketing Information (Standardized Subjective Evaluation Scale)

$$F^3: .2$$

8. Minimum Retail Stores' Cooperative Distribution Expenditures (\$)

$$F^4: 100,000$$

9. Desired Average Retail Distribution Control (Standardized Subjective Evaluation Scale)

$$G: .1$$

10. Desired Average Retail Distribution Flexibility (Standardized Subjective Evaluation Scale)

$$H: 0$$

11. Maximum Average Predicted Image Incongruence between a Manufacturer's Product and the Retail Stores in Each Market Segment (Standardized Subjective Evaluation Scale)

$$E_1: 0$$

$$E_2: -.1$$

$$E_3: .2$$

$$E_4: .1$$

$$E : .08$$

Table 4-8 Manufacturer's Initial Priority Structure

Priority	Goal Criteria
$P_1$	Maximize the sales volume
$P_2$	Minimize the retail distribution cost
$P_3$	Maximize the retail stores' cooperative distribution expenditures
$P_4$	Maximize the displaying shelf-space
$P_5$	Minimize the inventory stock-outs
$P_6$	Maximize the marketing information
$P_7$	Maximize the market coverage in terms of the number of retail potential consumers
$P_8$	Maximize the market exposure in terms of the number of retail store outlets
$P_9$	Maximize the manufacturer's retail distribution control in terms of the retail stores' compliance with his policies and practices
$P_{10}$	Maximize the manufacturer's retail distribution flexibility to adapt to his business environment changes
$P_{11}$	Minimize the predicted image incongruence between a manufacturer's product and the retail stores

product's attractiveness to each of the market segments. Therefore, this weight arrangement describes how much differential competitive advantages a manufacturer has in each market segment with which to improve his retail distribution efficiency. According to the weight assignment in Table 4-9, the manufacturer places more emphasis on the whole market than on each market segment. Also, the brand-loyal consumers, especially those who also have the store preference, are more attracted to his product. But he would put less efforts into the price-conscious or third market segment.

Table 4-9 Manufacturer's Initial Weight Assignment

Market Segment	Weight	Value
I	$W_2$	8
II	$W_3$	6
III	$W_4$	3
IV	$W_5$	5
Total	$W_1$	10

With the above simulated data for the previously developed model, the initial model, which follows in Table 4-10, is formulated to demonstrate its usefulness to improve the manufacturer's decision making in regard to retail store selection. In test I, the first solution from this initial goal programming model will be analyzed; then, in test II, the various postoptimal sensitivity analyses will be performed to show

Table 4-10 The Initial Model Formulation

Objective Function

$$\begin{aligned}
 \text{Minimize } Z = & P_1(8d_1^- + 6d_2^- + 3d_3^- + 5d_4^- + 10d_5^-) + P_2(d_6^+) + \\
 & P_3(d_{16}^-) + P_4(d_{13}^-) + P_5(d_{14}^+) + P_6(d_{15}^-) + \\
 & P_7(8d_7^- + 6d_8^- + 3d_9^- + 5d_{10}^- + 10d_{11}^-) + P_8(d_{12}^-) + \\
 & P_9(d_{17}^-) + P_{10}(d_{18}^-) + P_{11}(8d_{19}^+ + 6d_{20}^+ + 3d_{21}^+ + \\
 & 5d_{22}^+ + 10d_{23}^+)
 \end{aligned}$$

Goal Constraints

## 1. Maximum Sales Volume

$$\begin{aligned}
 .6X_1 + .3X_2 + .1X_4 - d_1^+ + d_1^- &= .75 \\
 .5X_1 + .2X_2 + .1X_3 + .1X_4 + .1X_5 - d_2^+ + d_2^- &= .71 \\
 .7X_3 + .2X_4 + .1X_5 - d_3^+ + d_3^- &= .33 \\
 .6X_2 + .2X_4 + .2X_5 - d_4^+ + d_4^- &= .6 \\
 5.9X_1 + 8.6X_2 + 7.0X_3 + 4.9X_4 + 3.6X_5 - d_5^+ + d_5^- &= 17
 \end{aligned}$$

## 2. Minimum Retail Distribution Cost

$$.9X_1 + .6X_2 + .3X_3 + .7X_4 + .2X_5 - d_6^+ + d_6^- = 2$$

Table 4-10 (Cont'd.)

## 3. Maximum Market Coverage (Number of Potential Consumers)

$$.3X_1 + .6X_2 + .1X_4 - d_7^+ + d_7^- = .9$$

$$.5X_1 + .2X_2 + .1X_3 + .1X_4 + .1X_5 - d_8^+ + d_8^- = .8$$

$$.4X_3 + .5X_4 + .1X_5 - d_9^+ + d_9^- = .5$$

$$.5X_2 + .4X_4 + .1X_5 - d_{10}^+ + d_{10}^- = .75$$

$$13X_1 + 30X_2 + 14X_3 + 34X_4 + 9X_5 - d_{11}^+ + d_{11}^- = 70$$

## 4. Maximum Market Exposure (Number of Retail Store Outlets)

$$2X_1 + 3X_2 + 4X_3 + 6X_4 + 9X_5 - d_{12}^+ + d_{12}^- = 10$$

## 5. Maximum Displaying Shelf-space

$$6X_1 + X_2 + 3X_3 + 5X_4 + 2X_5 - d_{13}^+ + d_{13}^- = 10$$

## 6. Minimum Inventory Stock-outs

$$X_1 + 2X_2 + 8X_3 + 4X_4 + 16X_5 - d_{14}^+ + d_{14}^- = 10$$

## 7. Maximum Marketing Information

$$.6X_1 - .1X_2 - .6X_3 + .1X_4 - X_5 - d_{15}^+ + d_{15}^- = 0$$

Table 4-10 (Cont'd.)

## 8. Maximum Retail Stores' Cooperative Distribution Expenditures

$$5X_1 + 4X_2 + X_3 + 3X_4 + 2X_5 - d_{16}^+ + d_{16}^- = 10$$

## 9. Maximum Retail Distribution Control

$$.3X_1 - .4X_2 + .1X_4 - .5X_5 - d_{17}^+ + d_{17}^- = 0$$

## 10. Maximum Retail Distribution Flexibility

$$.8X_1 - .6X_2 - .4X_3 - .2X_4 + .4X_5 - d_{18}^+ + d_{18}^- = 0$$

## 11. Minimum Predicted Image Incongruence

$$-.2X_2 + .2X_4 - d_{19}^+ + d_{19}^- = 0$$

$$-.2X_1 - .1X_2 + .7X_3 + .1X_5 - d_{20}^+ + d_{20}^- = 0$$

$$.6X_3 - .7X_4 - .5X_5 - d_{21}^+ + d_{21}^- = 0$$

$$-.4X_2 - .3X_4 + .4X_5 - d_{22}^+ + d_{22}^- = 0$$

$$-.28X_1 - .34X_2 + .64X_3 - .31X_4 + .04X_5 - d_{23}^+ + d_{23}^- = 0$$

trade-off analyses. Particularly, when the various levels of the manufacturer's management have different values of the model parameters for the given goals, these sensitivity analyses by their changes will help to resolve these conflicts through precise investigation.

As noted before, the model developed has multiple and conflicting goals with indivisibility of inputs, while the model's output is the decision either to accept or reject each alternative retail store. Therefore, the zero-one goal programming approach is applied in this research. The Lee and Morris algorithm,<sup>78</sup> based upon the implicit enumeration method of Balas<sup>79</sup> and the backtracking technique of Glover,<sup>80</sup> will be used to solve this research problem to select the manufacturer's optimum retail stores.

### Test I: Initial Analysis

In the above model formulated with the simulated data, 23 goal constraints are developed for the initial analysis to demonstrate the use of the goal programming model for optimum retail store selection in the manufacturer's distribution channel design. This hypothetical manufacturer assigns priorities to the eleven predetermined retail channel objectives. Moreover, within three objectives which consider market

---

<sup>78</sup>Sang M. Lee, and R. Morris, "Integer Goal Programming Methods," Management, TIMs Studies, No. 6 (1977), pp. 273-89.

<sup>79</sup>Balas, op. cit.

<sup>80</sup>Glover, op. cit.



segmentation, five differential weights are assigned at the same goal level to the four market segments and the whole market.

The results of the first solution are shown in Tables 4-11 and 4-12. The former describes the values of the solution variables, and the latter illustrates the goal achievements.

Table 4-11 The Values of the Solution Variables

$$X(A) = 1$$

$$X(B) = 1$$

$$X(C) = 1$$

$$X(D) = 0$$

$$X(E) = 0$$

(Twenty-nine total solution combinations were evaluated. The optimal solution was obtained on the fourth combination.)

Manufacturer-owned stores, department stores, and discount stores are accepted, while independent stores and other retail stores are rejected. As a result, discount stores, which have the second highest sales volume, are selected, even though they have the least store image congruence with the manufacturer's product (see Table 4-3).

With this solution, the first four goals are achieved, but the rest are not achieved. Two goals exceed the desired goal levels. The attained retail stores' cooperative distribution expenditures are precisely what was required for the third goal level, and the fourth goal level--needed displaying shelf-space--is achieved exactly. Then,

Table 4-12 The Goal Achievements

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum sales volume	Fully achieved	21,500,000 (\$)†
P <sub>2</sub>	Minimum retail distribution cost	Fully achieved	180,000 (\$)
P <sub>3</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	100,000 (\$)
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,000 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Underachieved by 1	11 (#)
P <sub>6</sub>	Maximum marketing information	Underachieved by .1	.1 (*)
P <sub>7</sub>	Maximum market coverage (the number of potential consumers)	Underachieved by 131.55	57,000 (#)†
P <sub>8</sub>	Maximum market exposure (the number of retail store outlets)	Underachieved by 1	9 (#)
P <sub>9</sub>	Maximum retail distribution control	Underachieved by .1	0 (*)
P <sub>10</sub>	Maximum retail distribution flexibility	Underachieved by .2	-.2 (*)
P <sub>11</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Underachieved by 4.4	-.02 (*)†

\*Standardized subjective evaluation scale

†This value represents the level attained in the whole market.



beginning with the number of inventory stock-outs at the fifth goal priority level, the goals are underachieved. Underachievement at the seventh goal priority level, market coverage as the number of potential consumers, is particularly noticeable, partly increased by the assigned differential weights. In other words, the goal of maximum sales volume is achieved at the expense of the goal of maximum market coverage. These are typical of the conflicting goal constraints in this initial model. In order to improve the attainment of goals below the fifth priority level, a deterioration at the higher priority levels would have to take place to offset it.

Moreover, the manufacturer's retail distribution budget is underused by \$20,000 for the first solution. Conceivably, the firm might use the surplus produced by this initial model, in some other profitable areas.

In reality, goal setting and goal prioritizing are likely to be the most difficult problems encountered in constructing a goal programming model. Discovering initial goal conflicts that are model apparent than real is to be expected. Indeed, it is highly improbable that a diverse group of managers at various levels in the management of a complex business organization have the detail knowledge or time to develop a mutually agreed upon goal structure for retail store selection. Moreover, many managers have various and sometimes narrow perspectives on how the most profitable and efficient retail stores should be selected to access and serve potential consumers better. Nevertheless, when presented with specific information regarding goal conflicts, managers whose goals appear to conflict may easily resolve the problem. Hence, the key to resolving the problem is the availability of specific

information about the conflicts which can be used in improving the decision making.

Therefore, the most important result of the first solution, from the manufacturer's short-run perspective, is that specific contradictions among the channel distribution goals have been identified. This information, provided by the initial model, is valuable to management for use in resolving conflicts. Thus, the first solution in the goal programming model serves as an aid to defining a consistent set of goal criteria and priorities for evaluating alternative retail stores.

In conclusion, besides the information of the achievement or underachievement of each goal and the level of its underachievement to optimize the allocation of limited resources, the best feature of the initial goal programming model is that it provides a logical and sequential system for better decision making by identifying the conflicts among goals. This analytical progress of the goal programming approach can only be an improvement on decision making which was, heretofore, largely dependent upon intuitive appeals and experience-based judgement. The results of the initial model, based on the manufacturer's short-run perspective, will be used to demonstrate in the following section the flexibility of the goal programming model, for the optimum retail store selection in the manufacturer's distribution channel design. This flexibility will be analyzed by changes of the model parameters.

## Test II: Sensitivity Analyses

On the basis of the results of the first solution, postoptimal sensitivity analyses of the effects on these results of changes in the model parameters will be performed. Through model reformulations the following parameter changes will be made in this last section: (1) a change in priority structure, (2) a change in weight assignment, (3) changes in resources or goal levels, and (4) changes in technological coefficients. These analyses will be investigated in order to test the model for its ability to assist the manufacturer, a decision maker, in evaluating his available retail store alternatives and identifying the optimal allocation of limited resources which best resolves the goal conflicts and satisfies as many goal criteria as possible.

### A Change in Priority Structure

The first solution illustrates the fact that many apparent goal conflicts exist in the manufacturer's optimum retail store selection within the complex marketing distribution channel. One way these conflicts can be resolved is by readjustment of goal priorities.

In comparison with the first solution, the second formulation revises the model so that those goals which were considered as less important to a manufacturer in the initial model are now assigned a higher priority. These lower goal constraints were underachieved somewhat in the first model formulation, because of conflicts with the goal constraints at higher levels. In this way, trade-offs between goals to improve decision making, can be demonstrated.

Table 4-13 provides a comparison of the revised priority structure with the one used to obtain the first solution. In the second priority structure, the market objectives and the store image objective are considered at the highest level, while the economic objectives are assigned the lowest priority. Also, the behavioral objectives have been assigned higher priorities than in the initial model formulation. Thus, a significant reordering of goal priorities has been effected. As a result, compared to the first model, the second model emphasizes goals associated with the manufacturer's long-run perspective to increase the market share for the long-run profitability.

In the second model, the same differential weight arrangement will be used; only the objective function will be changed, according to the new priority structure, as follows:

$$\begin{aligned} \text{Minimize } Z = & P_1(8d_7^- + 6d_8^- + 3d_9^- + 5d_{10}^- + 10d_{11}^-) + P_2(d_{12}^-) + \\ & P_3(8d_{19}^+ + 6d_{20}^+ + 3d_{21}^+ + 5d_{22}^+ + 10d_{23}^+) + \\ & P_4(d_{13}^-) + P_5(d_{14}^+) + P_6(d_{15}^-) + P_7(d_{17}^-) + \\ & P_8(d_{18}^-) + P_9(d_{16}^-) + P_{10}(8d_1^- + 6d_2^- + 3d_3^- + 5d_4^- + \\ & 10d_5^-) + P_{11}(d_6^+) \end{aligned}$$

The goal constraints remain the same as before.

The results of the second solution are shown in Tables 4-14 and 4-15. These tables present, for the second goal programming formulation, the values of the solution variables and the goal achievements, respectively.

This time, manufacturer-owned stores, department stores, and independent stores are adopted, instead of discount stores. According

Table 4-13 Manufacturer's Revised Priority Structure

New Priority	Old Priority	Goal Criteria
P <sub>1</sub>	(P <sub>7</sub> )	Maximize the market coverage in terms of the number of retail potential consumers
P <sub>2</sub>	(P <sub>8</sub> )	Maximize the market exposure in terms of the number retail store outlets
P <sub>3</sub>	(P <sub>11</sub> )	Minimize the predicted image incongruence between a manufacturer's product and the retail stores
P <sub>4</sub>	(P <sub>4</sub> )	Maximize the displaying shelf-space
P <sub>5</sub>	(P <sub>5</sub> )	Minimize the inventory stock-outs
P <sub>6</sub>	(P <sub>6</sub> )	Maximize the marketing information
P <sub>7</sub>	(P <sub>9</sub> )	Maximize the manufacturer's retail distribution control in terms of the retail stores' compliance with his policies and practices
P <sub>8</sub>	(P <sub>10</sub> )	Maximize the manufacturer's retail distribution flexibility to adapt to his business environment changes
P <sub>9</sub>	(P <sub>3</sub> )	Maximize the retail stores' cooperative distribution expenditures
P <sub>10</sub>	(P <sub>1</sub> )	Maximize the sales volume
P <sub>11</sub>	(P <sub>2</sub> )	Minimize the retail distribution cost



Table 4-14 The Values of the Solution Variables by Priority Changes

$$X(A) = 1$$

$$X(B) = 1$$

$$X(C) = 0$$

$$X(D) = 1$$

$$X(E) = 0$$

(Thirty total solution combinations were evaluated. The optimal solution was obtained on the seventh combination.)

to Tables 4-3 and 4-4, independent stores have the largest number of potential consumers and the second best store image congruence with the manufacturer's product. On the other hand, their sales volume is much lower and their needs for financial support from the manufacturer is greater, than the discount stores'.

In this second solution, complete goal attainment is indicated for nine out of the eleven goal priorities. This is a big improvement over the first solution. For the achieved nine goal priorities, all attained goal levels are higher than the desired goal levels except two, the manufacturer's retail distribution control and flexibility which are equal to the desired levels. However, the manufacturer's economic objectives are underachieved. First, at the tenth goal priority level, sales volume in market segment III falls short of the required goal level by \$1,170,000, but in the whole market, \$19,400,000 is realized, which represents \$2,400,000 more than the desired sales volume. Hence, in the second solution, the goal underachievement mainly comes from the third market segment. Second, the financial needs of the

Table 4-15 The Goal Achievements by Priority Changes

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum market coverage (the number of potential consumers)	Fully achieved	75,000 (#) <sup>†</sup>
P <sub>2</sub>	Maximum market exposure (the number of retail store outlets)	Fully achieved	11 (#)
P <sub>3</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Fully achieved	-.93 (*) <sup>†</sup>
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,200 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Fully achieved	7 (#)
P <sub>6</sub>	Maximum marketing information	Fully achieved	.8 (*)
P <sub>7</sub>	Maximum retail distribution control	Fully achieved	.1 (*)
P <sub>8</sub>	Maximum retail distribution flexibility	Fully achieved	0 (*)
P <sub>9</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	120,000 (\$)
P <sub>10</sub>	Maximum sales volume	Underachieved by 3.9	19,400,000 (\$) <sup>†</sup>
P <sub>11</sub>	Minimum retail distribution cost	Underachieved by .2	220,000 (\$)

\*Standardized subjective evaluation scale

<sup>†</sup>This value represents the level attained in the whole market.

retail stores selected exceed the manufacturer's financial retail distribution budget by \$20,000. But, the manufacturer receives \$20,000 more than the required amount of cooperative expenditures from these same retail stores.

For a more detailed look at the results of the second solution, it is helpful to compare its deviations with the deviations of the first solution. Insofar as the manufacturer is concerned with achieving the high priority goals of the second model, especially market objectives, he sacrifices achievement of the economic objectives, which were fully attained in the initial model. That is, in the second model, the sales volume in the whole market is reduced by \$2,100,000 from that attained in the first model. Furthermore, the manufacturer's retail distribution cost to support the retail stores selected in the second model is \$40,000 greater than in the first model. The poor performance of the stores in terms of these two goal criteria are the trade-offs, the costs which are necessary to make the attained levels of all the other conflicting goal criteria significantly higher in the second goal programming formulation.

It is worth noting that, in the second solution, a large amount of sales volume is lost in market segment III. This is because most of the price-conscious consumers, who make up this market segment, prefer to shop at discount stores, which are rejected in the second model (see Table 4-3). Thus, without changing the retail store selection, the deviation from the manufacturer's desired sales volume in the market segment III can be minimized only by lowering the subgoal's weight value, which reflects the manufacturer's attractiveness to this market segment.

Nothing can be done to completely reconcile all the multiple and somewhat conflicting goals shown in the two models presented. Therefore, management must accept the fact that its optimum retail store selection in channel design will, of necessity, fail to meet certain of its expectations.

In summary, the second goal programming model is a reformulation of the first solution, which identified the goal conflicts. This revised model is developed with goal priorities which reflect the manufacturer's long run perspective. This second solution satisfies most of the goal criteria, except the economic ones, for optimum retail store selection in the manufacturer's distribution channel design.

To demonstrate the diverse capabilities of the goal programming model as an analytical tool for profitable and efficient retail store selection, several modifications of the model can be investigated by changing other parameters involved in the model. By comparing the outputs of these modified models with that of the original one, the ability of the goal programming approach to deal with these changes can be demonstrated.

Since a major objective of this chapter is to demonstrate the flexibility of the goal programming approach, the two models previously developed will be reformulated by changing each of the following model parameters: weight assignment, resources or goal levels, and technological coefficients. The initial and revised models will be referred to throughout the rest of the model tests as the short-run model and the long-run model, respectively.

### A Change in Weight Assignment

Another model modification option available to the decision maker, will now be demonstrated. It involves changing differential weights,  $W_i$ , to specific goal constraints. In this research, the weight values were presumed to reflect the manufacturer's evaluation of his product's attractiveness to each of the four market segments identified and the whole market. Therefore, the weight arrangement affects the three goal criteria in this model that are broken down into five sub-goals at the same goal priority level. These three goal criteria pertain to sales volume, market coverage, and store image.

The various levels of management may have different evaluations of the attractiveness of the product to each market segment. This situation can be resolved by comparing the outcomes of the conflicting evaluations with each other.

In Table 4-16 are shown the revised weight values, to be used in

Table 4-16 Manufacturer's Revised Weight Assignment

Market Segment	Weight	Value
I	$W_2$	9
II	$W_3$	7
III	$W_4$	1
IV	$W_5$	3
Total	$W_1$	10

analyzing their effects on the manufacturer's selection of the optimum retail stores. Comparing to Table 4-9, the numerical values indicate that, in this case, management will be emphasizing market segments I and II more--and market segments III and IV less--than before.

The only effect on the above two models, of this new weight assignment is the revision of their objective functions. In the short-run model, it becomes:

$$\begin{aligned} \text{Minimize } Z = & P_1(9d_1^- + 7d_2^- + 1d_3^- + 3d_4^- + 10d_5^-) + P_2(d_6^+) + \\ & P_3(d_{16}^-) + P_4(d_{13}^-) + P_5(d_{14}^+) + P_6(d_{15}^-) + \\ & P_7(9d_7^- + 7d_8^- + 1d_9^- + 3d_{10}^- + 10d_{11}^-) + P_8(d_{12}^-) + \\ & P_9(d_{17}^-) + P_{10}(d_{18}^-) + P_{11}(9d_{19}^+ + 7d_{20}^+ + 1d_{21}^+ + \\ & 3d_{22}^+ + 10d_{23}^+) \end{aligned}$$

The results of this reformulated short-run model are shown in Tables 4-17 and 4-18. They illustrate the values of the solution variables for the alternative retail stores and each goal achievement.

Table 4-17 The Values of the Solution Variables by Weight Changes  
(Short-run)

$$\begin{aligned} X(A) &= 1 \\ X(B) &= 1 \\ X(C) &= 1 \\ X(D) &= 0 \\ X(E) &= 0 \end{aligned}$$

(Twenty-nine total solution combinations were evaluated. The optimal solution was obtained on the fourth combination.)

Table 4-18 The Goal Achievements by Weight Changes (Short-run)

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum sales volume	Fully achieved	21,500,000 (\$)†
P <sub>2</sub>	Minimum retail distribution cost	Fully achieved	180,000 (\$)
P <sub>3</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	100,000 (\$)
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,000 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Underachieved by 1	11 (#)
P <sub>6</sub>	Maximum marketing information	Underachieved by .1	.1 (*)
P <sub>7</sub>	Maximum market coverage (the number of potential consumers)	Underachieved by 130.85	57,000 (#)†
P <sub>8</sub>	Maximum market exposure (the number of retail store outlets)	Underachieved by 1	9 (#)
P <sub>9</sub>	Maximum retail distribution control	Underachieved by .1	0 (*)
P <sub>10</sub>	Maximum retail distribution flexibility	Underachieved by .2	-.2 (*)
P <sub>11</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Underachieved by 3.6	-.02 (*)†

\*Standardized subjective evaluation scale

†This value represents the level attained in the whole market.

Apparently, the same retail stores as the ones in the original short-run model are accepted. Also, the goal attainments are same, but for two underachieved goals, the degrees of deviation are decreased. Without changing the goal level attained, the amount of underachieved deviations for the seventh goal (market coverage) and the eleventh goal (store image) are reduced by .7 and .8, respectively (refer back to Tables 4-11 and 4-12).

The numerical value of goal deviation underachieved, is determined by adding up the amount of deviation each subgoal multiplied by its relevant weight value. Therefore, by change of weight assignment, the artificial improvements described above can be expected, but the optimum store selection remains the same.

As noted in the second solution, market segment III, consisting of price-conscious consumers, was not attractive to the manufacturer. This is because the manufacturer has a long-run perspective, which emphasizes store image congruence with his product. For this long-run model, the following objective function is reformulated by means of the new weight arrangement, which assigns the least possible weight value of 1 to market segment III:

$$\begin{aligned} \text{Minimize } Z = & P_1(9d_7^- + 7d_8^- + 1d_9^- + 3d_{10}^- + 10d_{11}^-) + P_2(d_{12}^-) + \\ & P_3(9d_{19}^+ + 7d_{20}^+ + 1d_{21}^+ + 3d_{22}^+ + 10d_{23}^+) + \\ & P_4(d_{13}^-) + P_5(d_{14}^+) + P_6(d_{15}^-) + P_7(d_{17}^-) + \\ & P_8(d_{18}^-) + P_9(d_{16}^-) + P_{10}(9d_1^- + 7d_2^- + 1d_3^- + \\ & 3d_4^- + 10d_5^-) + P_{11}(d_6^+) \end{aligned}$$

The results of this modification of the long-run model by weight



change are provided in the following two tables. Table 4-19 lists the values of the solution variables; Table 4-20 shows the goal achievements.

Table 4-19 The Values of the Solution Variables by Weight Changes  
(Long run)

$$X(A) = 1$$

$$X(B) = 1$$

$$X(C) = 0$$

$$X(D) = 1$$

$$X(E) = 1$$

(Thirty-one total solution combinations were evaluated. The optimal solution was obtained on the eighth combination.)

In this case, with this weight assignment, the solution variable E (other retail stores) becomes a part of the manufacturer's optimum retail store selection. According to Tables 4-6, other retail stores have the most retail store outlets, but they are in most the poorest when it comes to achieving the manufacturer's other distribution objectives.

The first four goals and the ninth goal are fully achieved, but the other goals are underachieved. To thoroughly analyze and evaluate this result to aid the manufacturer in better decision making, a comparison with the original long-run solution in Table 4-15 is necessary.

The degree of goals attained at the first two priority levels is significantly improved by the new weight arrangement, and the ninth

Table 4-20 The Goal Achievements by Weight Changes (Long-run)

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum market coverage (the number of potential consumers)	Fully achieved	86,000 (#) <sup>†</sup>
P <sub>2</sub>	Maximum market exposure (the number of retail store outlets)	Fully achieved	20 (#)
P <sub>3</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Fully achieved	-.89 (*) <sup>†</sup>
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,400 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Underachieved by 13	23 (#)
P <sub>6</sub>	Maximum marketing information	Underachieved by .4	-.2 (*)
P <sub>7</sub>	Maximum retail distribution control	Underachieved by .5	-.4 (*)
P <sub>8</sub>	Maximum retail distribution flexibility	Underachieved by .4	.4 (*)
P <sub>9</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	140,000 (\$)
P <sub>10</sub>	Maximum sales volume	Underachieved by .03	23,000,000 (\$) <sup>†</sup>
P <sub>11</sub>	Minimum retail distribution cost	Underachieved by .4	240,000 (\$)

\*Standardized subjective evaluation scale

<sup>†</sup>This value represents the level attained in the whole market.

goal priority, the retail stores' cooperative expenditures for a manufacturer's product, is increased by \$20,000. Furthermore, the tenth goal, sales volume, rises from \$19,400,000 to \$23,000,000, and displaying shelf-space is increased at the fourth goal level.

But the other goals are achieved to a lesser degree than in the original long-run solution. Even though the attained level of the third goal (store image congruence) exceeds the desired level, it is reduced by .04. The other goals, which attained the required goal levels before, are now underachieved in this reformulated long-run model.

Therefore, it can be concluded that, by the revised weight assignment, more potential consumers and a larger number of retail store outlets are achieved at the cost of other goals. In other words, the first and the second goal priorities receive more emphasis with the new weight values in the relevant market segments.

Concludingly, the analyses described in the models revised, by the change in weight arrangement, explain two facts. If the altered weight values do not affect the goal priority levels enough to change the manufacturer's optimum retail store selection, the artificial amount of deviation will be varied by them. On the other hand, if the new weight arrangement stresses some of the higher priority goals and obtains a different retail store selection, trade-offs among the goal achievements are unavoidable.

### Changes in Resources or Goal Levels

Still another way for a manufacturer to reformulate the model developed for the best retail store selection in channel design, is to change the right-hand side values of the goal constraints, as the goal constants, which may have some direct effect on the optimal solution. The goal constants, which are either the limited resources or the desired goal levels, should be accurately estimated by management for strategic planning.

In some cases, management may decide to adjust its distribution strategy in one area, such as the intensity of distribution. In other cases, management may adapt to changes in limited resources, for example the financial retail distribution budget. In all cases, management has to analyze their influence on his optimum retail store selection of revising the model by changing the relevant goal constants.

To investigate the effects of these changes in the goal constants, the following two cases will be considered in this research. In the short-run model, the manufacturer's financial budget for retail distribution will be cut by \$50,000, while in the long-run model, more market exposure up to 20 retail store outlets will be required by a manufacturer, to increase his market share.

In the short-run, the goal of minimum distribution cost is assigned to priority level  $P_2$ . For the short-run sensitivity analysis, only the right-hand side value of the sixth goal constraint, the budget ceiling, is changed from \$200,000 to \$150,000, as follows:

$$.9X_1 + .6X_2 + .3X_3 + .7X_4 + .2X_5 - d_6^+ + d_6^- = 1.5$$

The results of this reformulated model are presented in Tables 4-21 and 4-22. These tables show the values of the solution variables and the goal achievements, respectively.

Table 4-21 The Values of the Solution Variables by Goal-level Change  
(Short-run)

$$X(A) = 1$$

$$X(B) = 1$$

$$X(C) = 1$$

$$X(D) = 0$$

$$X(E) = 0$$

(Twenty-nine total solution combinations were evaluated. The optimal solution was obtained on the fourth combination.)

A closer look at this solution and the original short-run solution yields a number of points of comparison (see Tables 4-11 and 4-12). The same optimum retail stores are chosen by the manufacturer in both cases. Moreover, the goal achievements are same, but the minimum financial distribution goal at the second priority level is not achieved.

In regard to the retail distribution budget, \$20,000 was left over in the original short-run model, but now the manufacturer is short of \$30,000. In other words, to satisfy the first goal requirement, the second goal level is not attained.

In the long-run model also, the maximum market exposure as the degree of retail distribution intensity is ranked as the second highest

Table 4-22 The Goal Achievements by Goal-level Change (Short-run)

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum sales volume	Fully achieved	21,500,000 (\$)†
P <sub>2</sub>	Minimum retail distribution cost	Underachieved by .3	180,000 (\$)
P <sub>3</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	100,000 (\$)
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,000 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Underachieved by 1	11 (#)
P <sub>6</sub>	Maximum marketing information	Underachieved by .1	.1 (*)
P <sub>7</sub>	Maximum market coverage (the number of potential consumers)	Underachieved by 131.55	57,000 (#)†
P <sub>8</sub>	Maximum market exposure (the number of retail store outlets)	Underachieved by 1	9 (#)
P <sub>9</sub>	Maximum retail distribution control	Underachieved by .1	0 (*)
P <sub>10</sub>	Maximum retail distribution flexibility	Underachieved by .2	-.2 (*)
P <sub>11</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Underachieved by 4.4	-.02 (*)†

\*Standardized subjective evaluation scale

†This value represents the level attained in the whole market.

priority. For another examination of the effects of changes in the goal levels, the goal constant at the twelfth priority level--the desired number of retail store outlets--is doubled, as follows:

$$2X_1 + 3X_2 + 4X_3 + 6X_4 + 9X_5 - d_{12}^+ + d_{12}^- = 20$$

The results of the long-run model, revised with this goal constraint, are provided in two tables. Table 4-23 shows the optimum retail store selection, and the goal achievements are shown in Table 4-24.

Table 4-23 The Values of the Solution Variables by Goal-level Change  
(Long-run)

$$X(A) = 1$$

$$X(B) = 1$$

$$X(C) = 0$$

$$X(D) = 1$$

$$X(E) = 1$$

(Thirty-two total solution combinations were evaluated. The optimal solution was obtained on the ninth combination.)

In this case, the retail stores selected are identical to the ones selected when the weight assignment in the long-run model was changed (see Table 4-19). That is, manufacturer-owned retail stores, department stores, independent stores and other retail stores are accepted. Only the discount stores are excluded, because these stores lack image congruence with the manufacturer's product (refer to Table

Table 4-24 The Goal Achievements by Goal-level Change (Long-run)

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum market coverage (the number of potential consumers)	Fully achieved	86,000 (#) <sup>†</sup>
P <sub>2</sub>	Maximum market exposure (the number of retail store outlets)	Fully achieved	20 (#)
P <sub>3</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Fully achieved	-.89 (*) <sup>†</sup>
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,400 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Underachieved by .13	23 (#)
P <sub>6</sub>	Maximum marketing information	Underachieved by .4	-.2 (*)
P <sub>7</sub>	Maximum retail distribution control	Underachieved by .5	-.4 (*)
P <sub>8</sub>	Maximum retail distribution flexibility	Underachieved by .4	.4 (*)
P <sub>9</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	140,000 (\$)
P <sub>10</sub>	Maximum sales volume	Underachieved by .09	23,000,000 (\$) <sup>†</sup>
P <sub>11</sub>	Minimum retail distribution cost	Underachieved by .4	240,000 (\$)

\*Standardized subjective evaluation scale

<sup>†</sup>This value represents the level attained in the whole market.



4-3).

Consequently, the goal attainments are similar to those of the long-run model, reformulated by the weight change, except for the underachievement of the sales volume maximization goal at the eleventh priority level (see Table 4-20). This minor difference of the artificial deviation of .06 in sales volume, when compared with the former model, comes from the difference in the weight arrangements of the two models.

Hence, comparison of the original long-run solution with the solution of the model reformulated by a change in the goal constant provides insight into the cost/benefit trade-offs necessary to achieve the highest priority goals to the greatest extent. Thus, while it is extremely hard to predict exactly what trade-offs will be made among the goals, it is clear that a cost/benefit compromise exists in the goal programming model.

#### Changes in Technological Coefficients

Some degree of uncertainty is usually involved in predicting the needed technological coefficients in this model. Changes in these coefficients can also have profound effects on the solution to the manufacturer's optimum retail store selection problem.

In the goal programming model, the manufacturer, as a channel designer, should estimate the three relevant technological coefficients as model parameters through his evaluation process. They are the technological coefficients which pertain to marketing information, retail distribution control, and retail distribution flexibility goal constraints.

The different levels of management may evaluate the available retail store alternatives somewhat differently with respect to the above technological coefficients. One level may evaluate a certain retail store pessimistically, while the other level may have an optimistic evaluation of the same one.

To analyze the effects of changing the technological coefficients of the model for the manufacturer's optimum retail store selection, one technological coefficient in the short-run model will be changed. This coefficient is the one related to maximizing marketing information which is evaluated based on the contribution of each retail store alternative to the manufacturer's distribution management. Likewise, in the long-run model, the technological coefficient associated with the manufacturer's goal of maximum retail distribution control will be renewed.

The manufacturer's marketing information goal is at the sixth priority level in the short-run model. In this case, management changes its evaluation of the alternative retail stores' marketing information shown in Table 4-25. Now the following fifteenth, marketing information goal constraint, reflecting this new data, is substituted in the initial short-run model, to achieve the desired average goal level of .2

Table 4-25 Manufacturer's Revised Technological Coefficients of Marketing Information

Marketing Information	A	B	C	D	E
New	.9	.2	-.4	0	-.7
Old	.8	.1	-.4	.3	-.8

on the standardized subjective evaluation scale:

$$.7X_1 - .6X_3 - .2X_4 - .9X_5 - d_{15}^+ + d_{15}^- = 0$$

Tables 4-26 and 4-27 are the results of this short-run model reformulation. The former table gives the optimum retail store selection, and the latter lists the goal achievements.

Table 4-26 The Values of the Solution Variables by Technological Coefficient Changes (Short-run)

$$X(A) = 1$$

$$X(B) = 1$$

$$X(C) = 1$$

$$X(D) = 0$$

$$X(E) = 0$$

(Twenty-nine total solution combinations were evaluated. The optimal solution was obtained on the fourth combination.)

The retail stores selected this time are the same as those in the original short-run solution in Table 4-11. But the sixth goal level of marketing information, which was underachieved before, is now fully achieved, because manufacturer-owned stores and department stores better evaluations in this regard (see Table 4-12).

In the long-run model, management puts the retail distribution control maximization goal at the seventh goal priority level. Its evaluation on the standardized subjective evaluation scale of control over the alternative retail stores is shown in Table 4-28. With this new

Table 4-27 The Goal Achievements by Technological Coefficient Changes  
(Short-run)

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum sales volume	Fully achieved	21,500,000 (\$)†
P <sub>2</sub>	Minimum retail distribution cost	Fully achieved	180,000 (\$)
P <sub>3</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	100,000 (\$)
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,000 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Underachieved by 1	11 (#)
P <sub>6</sub>	Maximum marketing information	Fully achieved	.3 (*)
P <sub>7</sub>	Maximum market coverage (the number of potential consumers)	Underachieved by 131.55	57,000 (#)†
P <sub>8</sub>	Maximum market exposure (the number of retail store outlets)	Underachieved by 1	9 (#)
P <sub>9</sub>	Maximum retail distribution control	Underachieved by .1	0 (*)
P <sub>10</sub>	Maximum retail distribution flexibility	Underachieved by .2	-.2 (*)
P <sub>11</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Underachieved by 4.4	-.02 (*)†

\*Standardized subjective evaluation scale

†This value represents the level attained in the whole market.

Table 4-28 Manufacturer's Revised Technological Coefficients of Retail Distribution Control

Retail Distribution Control	A	B	C	D	E
New	1	-.6	-.3	-.4	.3
Old	.4	-.3	.1	.2	-.4

data, the seventeenth goal constraint of retail distribution control is modified to attain the needed goal level of .1 on the standardized subjective evaluation scale, as follows:

$$.9X_1 - .7X_2 - .4X_3 - .5X_4 - .2X_5 - d_{17}^+ + d_{17}^- = 0$$

In the long-run model, reformulated by this new goal constraint, the values of the solution variables, shown in Table 4-29, are the same as the original optimum store selection in the long-run model in Table 4-14. However, the manufacturer's retail distribution control goal at the seventh priority level, which was previously achieved (see Table

Table 4-29 The Values of the Solution Variables by Technological Coefficient Changes (Long-run)

$$X(A) = 1$$

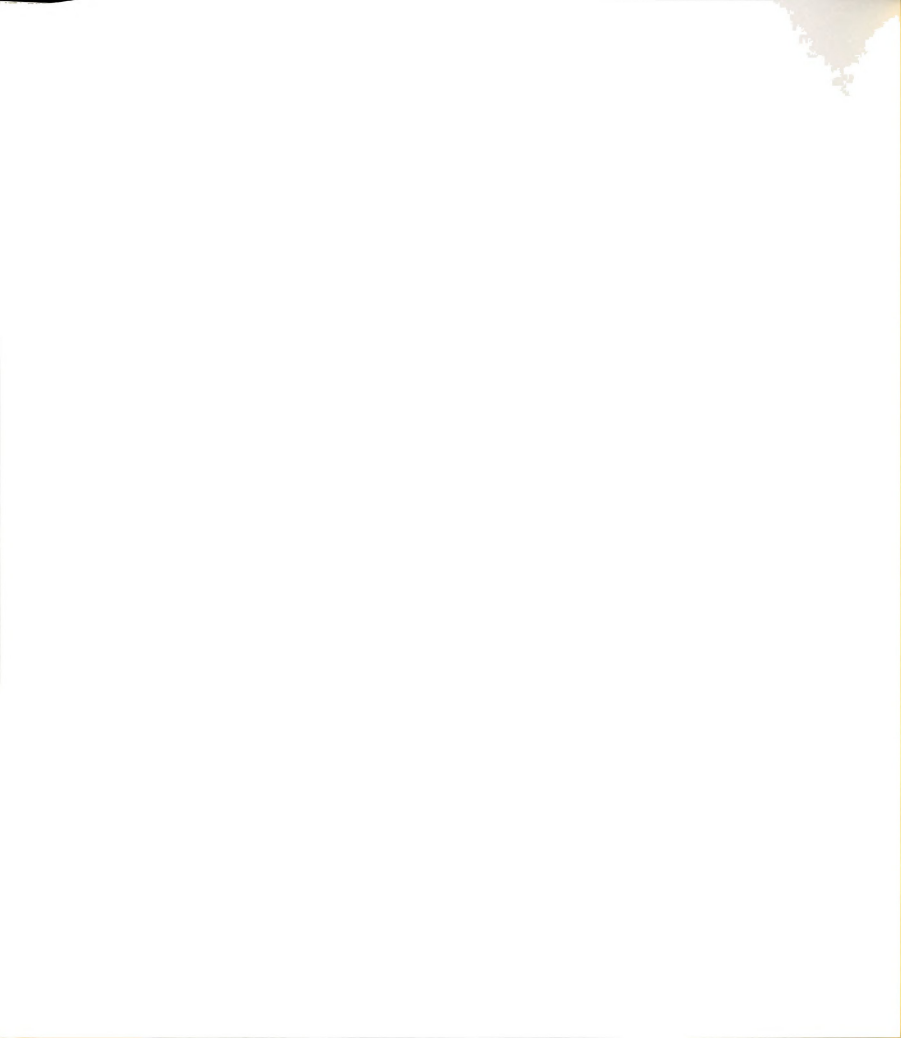
$$X(B) = 1$$

$$X(C) = 0$$

$$X(D) = 1$$

$$X(E) = 0$$

(Thirty total solution combinations were evaluated. The optimal solution was obtained on the seventh combination.)



4-15), is not attained in this revised long-run model in Table 4-30, because the evaluation of the manufacturer's control over the independent stores is more pessimistic.

In the above analyses, the change in technological coefficients, which pertain to the lower goal priority levels, do not affect the optimum solution, except to change the achievement of the goal constraints related to this coefficient change. Nevertheless, the optimum solution may change if technological coefficients at the higher goal priority levels are altered.

In addition to the sensitivity analyses already described, after the optimal solution has been reached, the manufacturer could add additional goal constraint(s) or new decision variable(s) of alternative retail store(s) to modify the model developed for the best retail store selection. To avoid these complicated processes in a complex marketing distribution channel, the manufacturer should develop complete and unambiguous decision structure which are related to the goal definitions and the priority structure. Also, all the retail store alternatives available for distribution of his product should be identified as the decision variables in the model. Several iterations may be required, based on the firm's specific business environment, before a satisfactory model formulation is finally developed.

After the model is developed, when the manufacturer attempts to actually implement the optimum result of the developed model in his retail distribution, he may encounter mutually exclusive conditions among the selected retail stores, which make it impossible for him to use them at the same time. In this special case, the manufacturer can and should adjust the model by relevant changes in the decision

Table 4-30 The Goal Achievements by Technological Coefficient Changes  
(Long-run)

	Goal Priority	Solution	Attained Level
P <sub>1</sub>	Maximum market coverage (the number of potential consumers)	Fully achieved	75,000 (#) <sup>†</sup>
P <sub>2</sub>	Maximum market exposure (the number of retail store outlets)	Fully achieved	11 (#)
P <sub>3</sub>	Minimum image incongruence between a manufacturer's product and the retail stores	Fully achieved	-.93 (*) <sup>†</sup>
P <sub>4</sub>	Maximum displaying shelf-space	Fully achieved	1,200 (sq. ft)
P <sub>5</sub>	Minimum inventory stock-outs	Fully achieved	7 (#)
P <sub>6</sub>	Maximum marketing information	Fully achieved	.8 (*)
P <sub>7</sub>	Maximum retail distribution control	Underachieved by .3	-.2 (*)
P <sub>8</sub>	Maximum retail distribution flexibility	Fully achieved	0 (*)
P <sub>9</sub>	Maximum retail stores' cooperative expenditures	Fully achieved	120,000 (\$)
P <sub>10</sub>	Maximum sales volume	Underachieved by 3.9	19,400,000 (\$) <sup>†</sup>
P <sub>11</sub>	Minimum retail distribution cost	Underachieved by .2	220,000 (\$)

\*Standardized subjective evaluation scale

<sup>†</sup>This value represents the level attained in the whole market.



variables which are the retail store alternatives, and eliminate these contradictory situations before his actual application in the business.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

The relative success of the business firm in a competitive environment is dependent upon the strategic planning and management of its distribution channels. Even though the importance of channels of distribution in management has been emphasized in the marketing literature, considerable attention has not been given to optimizing channel decisions, especially channel design.

Until now, virtually all the quantitative models proposed to deal with channel design have neglected or only superficially treated the problem of multiple and often conflicting objectives in the complex marketing distribution channel. In this research for retail store selection in the manufacturer's normative distribution channel design, the goal programming approach has been investigated to maximize the firm's profits and consumers' satisfaction. This analytical model allows the manufacturer, as a channel designer, to optimize the allocation of the firm's limited resources among the available retail store alternatives, while considering their different contributions to achieve the explicit but sometimes conflicting channel objectives to the fullest extent possible. In this research the zero-one goal programming model has been applied to allow for the problem of the indivisibility of the manufacturer's retail store selection decision.

The purpose of this research has been: (1) to illustrate the applicability of the goal programming approach to the manufacturer's optimum retail store selection, (2) to present one possible goal programming model formulation, and (3) to demonstrate the ability of the developed model solutions to optimize the manufacturer's retail distribution. The model provides three principal types of quantified information for better decision making: (1) identification of the optimal allocation of limited resources, (2) the degree of goal attainment provided within given inputs, and (3) the degree of goal attainment provided by changing the various model parameters.

Toward these ends, the general, multiple, and often conflicting retail channel objectives were induced from the marketing literature review to develop the manufacturer's evaluation criteria. Then, one specific goal programming model, as just one of many goal programming model formulations possible according to the various business environments, was developed to demonstrate the diverse ability of the model solution, given the specific model assumptions. This model for retail store selection in the manufacturer's distribution channel design, was tested in the hypothetical case study, which reflected the situations in real business.

This final chapter consists of two sections. Conclusions are presented in the first section, and future research is recommended in the next section.

## Conclusions

The research conclusions which follow are developed from the test findings presented in Chapter IV. Based upon the results, the general conclusion of this study is that goal programming can provide a useful analytical tool to aid in several important ways a manufacturer, as a decision maker, in the difficult and complex task of retail store selection.

First of all, goal programming for retail store selection in the manufacturer's distribution channel design helps define his decision environment in unambiguous terms. Every discretionary retail channel objective in the complex marketing channel environment can be identified and ranked in terms of its importance to developing the most profitable and efficient retail distribution. As a result, a common decision structure as the evaluation criteria for retail store selection can be provided for all decision makers in the firm's management. Hence, the manufacturer can improve the planning and management of the firm's retail distribution by analyzing his specific business situation, based on these predetermined evaluation criteria.

Second, developing and solving the goal programming model provides valuable insight into the points of conflict within a given decision environment. By examining the model output, the manufacturer can gain an understanding of trade-offs necessary to increase the achievement of certain goals which will optimize his retail distribution. Therefore, a manufacturer may consistently resolve many apparent goal conflicts that arise when individuals from different levels of management bring their various and sometimes narrow perspectives to the goal-setting

task. In cases in which goal conflicts cannot be resolved within the given model framework, the model points out where and to what extent some goals cannot be achieved under a certain decision structure.

Third, the model allows a manufacturer to undertake a systematic evaluation of alternative decision structures based on goals and their priorities, while ensuring that all key objectives of retail channel distribution are considered logically and consistently each time a decision structure is evaluated. Through this iterative process, goal programming generates the best solution by allowing for modification of the goal constraints and/or priorities in the model. In case there is uncertainty or conflict among decision makers in management concerning the appropriate objectives for the best retail store selection, the model helps management adjust the priorities of the proposed retail channel objectives.

Fourth, the model output enables a manufacturer to utilize his limited resources more efficiently and effectively by indicating the best solution that optimizes resource allocation among the retail store alternatives in the goal programming model. When the manufacturer exceeds some of his established goal levels, he can determine how much of his surplus resources can be used somewhere else more profitably while achieving the same goals. On the other hand, for the under-achieved goals, the manufacturer knows how much more of each resource he needs to achieve them.

Finally, perhaps the greatest strength of goal programming, which makes it superior in utility to other modeling techniques, is its flexibility. The goal programming approach allows model reformulations by means of various postoptimal sensitivity analyses to improve a

manufacturer's decision making. This flexibility is necessary in a real business environment, particularly in a marketing distribution channel, where some degree of uncertainty usually exists. In this research, the model's diverse capabilities were demonstrated by changes in priority structure, weight assignment, resources or goal levels, and technological coefficients. Furthermore, because of this flexibility, the manufacturer can reformulate the model and/or revise the data from time to time, taking into account modified circumstances in his changing business environment, and, thus, achieve continuous planning and management of the firm's retail distribution.

In short, the primary advantage of goal programming is its ability to handle decision problems involving multiple, incompatible goals according to their importance. As soon as management establishes an ordinal ranking of goals, the goal programming model provides management with the opportunity to critically review the priority structure to improve its decision making. Indeed, the most important characteristic of goal programming is its great flexibility, which allows model reformulations with numerous variations in the model parameters.

Although goal programming is an effective decision-making tool for resolving most managerial problems, it has some limitations. The most obvious limitation is that the goal programming model simply provides the best solution under the given constraints and priority structure. Therefore, if management begins with incomplete or vague goals and then assigns incorrect priorities to these various goals, the model solution will not provide the optimum retail store selection, as is usually the case with any optimization model developed inappropriately. The proper application of goal programming to managerial decision

analysis requires the manager to think of goals and constraints in terms of their importance to the organization.

This study is an attempt to provide management with a general model robust enough to overcome the aforementioned complications: the indivisibility of retail store selection decisions as well as the multiple and possibly conflicting goals of retail channel distribution. The research indicates that the zero-one goal programming approach is appropriate and useful for analysis of the optimum retail store selection for the manufacturer's channel modification. In a general sense, by providing valuable information for planning and management, the goal programming model can be used for channel selection to develop the manufacturer's optimum distribution channel design backward from the consumer market. Accordingly, the rest of the channel members between the manufacturer and the optimum retail stores can be selected by using the goal programming approach to complete the manufacturer's total channel system.

#### Future Research

Since the model formulation developed in this research has been highly simplified, based on theoretical relationships, an elaboration of the model would inject more complexity and realism into the analysis. For example, a manufacturer may add specific goal constraints according to his specific situation in the business environment, when he develops the relevant objectives of retail channel distribution. Without these model refinements, derived from additional research, the developed

model may not provide the optimum solution for a particular firm.

In this research, the simulated data have been used throughout the illustrative case study to test the developed model for the pedagogical demonstration of its various abilities to solve the problem. However, actual data from empirical research are needed to generalize the applicability of the model to the real business problem of retail store selection for a manufacturer's consumer shopping goods.

Also, this research has been constrained to retail store selection in the manufacturer's distribution channel design, with the assumption that this normative model could be expanded to total channel system between a manufacturer and the potential market, as the backward channel design. Because the marketing distribution channel environment generally involves multiple decision-making criteria, the goal programming approach is strongly recommended for total channel development in the future. In this regard, it would be interesting to reformulate the model developed in this research for selecting the rest of the channel members in the manufacturer's total channel design.

Finally, supplementary research is required to evaluate the demand creation aspects of alternative retail stores. This study has focused on the demand satisfaction aspects of alternative retail stores, while assuming the sales volume or demand of each retail store to be fixed. When this assumption is relaxed, further research will be needed to determine the different demand patterns which the various retail stores could create in the manufacturer's potential market for his product. For this purpose, the different demand functions for each alternative retail store have to be developed to include the activities of demand creation to make this goal programming model dynamic in the



firm's changing business environment.

## BIBLIOGRAPHY

Alderson, Wroe. "Factors Governing the Development of Marketing Channel." Marketing Channels for Manufactured Products edited by R. M. Clewett. Homewood, Ill.: Richard D. Irwin, Inc., 1954. pp. 5-34.

\_\_\_\_\_. Marketing Behavior and Executive Action. Homewood, Ill.: Richard D. Irwin, Inc., 1957.

\_\_\_\_\_, and Green, Paul E. "Bayesian Decision Theory in Channel Selection." Planning and Problem Solving in Marketing edited by Wroe Alderson and Paul E. Green. Homewood, Ill.: Richard D. Irwin, Inc., 1964. pp. 311-17.

Amstutz, A. E. Computer Simulation of Competitive Market Response. Cambridge, Mass.: M.I.T. Press, 1967.

Artle, Roland, and Berglund, Sture. "A Note on Manufacturers' Choice of Distribution Channels." Management Science, Vol. 5, No. 4 (July 1959), pp. 460-71.

Aspinwell, Leo. "The Characteristics of Goods and Parallel Systems Theories." Managerial Marketing edited by Eugene Kelly and William Lazer. Homewood, Ill.: Richard D. Irwin, Inc., 1958. pp. 434-50.

Balas, E. "An Additive Algorithm for Solving Linear Programs with Zero-one Variables." Operations Research, Vol. 13 (1965), pp. 517-45.

\_\_\_\_\_. "Direct Programming by the Filter Method." Operations Research, Vol. 15 (1967), pp. 915-57.

Balderston, F. C. "Communication Networks in Intermediate Markets." Management Science, Vol. 4 (1958), pp. 154-71.

\_\_\_\_\_. "Design of Marketing Channels." Theory in Marketing edited by Reavis Cox, Wroe Alderson, and Stanley J. Shapiro. Homewood, Ill.: Richard D. Irwin, Inc., 1964. pp. 176-89.

\_\_\_\_\_, and Hoggart, A. C. Simulation of Market Processes. Berkeley, California: Institute of Business and Economic Research, University of California, 1962.

- Baligh, Hemly H. "A Theoretical Framework for Channel Choice." Economic Growth, Competition and World Markets edited by P. D. Bennett. Chicago: American Marketing Association, 1965. pp. 631-54.
- \_\_\_\_\_, and Richartz, L. E. Vertical Marketing Structures. Boston: Allyn and Bacon, Inc., 1967.
- Bartels, Robert. Marketing Theory and Metatheory. Homewood, Ill.: Richard D. Irwin, Inc., 1970.
- Bass, Frank M., and Wilkie, William L. "A Comparative Analysis of Attitudinal Predictions of Brand Preference." Journal of Marketing Research, Vol. 10, No. 3 (August 1973), pp. 262-69.
- Baumal, William J., and Ide, E. A. "Variety in Retailing." Management Science, Vol. 2 (October 1956), pp. 93-101.
- Bellenger, Danny; Steinberg, Earle; and Stanton, Wilbur. "The Congruence of Store Image and Self Image." Journal of Retailing, Vol. 52, No. 1 (Spring 1976), pp. 17-32.
- Berg, Thomas L. "Designing the Distribution System." The Social Responsibilities of Marketing edited by W. D. Stevens. Chicago: American Marketing Association, 1962. pp. 481-90.
- Berry, Leonard L. "The Components of Department Store Image: A Theoretical and Empirical Analysis." Journal of Retailing, Vol. 45, No. 1 (Spring 1969), pp. 3-20.
- Birdwell, Al E. "A Study of the Influence of Image Congruence on Consumer Choice." Journal of Business, Vol. 41, No. 1 (January 1968), pp. 76-88.
- Bogart, Leo. "The Future of Retailing." Harvard Business Review, Vol. 51 (November-December 1973), pp. 16-28.
- Bowersox, Donald J. "Physical Distribution Development, Current Status and Potential." Journal of Marketing, Vol. 33, No. 1 (January 1969), pp. 63-70.
- \_\_\_\_\_. Logistical Management. New York: The Macmillian Company, 1974.
- \_\_\_\_\_; Cooper, M. Bixby; Lambert, Douglas M.; and Taylor Donald S. Management in Marketing Channels. New York: McGraw-Hill Book Company, 1980.
- Boyd, Harper W., Jr., and Massy, William F. Marketing Management. New York: Harcourt Brace Jovanovich, 1972.

Breyer, Ralph F. Quantitative Systematic Analysis and Control: Study No. 1--Channel and Channel Group Costing. Philadelphia, Pa.: Ralph F. Breyer, 1949.

\_\_\_\_\_. "Some Observation on "Structural" Formation and the Growth of Marketing Channels." Theory in Marketing edited by Reavis Cox, Wroe Alderson, and Stanley J. Shapiro. Homewood, Ill.: Richard D. Irwin, Inc., 1964. pp. 163-75.

Bucklin, Louis P. "The Economic Structure of Channels of Distribution." Marketing: A Maturing Discipline edited by Martin L. Bell. Chicago: American Marketing Association, 1960. pp. 370-85.

\_\_\_\_\_. "Retail Strategy and the Classification of Consumer Goods." Journal of Marketing, Vol. 27, No. 1 (January 1963), pp. 50-55.

\_\_\_\_\_. "Postponement, Speculation and the Structure of Distribution Channels." Journal of Marketing Research, Vol. 2, No. 1 (February 1965), pp. 26-31.

\_\_\_\_\_. A Theory of Distribution Channel Structure. Berkeley, California: Institute of Business and Economic Research, University of California, 1966.

\_\_\_\_\_. "Management of the Channel." Managerial Analysis in Marketing edited by Sturdivant, et al. Glenview, Ill.: Scott, Foresman and Company, 1970. pp. 620-62.

\_\_\_\_\_. Vertical Marketing System. Glenview, Ill.: Scott, Foresman and Company, 1970.

\_\_\_\_\_. Competition and Evolution in the Distributive Trades. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.

\_\_\_\_\_. "The Locus of Channel Control." Marketing and the New Science of Planning edited by Robert L. King. Chicago: American Marketing Association, 1973. pp. 28-40.

\_\_\_\_\_. "A Theory of Channel Control." Journal of Marketing, Vol. 37, No. 1 (January 1973), pp. 39-47.

\_\_\_\_\_, and Ellis, R. G. "On Optimizing the Number of Distributors." Working Paper, No. 25. Berkeley, California: Institute of Business and Economic Research, University of California, 1968.

Buzzell, Robert D.; Gale, Bradley T.; and Sulton, Ralph G. M. "Market Share--A Key to Profitability." Harvard Business Review, No. 53 (January-February 1975), pp. 97-106.

Cairns, James P. "Suppliers, Retailers, and Shelf-space." Journal of Marketing, Vol. 26, No. 3 (July 1962), pp. 34-36.

- \_\_\_\_\_. "Allocate Space for Maximum Profits." Journal of Retailing, Vol. 39, No. 2 (Summer 1963), pp. 41-45+.
- Charnes, A., and Cooper, W. W. Management Models and Industrial Applications of Linear Programming, 2 volumes. New York: John Wiley and Sons, Inc., 1961.
- Clark, Fred E. Principles of Marketing. New York: The Macmillan Company, 1923.
- Clewett, Richard M., ed. Marketing Channels for Manufactured Products. Homewood, Ill.: Richard D. Irwin, Inc., 1954.
- Corstjens, Marcel, and Doyle, Peter. "Channel Optimization in Complex Marketing Systems." Management Science, Vol. 25, No. 10 (October 1979), pp. 1014-25.
- Cox, Reavis, and Goodman, Charles S. "Marketing of House Building Materials." Journal of Marketing, Vol. 21, No. 3 (July 1959), pp. 36-61.
- Cox, Reavis, and Schutte, Thomas F. "A Look at Channel Management." Marketing Involvement in Society and the Economy edited by Philip McDonald. Chicago: American Marketing Association, 1969. pp. 99-105.
- Cox, Reavis; Alderson, Wroe; and Shapiro, Stanley J., eds. Theory in Marketing, Second series, prepared under the sponsorship of the American Marketing Association. Homewood, Ill.: Richard D. Irwin, Inc., 1964.
- Dalrymple, Douglas J. "Controlling Retail Inventories." Journal of Retailing, Vol. 40, No. 1 (Spring 1964), pp. 9-14.
- Davidson, William R. "Changes in Distributive Institutions." Journal of Marketing, Vol. 34, No. 1 (January 1970), pp. 7-10.
- Dodge, Robert H., and Summer, Harry N. "Choosing Between Retail Stores." Journal of Retailing, Vol. 45, No. 3 (Fall 1969), pp. 11-21.
- Dommermuth, William P., and Clifton, Anderson R. "Distributive Systems--Firms, Functions and Efficiencies." MSU Business Topics, Vol. 17 (Spring 1969), pp. 51-56.
- Dornoff, Ronald, and Tatham, Ronald. "Congruence Between Personal Image and Store Image." Journal of the Market Research Society, Vol. 14, No. 1 (January 1972), pp. 42-52.
- Duncan, Delbert J.; Philips, Charus F.; and Hollander, Stanley C. Modern Retailing Management: Basic Concept and Practices. 8th edition. Homewood, Ill.: Richard D. Irwin, Inc., 1972.

El-Ansary, Adsel I. "A Model for Power-Dependence Relations in the Distribution Channel." Relevance in Marketing edited by Fred C. Allvine. Chicago: American Marketing Association Fall Conference Proceedings, 1971. pp. 200-203.

\_\_\_\_\_. "Determinants of Power Dependence in the Distribution Channel." Journal of Retailing, Vol. 51, No. 2 (Summer 1975), pp. 59-74.

\_\_\_\_\_, and Robicheaux, Robert A. "A Theory of Channel Control: Revisited." Journal of Marketing, Vol. 38, No. 1 (January 1974), pp. 2-7.

\_\_\_\_\_. "A General Model for Understanding Channel Member Behavior." Journal of Retailing, Vol. 51, No. 4 (Winter 1975-76), pp. 20-32.

El-Ansary, Adsel I., and Stern, Louis W. "Power Measurement in the Distribution Channel." Journal of Marketing Research, Vol. 9, No. 1 (February 1972), pp. 47-52.

Ellwein. "A Flexible Enumeration Scheme for Zero-one Programming." Operations Research, Vol. 22 (1974), pp. 144-50.

Enis, Ben M., and Paul, Gordon W. "Store Loyalty: Characteristics of Shoppers and Switchers." Journal of Business, Vol. 41 (July 1968), pp. 266-76.

\_\_\_\_\_. "'Store Loyalty' as a Basic for Market Segmentation." Journal of Retailing, Vol. 46, No. 3 (Fall 1970), pp. 42-56.

Etgar, Michael. "Channel Domination and Countervailing Power in Distribution Channels." Journal of Marketing Research, Vol. 13, No. 3 (August 1976), pp. 254-62.

Fisk, George. "A Conceptual Model for Studying Customer Image." Journal of Retailing, Vol. 17, No. 4 (Winter 1961-62), pp. 1-8.

Forrester, J. W. "Industrial Dynamics." Harvard Business Review, Vol. 36 (July-August 1958), pp. 37-66.

Fry, J. N., and Clayton, J. D. "Semantic Differential and Nonmetric Multidimensional Scaling Description of Brand Images." Journal of Marketing Research, Vol. 8, No. 2 (May 1971), pp. 238-40.

Glover, F. "Multi-phase Dual Algorithm for the Zero-one Integer Programming Problems." Operations Research, Vol. 13 (1965), pp. 879-919.

Guiltinan, Joseph P. "Planned and Evolutionary Changes in Distribution Channels." Journal of Retailing, Vol. 50, No. 2 (Summer 1974), pp. 79-91.

- Hall, Margaret. "Economic Analysis of Retail Trade." Marketing Channels: A Systems Viewpoint edited by William G. Moller, Jr., and David L. Wilemon. Homewood, Ill.: Richard D. Irwin, Inc., 1971. pp. 149-59.
- Hansen, Robert A., and Deutscher, Terry. "An Empirical Investigation of Attribute Importance in Retail Store Selection." Journal of Retailing, Vol. 53, No. 4 (Winter 1977-78), pp. 59-72+.
- Harper, Marion, Jr. "A New Profession to Aid Management." Journal of Marketing, Vol. 25, No. 1 (January 1961), pp. 1-5.
- Hartung, Philip H., and Fisher, James L. "Brand Switching and Mathematical Programming in Market Expansion." Management Science, Vol. 11, No. 10, Series B (August 1965), pp. 231-43.
- Heskett, James L.; Stern, Louis W.; and Beier, Frederick J. "Bases and Uses of Power in Interorganization Relations." Vertical Marketing System edited by Louis P. Bucklin. Glenview, Ill.: Scott, Foresman and Company, 1970. pp. 75-93.
- Hill, Richard M.; Alexander, Ralph S.; and Cross, James G. Industrial Marketing. 4th edition. Homewood, Ill.: Richard D. Irwin, Inc., 1957.
- Hollander, Stanley. "The Wheel of Retailing." Journal of Marketing, Vol. 24, No. 3 (July 1960), pp. 37-42.
- Hunt, Shelby D., and Nevin, John R. "Power in a Channel Distribution: Sources and Consequences." Journal of Marketing Research, Vol. 11, No. 2 (May 1974), pp. 186-93.
- Jain, Arun K., and Etgar, Michael. "Measuring Store Image Through Multi-dimensional Scaling of Free Response Data." Journal of Retailing, Vol. 52, No. 4 (Winter 1976-77), pp. 61-70.
- James, Don L.; Durand, Richard M.; and Dreves, Robert A. "The Use of a Multi-Attribute Attitude Model in a Store Image Study." Journal of Retailing, Vol. 52, No. 2 (Summer 1976), pp. 23-32.
- Jolson, Marvin A., and Spath, Walter F. "Understanding and Fulfilling Shoppers' Requirements." Journal of Retailing, Vol. 49, No. 2 (Summer 1973), pp. 38-50.
- Kelly, Robert F., and Stephenson, Ronald P. "Semantic Differential: An Information Source for Designing Retail Patronage Appeals." Journal of Marketing, Vol. 16, No. 4 (October 1967), pp. 43-47.
- Kollat, David T.; Blackwell, Robert D.; and Robeson, James F. Strategic Marketing. New York: Holt, Rinehart and Winston, Inc., 1972.

- Kotler, Philip. Marketing Decision Making: A Model Building Approach. New York: Holt, Rinehart and Winston, Inc., 1971.
- Kunkel, John H., and Berry, Leonard L. "A Behavioral Conception of Retail Image." Journal of Marketing, Vol. 32, No. 4 (October 1968), pp. 21-27.
- Lambert, Douglas M. The Distribution Channels Decision. New York: National Association of Accountants, 1978.
- Lambert, Eugene W., Jr. "Financial Considerations in Choosing a Marketing Channel." MSU Business Topics, Vol. 14 (Winter 1966), pp. 17-26.
- Lee, Sang M. Goal Programming for Decision Analysis. Philadelphia, Pa.: Auerbach Publishers, Inc., 1972.
- \_\_\_\_\_. "LEESGP: Program for Goal Programming." Journal of Marketing Research, Vol. 10, No. 2 (May 1973), pp. 198-99.
- \_\_\_\_\_, and Morris, R. "Integer Goal Programming Methods." Management, TIMs Studies, No. 6 (1977), pp. 273-89.
- \_\_\_\_\_, and Nicely, Roy E. "Goal Programming for Marketing Decision: A Case Study." Journal of Marketing, Vol. 38, No. 1 (January 1974), pp. 24-32.
- Leed, T. W. "Another Look at Image Studies." Journal of Food Distribution Research, Vol. 7, No. 1 (February 1976), pp. 113-15.
- Lessig, V. Parker. "Relating Multivariate Measures of Store Loyalty and Store Image." AMA Conference, 1972.
- \_\_\_\_\_. "Consumer Store Images and Store Loyalties." Journal of Marketing, Vol. 37, No. 4 (October 1973), pp. 72-74.
- Lewis, Edwin H. Marketing Channels: Structure and Strategy. New York: McGraw-Hill, Inc., 1968.
- Lewis, Richard J., and Erickson, Leo G. "Marketing Functions and Systems: A Synthesis." Journal of Marketing, Vol. 33, No. 3 (July 1969), pp. 10-14.
- Lindquist, Jay D. "Meaning of Image." Journal of Retailing, Vol. 50, No. 4 (Winter 1974-75). pp. 29-38.
- Little, Robert W. "The Marketing Channel: Who Should Lead This Extra-Corporate Organization?" Journal of Marketing, Vol. 34, No. 1 (January 1970), pp. 31-38.



- McCammon, Bert C., Jr. "Alternative Explanations of Institutional Change and Change Evolution." Toward Scientific Marketing edited by Stephen A. Greyser. Chicago: American Marketing Association, 1963, pp. 477-90.
- \_\_\_\_\_. "Perspectives in Distribution Programming." Vertical Marketing Systems edited by Louis P. Bucklin. Glenview, Ill.: Scott, Foresman and Company, 1970. pp. 32-51.
- \_\_\_\_\_, and Bates, Albert D. "The Emergence and Growth of Contractually Integrated Channels in the American Economy." Marketing and Economic Development edited by Peter D. Bennett. Chicago: American Marketing Association, 1965, pp. 321-85.
- \_\_\_\_\_, and Little, Robert W. "Marketing Channels: Analytical Systems and Approaches." Science in Marketing edited by George Schwarts. New York: John Wiley and Sons, Inc., 1965. pp. 321-85.
- McDonald, A. L., Jr. "Do Your Distribution Channels Need Reshaping?" Business Horizons, Vol. 7, No. 2 (Summer 1964), pp. 29-38.
- McVey, Phillip. "Are Channels of Distribution What the Textbooks Say?" Journal of Marketing, Vol. 24, No. 1 (January 1960), pp. 61-64.
- Mallen, Bruce. "A Theory of Retailer-Supplier Conflict, Control, and Cooperation." Journal of Retailing, Vol. 39, No. 2 (Summer 1963), pp. 24-32+.
- \_\_\_\_\_. "Functional Spin-off: A Key to Anticipation Change in Distribution Structure." Journal of Marketing, Vol. 37, No. 3 (July 1973), pp. 18-25.
- Marcus, Burton H. "Image Variation and the Multi-Unit Retail Establishment." Journal of Retailing, Vol. 48, No. 2 (Summer 1972), pp. 29-43.
- Marks, Ronald B. "Operationalizing the Concept of Store Image." Journal of Retailing, Vol. 52, No. 3 (Fall 1976), pp. 37-46.
- Martilla, John A., and James, John C. "Importance-Performance Analysis." Journal of Marketing, Vol. 41, No. 1 (January 1977), pp. 77-79.
- Martineau, Pierre. "The Personality of the Retail Store." Harvard Business Review, Vol. 36 (January-February 1958), pp. 47-55.
- May, Eleanor G. "Management Applications of Retail Image Research." A Marketing Science Institute Working Paper (September 1973), pp. 25-62.
- \_\_\_\_\_. "Practical Applications of Recent Retail Image Research." Journal of Retailing, Vol. 50, No. 4 (Winter 1974-75), pp. 15-20.

- Michiman, Ronald. "Channel Development and Innovation." Marquette Business Review, Vol. 15 (Spring 1971), pp. 45-49.
- Montgomery, David, and Urban, Glenn. Management Science in Marketing. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1960.
- Murphy, John, and Coney, Kenneth A. "Comments on 'Consumer Store Images and Store Loyalties'." Journal of Marketing, Vol. 39, No. 3 (July 1975), pp. 64-66.
- Naert, Philippe A. "Optimizing Consumer Advertising, Intermediary Advertising, and Markup in a Vertical Market Structure." Management Science, Vol. 18, No. 4, Part II (December 1971), pp. 90-101.
- Oxenfeldt, Alfred, and Kelly, Anthony. "Will Successful Franchise Systems Ultimately Become Wholly-Owned Chains?" Journal of Retailing, Vol. 44, No. 4 (Winter 1968-69), pp. 69-85.
- Pessemier, Edgar A. Product Management Strategy and Organization. New York: John Wiley and Sons, Inc., 1977.
- \_\_\_\_\_. "Retail Patronage Behavior." Working Paper. West Lafayette, Ind.: Kramert Graduate School of Management, Purdue University, 1979.
- \_\_\_\_\_. "Store Image and Positioning." Working Paper. West Lafayette, Ind.: Kramert Graduate School of Management, Purdue University, 1979.
- Peyson, Roger M. "Selecting and Evaluating Distribution." Business Policy Study, No. 116. New York: National Industrial Conference Board, 1965. pp. 93-113.
- Revzan, David A. Wholesaling in Marketing Organization. New York: John Wiley and Sons, Inc., 1961.
- Ring, Lawrence J. "Retail Positioning: A Multiple Discriminant Analysis Approach." Journal of Retailing, Vol. 55, No. 1 (Spring 1979), pp. 25-36.
- Rosenberg, Larry J., and Stern, Louis W. "Toward the Analysis of Conflict in Distribution Channels: A Descriptive Model." Journal of Marketing, Vol. 34, No. 4 (October 1970), pp. 40-46.
- \_\_\_\_\_. "Conflict Measurement in the Distribution Channel." Journal of Marketing Research, Vol. 8, No. 4 (November 1971), pp. 437-42.
- Rosenbloom, Bert. "Conflict and Channel Efficiency: Some Conceptual Models for the Decision Maker." Journal of Marketing, Vol. 37, No. 3 (July 1973), pp. 26-30.

- Ruhuke, H. O. "Vertical Integration: Trend for the Future." Advanced Management Journal (January 1966), pp. 69-73.
- Schiffman, L.; Dash, J.; and Dillon, W. "The Contribution of Store Image Characteristics to Store-Type Choice." Journal of Retailing, Vol. 53, No. 2 (Summer 1977), pp. 2-14.
- Singson, Richard L. "Multidimensional Scaling Analysis of Store Image and Shopping Behavior." Journal of Retailing, Vol. 51, No. 2 (Summer 1975), pp. 38-52+.
- Stern, Louis W. "Channel Control and Interorganizational Management." Marketing and Economic Development edited by Peter D. Bennett. Chicago: American Marketing Association, 1965. pp. 655-65.
- \_\_\_\_\_. "The concept of Channel Control." Journal of Retailing, Vol. 43, No. 2 (Summer 1967), pp. 14-20+.
- \_\_\_\_\_, and El-Ansary, Adsel I. Marketing Channels. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1977.
- \_\_\_\_\_, and Heskett, J. C. "Conflict Management in Interorganization Relations: A Conceptual Framework." Distribution Channels: Behavioral Dimensions edited by Louis W. Stern. Boston: Houghton Mifflin Company, 1969.
- Sturdivant, Fred. "Determinants of Vertical Integration." Toward Scientific Marketing edited by Stephen A. Greyser. Chicago: American Marketing Association, 1963. pp. 491-506.
- Swartz, George. "Buyer Study: Quantitative Systematic Analysis and Control." Development of Marketing Theory edited by George Swartz. Cincinnati, Ohio: Southwestern Publishing Co., 1963. pp. 121-23.
- Walter, C. K., and Grabner, J. R. "Stockout Cost Models: Empirical Tests in a Retail Situation." Journal of Marketing, Vol. 39, No. 3 (July 1975), pp. 56-60.
- Walters, Glenn C. Marketing Channels. Santa Monica, California: Goodyear Publishing Co., 1977.
- Weigand, Robert E. "The Marketing Organization, Channels, and Firm Size." Journal of Business, Vol. 36 (April 1963), pp. 228-36.
- \_\_\_\_\_. "Fit Products and Channels to Your Markets." Harvard Business Review, Vol. 55 (January-February 1977), pp. 95-105.
- Weber, John A. "Marketing Structure Profile Analysis and Strategic Growth Opportunities." California Management Review, Vol. 20, No. 1 (Fall 1977), pp. 34-46.

Weiss, Edward B. "How Much of a Retailer is the Manufacturer?"  
Advertising Age, Vol. 29, No. 29 (July 1958), pp. 68-75.

Wyckham, Robert G.; Lazer, William; and Crissy, William J. E., eds.  
Image Marketing: A Selected and Annotated Bibliography. Chicago:  
American Marketing Association, 1971.

MICHIGAN STATE UNIV. LIBRARIES



31293000625198