

Chapter 1

Mathematical Marketing Models: Some Historical Perspectives and Future Projections

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There is an old cartoon, first published in the *New Yorker* magazine, showing two executives at a cocktail party. One says to the other, 'So you're in marketing. That's funny, in my family, my wife does the marketing'.

The image of the field of marketing has, to this day, retained some of the vague, intuitive flavor that the above cartoon suggests. When the term 'marketing' comes to mind, many people think of 'pet rocks', cans of 'New York City air', and the cyclical movement of hemlines in women's fashions; the analysis of the demand for such items seems well removed from the reliance on mathematical models that characterizes much of the work in operations research and management science (OR/MS).

Indeed, many company executives despair of putting marketing on a more scientific basis. Many see marketing processes as lacking the neat quantitative properties found in production and finance. In marketing, human factors play a large role, marketing expenditures affect demand and cost simultaneously and information to support truly systematic decisions is rarely available. Further, the effects of most marketing actions are typically delayed, nonlinear, stochastic and difficult to measure.

Yet, the OR/MS developments in marketing have been profound and substantial: the chapters of this book describe a significant literature, sketching a broad range of applications of OR/MS in marketing. A major force behind these developments is the battle for markets that has been dictating organizational success and failure in recent years. Sales in many markets are flat or declining while competitors have been growing in number and becoming more desperate. Products are exhibiting shorter life-cycles, and leaner staff organizations have become buried in oceans of new types of data (from bar-code scanners and other sources), demanding rapid comprehension and sound decision making in dynamic and risky environments.

This book represents the state of the art in the OR/MS approach applied to marketing problems. Each of the chapters develops the concepts and describes key mathematical models in specific areas of marketing, leading the reader up to the current state of affairs and projecting future developments. Before proceeding, however, it is appropriate to reflect a bit on the history of this field.

1. Reflections on the past

The OR/MS field emerged during and after World War II, focusing primarily on problems in production, operations, and logistics. Early successes in those areas encouraged analysts to engage in a broader set of problems. The OR/MS literature in marketing began to emerge in a significant way in the 1960s.

At that time, several authors provided classification schemes that were useful in trying to organize the growing literature on marketing models. Several of those schemes were:

- iconic vs analog vs symbolic models [King, 1967],
- descriptive vs predictive vs normative models [Montgomery & Urban, 1969],
- macromarketing vs micromarketing models [Kotler, 1971].

For the purpose of this paper, we will use a classification scheme that focuses purely on the purpose of the model.

There are essentially three purposes for modeling in marketing: measurement, decision-making, and theory-building. We will call the corresponding models measurement models, decision-making models, and stylized theoretical models, respectively (although it may be equally helpful to interpret these ‘categories’ as classification dimensions for interpreting the multiple purposes of models).

1.1. Measurement models

The purpose of measurement models is to measure the ‘demand’ for a product as a function of various independent variables. The word ‘demand’ here should be interpreted broadly. It is not necessarily units demanded but could be some other related variable. For example, in conjoint measurement models, the most crucial variable in determining demand is the individual’s preference for a choice alternative. In models of diffusion of new durables, the demand variable is captured mainly through ‘sales to first adopters’. In some choice models, the dependent variable is whether or not an individual made a purchase of a given brand on a given purchase occasion.

The independent variables in measurement models are usually marketing mix variables – again interpreted broadly to mean any variables the firm controls – but they could include variables to account for seasonality in employment, GNP, consumer characteristics, and competitors’ actions. In conjoint measurement models, for example, the independent variables are usually the attributes of the choice alternatives. Diffusion models typically have ‘cumulative sales since introduction’ as one of the independent variables. Other choice models have several