

Marketing Models: Reflections and Predictions

Jehoshua ELIASHBERG (*)
Gary L. LILIEN ()**

(*) University of Pennsylvania, Philadelphia, U.S.A.

(**) The Pennsylvania State University, University Park, U.S.A.

Marketing Models: Reflections and Predictions*

Jehoshua Eliashberg
University of Pennsylvania

and

Gary L. Lilien
Penn State University

Abstract

We show that the past several decades have seen explosive growth in the development and dissemination of marketing models. While developments have not matched all the field's early goals, achievements in the marketing models area have been dramatic. We provide a personal perspective on past accomplishments in the field and outline nine areas we anticipate will see some exciting development in the next few years.

* Portions of this paper are adapted from Eliashberg and Lilien (1993).

I. Introduction

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 so-called "marketing models."

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, marketing model developments have been profound and substantial. 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.

In this paper we reflect on the development, evolution and future of the marketing models field. We will show substantial developments, trends and what we feel are exciting areas for future development in the sections to follow.

II. Categorizing Marketing Models

The marketing models literature began to emerge in a significant way in the 1960s, following the successful application of mathematical models to the areas of production, operations and logistics during and immediately following World War II.

At that time, several authors provided some 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 (Montgomery and Urban, 1969)

Macromarketing vs Micromarketing (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).

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 Bass's (1969) model of diffusion of new durables, the demand variable is "sales to first adopters." In Guadagni and Little's (1983) model, the dependent variable is the probability that an individual will purchase a given brand on a given purchase occasion (Exhibits 1a and 1b).

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.

$$Q_t = p(\bar{Q} - N_t) + r\left(\frac{N_t}{Q}\right)(\bar{Q} - N_t) = \left(p + r\frac{N_t}{Q}\right)(\bar{Q} - N_t)$$

innovation effect	imitation effect
or	or
external influence	internal influence

where

- Q_t = number of adopters at time t
- \bar{Q} = ultimate numbers of adopters
- N_t = cumulative number of adopters to date
- r = effect of each adopter on each nonadopter
(coefficient of internal influence)
- p = individual conversion ratio in the absence of adopters'
influence (coefficient of external influence)

Exhibit 1a. Bass's (1969) model of innovation diffusion (in discrete time form).

$$p_k = \frac{e^{v_k}}{\sum_{j \in S_i} e^{v_j}}$$

where	v_k	=	(deterministic) component of individual i's utility for brand k
	S_i	=	individual i's set of brand alternatives
	P_k	=	probability of choosing brand i
and	v_k	=	$\sum_j b_{jk} x_{jk}$
where	x_{jk}	=	observed value of attribute j for alternative k
and	b_{jk}	=	utility weight of attribute j

Exhibit 1b. Guadagni and Little's (1983) multinomial logit model of brand choice.

Other choice models have several independent variables including whether or not the brand was on deal at a given purchase occasion, regular price of the brand, deal price (if any), brand loyalty of the individual, etc. These examples suggest that measurement models can deal with individual (disaggregate) demand or aggregate (market-level) demand.

Once the demand functions have been specified, they are then "calibrated" to measure the parameters of the function. Calibration reveals the role of various independent variables in determining demand for this project: which variables are more important and which are less. Also, once the demand function has been calibrated, it can be used to predict demand as well as other relevant performance measures in a given situation. A variety of methods have been used to calibrate demand functions: judgment, econometric techniques, experimentation, simulation, etc.

Note that advances in measurement models can be due to better data (scanner data, for example) or better calibration methods and procedures (maximum likelihood methods for generalized logit models, for example).

Decision-Making Models. Models are designed to help marketing managers make better decisions. They incorporate measurement models as building blocks, but go beyond measurement models in recommending marketing-mix decisions for the manager. The methods used to drive the optimal policies vary across applications, and include calculus, dynamic programming, optimal control and calculus of variations techniques, as well as

linear and integer programming, and simulation. A classical example is Little and Lodish's (1969) MEDIAC model for developing media schedules. They develop an underlying measurement model here, relating sales in each segment to advertising exposure level. That model is calibrated by managerial judgment. The estimated sales-response function is then maximized to develop an optimal media schedule using a variety of maximization techniques--dynamic programming, piecewise linear programming, heuristic methods--and incorporating various technical and budgetary constraints.

Exhibit 2 shows a general framework for a marketing-decision-making system. Note the dashed arrow leading from "marketer actions" to "competitive reactions." This is to recognize that, unlike other environmental variables, competitors' actions could be affected by "our actions (and even by announcements concerning our intended actions).

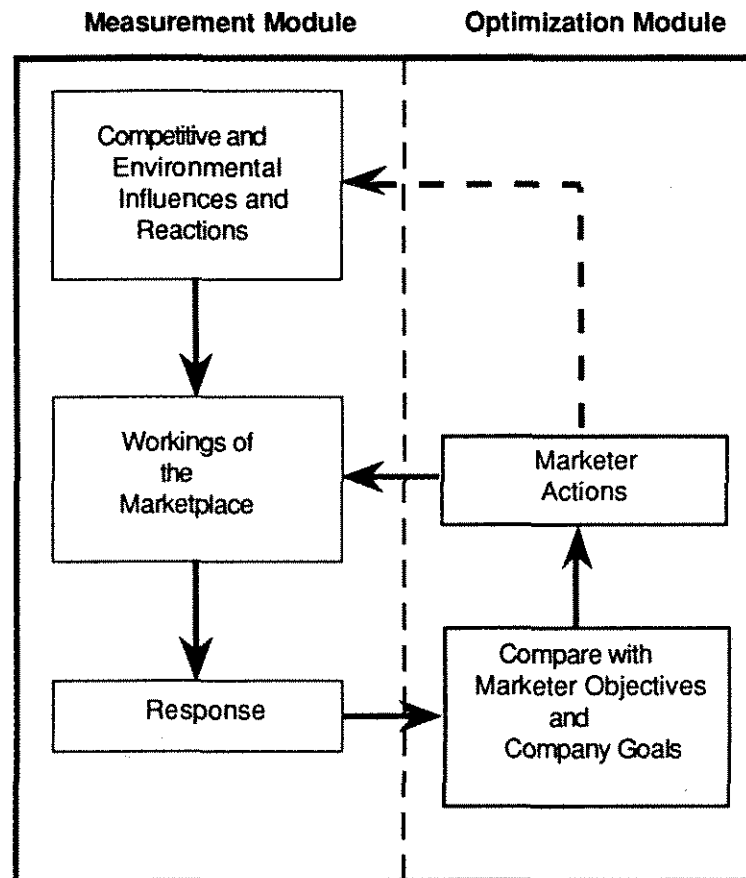


Exhibit 2. A decision-making system, showing measurement and optimization modules.

Stylized Theoretical Models. The purpose of stylized theoretical models is to explain and provide insights into marketing phenomena: a stylized theoretical model typically begins with a set of assumptions that describes a particular marketing environment. Some of these assumptions are purely mathematical, at best intuitively logical, designed to make the analysis tractable. Others are substantive assumptions with real empirical grounding. They can

describe such things as who the actors are, how many of them there are, what they care about, the external conditions under which they make decisions, how they have behaved in the past, etc. It is these latter assumptions that will participate in the explanation being offered. Note that the concept of a model in a stylized theoretical fashion is different from the concept of a decision-making model. A decision-making model is defined as a "mathematical description of how something works" and it often takes the point of view of one particularly interested party. A stylized theoretical model is simply a setting--a subset of the real-world--in which "the action takes place." It often takes the viewpoint of an outside (objective) third party

Once a theoretical model has been built, the model builder analyzes its *logical* implications for the phenomenon being explored. Then another model, *substantively different from the first*, is built--very likely by another model-builder--and its implications are analyzed. The process may continue with a third and a fourth model, if necessary, until all the ramifications of the explanation being proposed have been examined. By comparing the implications of one model with those of another, and by tracing the differences to the different assumptions in the various models, we can develop a theory about the phenomena in question (see Exhibit 3). This is as if a logical experiment was being run, with the various models as the "treatments." The key difference from empirical experiments is that, whereas in empirical experiments the subject produces the effects, here the researcher produces the effects by logical argument and (often) mathematical analysis.

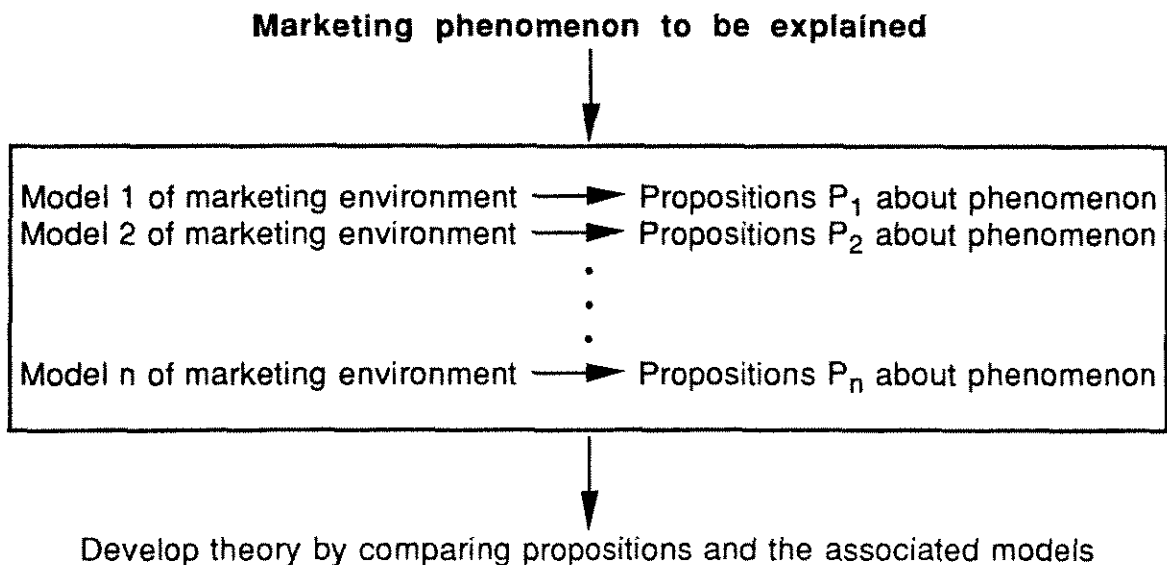


Exhibit 3. Overview of the theoretical modeling process.

As an example consider Exhibit 4, where two key variables driving the design of optimal salesforce compensation plans are displayed: salesperson attitude toward risk and observability of salesperson effort. In Model 1, the simplest model, where the salesperson is risk neutral and effort is observable, any combination of salary (certain) and commission (risky) will be equally

attractive to the risk-neutral salesperson. In contrast, in Model 3, where the salesperson's effort is unobservable, a pure commission scheme (based on gross margin) induces the salesperson to work in the firm's best interest (while maximizing his income) (Farley, 1964). With risk averse salespeople and unobservable effort (Model 4), under some technical conditions, the optimal compensation scheme involves both salary and commission (Grossman and Hart, 1983; Basu et al., 1985). Note that different model builders have provided the results in different cells of the matrix (Moorthy, 1990).

		Salesperson Attitude Toward Risk	
		RISK NEUTRAL	RISK AVERSE
Observability of Salesperson Effort	OBSERVABLE	Model 1 Any combination of salary and commission	Model 2 All salary
	UNOBSERVABLE	Model 3 Pure commission	Model 4 Specific mixture of salary and commission*

*Under some technical conditions

Exhibit 4. The experimental design for stylized theoretical models for optimal salesforce compensation. Different model builders have provided the results in different cells of the matrix.

Exhibit 5 looks like a 2 x 2 experimental design with two factors and two levels of each factor. Comparing model 1 versus 2 and model 3 versus 4 shows that risk preference has a "main effect" on the optimal compensation plan: with risk neutrality salaries are not needed, with risk aversion, salaries are not needed. One sees similar main effects on the need for commissions with observability. Interactions appear as well. (Coughlan (1993) discusses salesforce compensation literature in more detail.)

The main purpose of theoretical modeling is pedagogy--teaching us how the real world operates--and that purpose is well served by internally valid theoretical experiments. But what about the practical use of such work for marketing managers? Such models are of direct value to managers when they

uncover robust results that are *independent* of the unobservable features of the decision-making environment. Under these circumstances the models have two uses: (1) as direct *qualitative* guidance for policy (in our situation, we need low (high) proportions of salesforce compensation in commissions") and (2) as the basis for specifying operational models and associated models associated decision-making systems that can adapt the theory to a particular environment and generate *quantitative* prescriptions.

Technique	Typical Area(s) of Application
<ul style="list-style-type: none"> • Poisson Processes • Differential Equations • Stochastic Processes • Decision Theory/Analysis • Mathematical Programming • Computer Simulation • Game Theory 	<ul style="list-style-type: none"> • Effect of Promotional Effort on Sales • Effect of Advertising on Sales • Consumers Brand Choice • Evaluation of Marketing Research Expenditures • Advertising Decision-Making • Advertising Media Selection • Warehouse Location • Microsimulation of Market Processes and Behavior • Competitive Advertising Expenditures

Exhibit 5. A sample of OR/MS methodology applied to marketing problems prior to 1970.

III. The Evolution of Marketing Models

The Early Years. Exhibit 5 synthesizes a range of OR/MS techniques and the typical problems that they were applied to in the 1960s. Those problems (Kotler, 1971) include product decisions, pricing decisions, distribution system decisions, salesforce management decisions, advertising and mass communication decisions, and promotion decisions. The OR/MS tools that seemed most prevalent in the 1960s and earlier include mathematical programming, computer simulations, stochastic models of consumer choice behavior, response function analysis and various forms of dynamic modeling (difference and differential equations, usually of first order). Some uses of game theory were reported for competitive situations, but most studies involving competition used decision analysis, risk analysis or marketing simulation games.

Note that most of the models being published in the 1960s era were of the "measurement model" and "decision-making model" variety, introduced earlier and that the volume of research was more modest than in recent years (Exhibit 6).

Our impression is that the OR/MS work in marketing in the 1960s and before was largely produced by individuals trained as engineers, scientists and applied mathematicians, applying the OR/MS approach to the field of marketing rather than by individuals from business schools trained in marketing, the more dominant trend in recent years.

The 1970s: Early Growth Period. As Exhibit 6 indicates, nearly three times the number of marketing articles appeared in the 1970s as appeared in the period from 1952 through 1969.

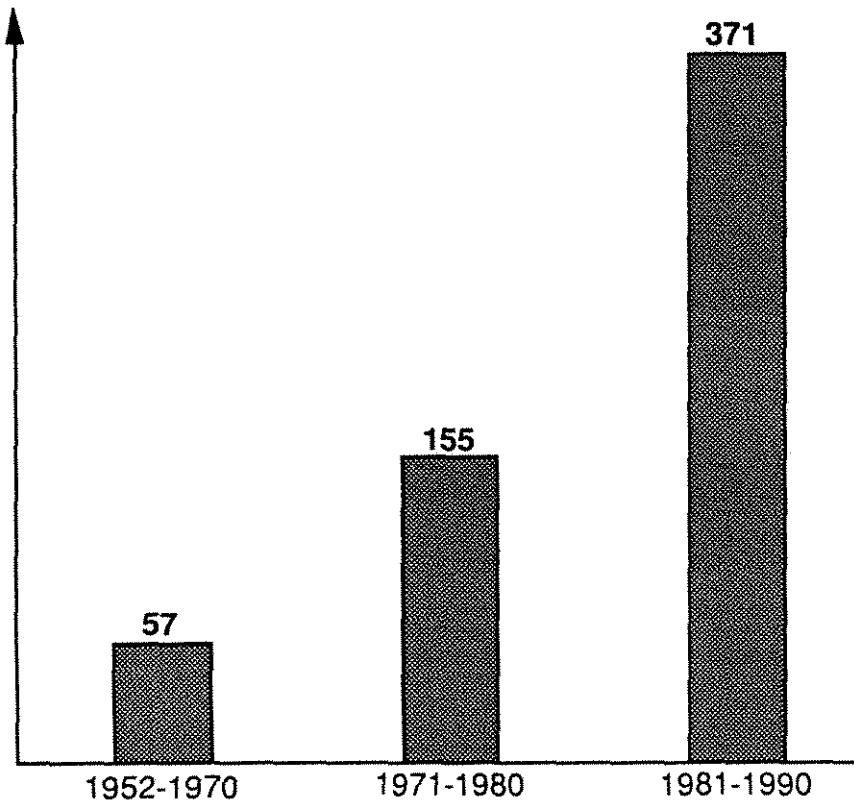


Exhibit 6. Number of articles on marketing topics published in *Management Science*, *Operations Research*, *Interfaces* and *Marketing Science* from 1952-1990 as reported in the *OR/MS Index*, Volumes 1, 2 and 3.

In addition to the increase in numbers of articles, reviews by Schultz and Zoltners (1981) and Lilien and Kotler (1983) reveal that a number of new areas had begun to attract attention in the literature. These included descriptive models of marketing decisions, the impact and interaction of marketing models and organizational design, subjective decision models, strategic planning models, models for public and non-profit organizations, organizational buying models, and the emergence of the concept of the Marketing Decision Support System (MDSS). In addition, while the number of published articles rose dramatically, the impact on organizational performance did not appear to be equally significant, and issues of implementations began to be stressed. Much of the literature in the 1970s pointed to the need for expanding the domain of application in the next decade and beyond. The limitations sections of some of the literature in the 1970s pointed out that many important phenomena that were being overlooked (such as competition, dynamics and interactions amongst marketing decision variables) were both important and inherently more complex to model. Hence, the level of model-complexity and the

insightfulness of the analyses in marketing seemed destined to escalate in the 1980s and beyond.

The 1970s saw growth in the areas of measurement models and decision-making models that had been the foundation of earlier work. However, stylized theoretical models were beginning to emerge, foreshadowing their growth in the 1980s.

The 1980s to the Present. Exhibit 6 demonstrates the explosive growth seen in the marketing models publications in the 1980s in the OR/MS journals that formed the basis for the analysis. Some of that growth was due to the emergence of the journal *Marketing Science*. However, the journal emerged in response to a need to accommodate the volume of OR/MS papers that were being produced in any case, and its appearance coincided with *Operations Research* closing its publication-doors to marketing papers. (We leave the analysis of a feedback effect between the emergence of a new journal and the new papers that that journal may encourage to eager, younger researchers.)

Compared to the earlier decades, the OR/MS in marketing area saw its greatest growth in the emergence of stylized theoretical models. While it is often difficult to derive direct decision-making guidance from stylized theoretical models, many of those models are well grounded in the thirty-plus years of empirical evidence concerning marketing phenomena.

Hence, we have reason to feel that many of the theoretical marketing models are based on well-founded primitives and axioms. In addition, qualitative guidance for policy decisions that can be derived from theoretical models are often of the contingency variety, and can be used as rules in expert systems, as follows. Many expert systems require decision rules with the structure: if (Condition (Event) A or Condition (Event) B), then (Conclusion (Recommendation)C). Stylized theoretical models (confirmed by empirical observation whenever possible) often provide such contingent guidance.

Stylized theoretical modeling of marketing processes represents an important trend in the OR/MS in Marketing area. Such modeling demands greater mathematical sophistication from researchers and readers of that research as well.

Another trend in the 1980s has been a shift from outcome modeling to more process-oriented modeling. The shortening of product lifecycles and the impact of competitive reactions in the marketplace preclude most markets from reaching steady state or equilibrium. Hence such areas as consumer behavior modeling (where the temporal nature of the stimuli that affect consumers reactions has been the focus of some emerging research), the new product area (where the moves and counter-moves of competitors keep the marketplace in a constant state of flux) and negotiations (where the offers/counter-offers of one party provide much information to the other party and can determine the future flow of the negotiation) have seen new modeling approaches.

IV. Marketing Models Today

We all have different impressions about what issues are topical and where the frontiers are or should be in any field. Here are ours.

1. *Marketing Models are having important impact both on academic development in marketing and in marketing practice.* During the 1980s two new and important journals were started: *Marketing Science* and the *International Journal of Research in Marketing (IJRM)*. Both are healthy, popular, and extremely influential, especially among academics. And both reflect the developments of marketing models. In addition, on the practice side from 1980 to 1990, the Edelman Prize Competition (held annually to select the best example of the practice of management science) selected seven finalists in the field of marketing and two winners (Lodish et al., 1988 and Gensch et al. 1990). For two excellent discussions on the application and impact of market models on practice see Little et al. (1993) and Parsons et al. (1993).

2. *New data sources are having a major impact on marketing modeling developments.* One of the single most influential developments of the 1980s has been the impact of scanner data on the marketing models field. There are typically two or more special sessions at national meetings on the use of scanner data, a special interest conference on the topic was held recently, and a special issue of *IJRM* was devoted to the topic. Scanner data and the closely related single source data (where communication consumption data are tied into diary panel data collected by means of scanners) have enabled marketing scientists to develop and test models with much more precision than ever before. Indeed, the very volume of new data has helped spawn tools to help manage the flow of new information inherent in such data (Schmitz, Armstrong and Little, 1990). Relatedly, both the Marketing Departments in *Management Science* and *Marketing Science* have initiated editorial actions to encourage behaviorally-oriented submissions. Such papers provide substantive evidence based on which new marketing theories can be developed and marketing decision-making models further improved.

3. *Stylized theoretical modeling has become a mainstream research tradition in marketing.* While the field of microeconomics has always had a major influence on quantitative model developments in marketing, that influence became most profound in the 1980s. The July 1980 issue of the *Journal of Business* reported on the proceedings of a conference on the interface between Marketing and Economics. In January 1987, the European Institute for Advanced Studies in Management held a conference on the same topic and reported that "the links between the two disciplines were indeed strengthening" (Bultez, 1988). Key papers from that conference were published in issue 4 of the 1988 volume of *IJRM*. Issues 2 and 3 of the 1990 volume of *IJRM* on salesforce management provide several examples of how agency theory (a microeconomic development) is being used to study salesforce compensation. Other major theoretical modeling developments, primarily in areas of pricing, consumer behavior, product policy, promotions, and channel decisions are covered in detail in Lilien et al.(1992); the impact on the field has been dramatic.

4. *New tools and methods are changing the content of marketing models.* The November 1982 issue of the *Journal of Marketing Research* was devoted to causal modeling. A relatively new methodology at the time, causal modeling has become a mainstream approach for developing explanatory models of behavioral phenomena in marketing. New developments have also occurred in psychometric modeling. As the August 1985 special issue of *JMR*

on competition in marketing pointed out, techniques like game theory, optimal control theory, and market share/response models are essential elements of the marketing modeler's tool kit. And finally, the explosion of interest in and the potential of artificial intelligence and expert systems approaches to complement traditional marketing modeling approaches has the potential to change the norms and paradigms in the field. (See the April 1991 special issue on expert systems in marketing of *IJRM* and Rangaswamy, 1993.)

5. *Competition and interaction is the key marketing models game today.* The saturation of markets and the economic fights for survival in a world of relatively fixed potential and resources has changed the focus of interest in marketing models, probably forever. A key-word search of the 1989 and 1990 volumes of *Marketing Science*, *JMR*, and *Management Science* (marketing articles only) reveals multiple entries for "competition," "competitive strategy," "non-cooperative games," "Competitive entry," "Late entry," and "Market structure." These terms are largely missing in a comparable analysis of the 1969 and 1970 issues of *JMR*, *Management Science*, and *Operations Research* (which dropped its marketing section when *Marketing Science* was introduced, but was a key vehicle for marketing papers at that time). (See Moorthy, 1993.)

V. Marketing Models in the 1990s

As we have tried to show above, the marketing models area has had important impact on the practice of marketing as well as on the development of an understanding of the nature of marketing phenomena. That trend will continue--the area is healthy and growing. Let us take a crack at a few extrapolations that we think (and hope) will have a dramatic impact on developments in the marketing models area in the next decade.

1. *Interface Modeling.* Marketing is a boundary-spanning function, linking the selling organization with buyers and channel intermediaries in some way. To operate most effectively, its activities must be coordinated with other functional areas of the firm. An area that has begun to see research is the marketing-manufacturing interface. In this case, the firm is suboptimizing by looking at the marketing function, given a manufacturing decision; the coordination of efforts allows for significant savings in many situations (see Eliashberg and Steinberg, 1993). We expect the interface-modeling area to be explored both theoretically and empirically in the next decade.

2. *Process Modeling.* Models of competition and models of bargaining and negotiations have generally focused on identifying equilibrium (steady-state) outcomes. Yet markets rarely reach such equilibria; indeed, even the equilibria that are obtainable are often determined by the "transient" part of the analysis. We expect that such models will be built and tested (Balakrishnan and Eliashberg, 1990). Those tests will become more doable given the ability of interactive computer networks to capture the dynamics of moves and countermoves in negotiation contexts, for example.

3. *Models of Competition and Coordination.* The markets of the 1990s will be characterized by strategic competition. This means that our models will find those situations (like the tit-for-tat solution to repeated prisoner's dilemma games that induces cooperation; see Axelrod, 1984 and Fader and Hauser, 1988) that induce price coordination in low margin markets, that allow for

mutual "understandings" about permitting monopolies or near monopolies in small market niches and the like. Competitive signaling represents one major paradigm in this direction. This is in contrast to most of the current models of competition that focus on the actionable "warfare" aspects of competition.

4. *Marketing Generalizations.* The concept behind meta-analysis (Farley and Lehman, 1986) should become the norm for the development of operational market response models in the 1990s. It is absurd to analyze data on sales response to price fluctuations, for example, and ignore the hundreds of studies that have previously reported price elasticities. The 1990s will see such "generalizations" become formal Bayesian priors in estimating response elasticities in marketing models. The grouping of our knowledge in this way will allow the discipline to make direct use of the information that it has been accumulating.

5. *New Measurement Technologies.* Single-source data will boost our ability to tie advertising and communications variables into consumer choice models. The increasing and expanded use of electronic forms of communications, data entry, order entry, expanded bar coding, and the like will provide explosions of data that will stimulate the development of marketing models parallel to those that resulted from the introduction of scanner data. For example, it is feasible to capture the complete set of computer screen protocols facing a travel agent when making a client's booking. Since the actual booking (the airline connection chosen, for example) is known, an airline can test the impact of different ways of presenting alternatives to travel agents (time order, price order, alphabetical order, etc.) on both the travel agent's search process (the computer screen options the agent selects) as well as on the final choice. CD ROM and related technologies will enable computer-based questionnaires to incorporate video on-screen demonstrations of product-alternatives within the questionnaire process, hopefully leading to improved measurements and improved models. The implications of such technology for model development, experimentation, and testing are enormous.

With more emphasis on incorporating the voice of the customer in designing new products, we also expect to see more measurement work related to yet unexplored aspects of consumer behavior processes such as consumption/usage experiences as well as post-purchase attitudes and feelings. This would entail, among other things, close examination and understanding of moods and emotional responses in addition to the more traditional examinations of judgment and decision-making. Given the inherent complexities of constructs such as consumer emotions, we expect to see explicit recognition of measurement errors in such contexts.

6. *New Methodologies.* The impact of logit and related choice models had tremendous impact on both marketing model development and applications in the 1980s. (For a striking example of the effect such modeling had at one firm, resulting in an application that won the 1989 Edelman Prize, see Gensch et al., 1990.) We see a similar impact of Bayesian procedures in calibrating marketing models in the 1990s. For example, advances in elicitation of subjective judgments as well as in computation will increasingly allow analysis to exploit coefficient similarity across equations relying on similar data (perhaps from different regions or different market segments) to produce more robust estimates (see Blattberg and George, 1991, for a marketing illustration).

7. *Intelligent Marketing Systems.* The 1970s and early 1980s saw the explosion of Decision Support Systems (DSS) in marketing. (Little, 1979). A DSS can be very powerful, but used inappropriately, can provide results that are either worthless or, possibly, foolish. The 1990s will see the development of a generation of IMSs (Intelligent Marketing Systems) that will have the "autopilots" on board the marketing aircraft (the DSS) to take care of the routine activities and focus the analyst's attention on outliers. Forerunners of such systems are Collopy and Armstrong's (1992) rule-based forecasting procedure and Schmitz, Armstrong and Little's (1990) CoverStory system. Collopy and Armstrong's system relies on a review of published literature on empirical forecasting as well as knowledge from five leading experts to form an "expert base." The system then provides rules for cleaning/adjusting the raw data, rules for selecting an appropriate set of forecasting models and rules for blending the models. CoverStory uses rules that experienced sales promotion analysts employ to clean, summarize and "scan" scanner data to summarize what has happened in the most recent set of data and to identify the key points that are hidden in data summaries and reports. Indeed, the system even writes the managerial cover memo--hence the name.

8. *New Areas of Application.* Most reported applications of marketing models have been to consumer products, both for frequently purchased packaged goods as well as for consumer durables. Yet the business-to-business and services marketplaces have seen only limited modeling activity in spite of the fact that more than twice the dollar volume of transactions takes place between business than in the consumer marketplace and service industries, including telecommunications, food, lodging, education, health care, entertainment and the like, account for about 70% of US national income. To take one under-modeled area, the film industry generated revenues of over \$13 billion in 1990 and has seen almost no attention by the marketing modeling community. These observations suggest that there are many under-researched and under-modeled domains available for development of new marketing models and for adaptation of existing models.

9. *More Impact on Practice.* Even several decades after the earliest operational marketing models were first introduced, their impact on practice remains far below its potential. Shorter life cycles, more competitive (and risky) decisions, better theory, faster computers, new technologies and the convergence of the developments outlined above will permit marketing models to impact marketing practice in a way that approaches its impact in the academic realm.

This last point--the impact on practice--merits further development. Few topics concern marketing modeling practitioners and academics alike as much as the "low" level of impact of marketing model developments on practice (see Simon, 1993 and Ehrenberg, 1993). We see at least three reasons for this situation: expectations, transfer-dysfunction and model-quality.

Expectations for new marketing models are very much akin to expectations for new products of any type: most fail in the marketplace, but their developers always have high expectations for them, or they wouldn't invest in their development in the first place. The broad successes in the fields of pre-test market models (Urban and Katz, 1983, for example), in conjoint analysis

(Wittink and Cattin, 1989) and other areas (Little et al., 1993 and Parsons, et al., 1993) demonstrate that models that directly solve problems that occur similarly across organizations and product-classes have great value. The domain of profitable application of such models is limited, however, and we should not expect to see the same levels of success in areas such as strategy, competitive analysis and the like, where the value of models may be more in helping to guide thinking than to provide operationally definitive recommendations for action. In other words, as with any new product development program, we must tolerate a high rate of failure in the marketplace as a cost associated with innovation.

Transfer-dysfunction frustrates academics and practitioners alike. Few academic marketing modelers have the personal characteristics associated with successful implementation. Hence, much good work, with potential great practical value, lies in our academic literature, as "better mousetraps," waiting for eager customers. We have yet to develop either the skills within academic model-developers or the set of appropriately-trained transfer agents to do the selling and implementation job needed.

Finally, many of the models that appear in our literature (and much of academic research in general) are trivial or misguided. Models published on research questions many generations removed from real problems (if ever stimulated by real problems in the first place) are not likely to affect practice. As a field, marketing modelers are not alone here; however, we do have to share in the academic blame associated with the irrelevance of much of our work.

But we will not dwell on unfulfilled expectations and shortcomings; we leave such angst to others. Our glass IS half full, after all, and the successes we have outlined here are substantial and the future seems to us extraordinarily exciting.

REFERENCES

- Axelrod, Robert (1984), *The Evolution of Cooperation*. Basic Books: New York.
- Balakrishnan, P. V. and Jehoshua Eliashberg (1990), "A New Analytical Process Model of Two-Party Interorganizational Negotiation: Theoretical Implications and Empirical Findings," Working Paper, The Wharton School of the University of Pennsylvania (August).
- Bass, F. (1969), "A New Product Growth Model for Consumer Durables," *Management Science*, Vol. 15 (January), pp. 215-227.
- Basu, A., R. Lal, V. Srinivasan, and R. Staelin (1985), "Salesforce Compensation Plans: An Agency Theoretic Perspective," *Marketing Science*, Vol. 4 (Fall), pp. 267-291.
- Blattberg, Robert C. and Edward I. George (1991), "Shrinkage Estimation of Price and Promotional Elasticities: Seemingly Unrelated Equations," *Journal of the American Statistical Association*, Vol. 86, No. 4 (June), pp. 304-315.
- Bultez, Alain (1988), "Editorial for Special Issue on Marketing and Microeconomics," *International Journal of Research in Marketing*, Vol. 5, No. 4, pp. 221-224.
- Collopy, Fred and J. Scott Armstrong (1992), "Rule Based Forecasting: Development and Validation of an Expert Systems Approach to Combining Time Series Extrapolations," *Management Science*, Vol. 38, No. 10 (October), pp. 1394-1414.
- Coughlan, Anne T. (1993), "Salesforce Compensation: A Review of MS/OR Advances." In Jehoshua Eliashberg and Gary L. Lilien, eds., *Handbooks in Operations Research and Management Science: Marketing*. Elsevier Science Publishers B.V.: Amsterdam.
- Ehrenberg, A.S.C. (1993), "Comment on Gary L. Lilien, 'Marketing Models: Past, Present and Future'." In Gilles Laurent, Gary L. Lilien and Bernard Pras, eds., *Research Traditions in Marketing*. Kluwer: Norwell, MA.
- Eliashberg, Jehoshua and Richard Steinberg (1993), "Marketing-Production Joint Decision Making." In Jehoshua Eliashberg and Gary L. Lilien, eds., *OR/MS in Marketing Handbook*. Elsevier Science Publishers B. V.: Amsterdam.
- Fader, Peter S. and John R. Hauser (1988), "Implicit Coalitions in a Generalized Prisoner's Dilemma," *Journal of Conflict Resolution*, Vol. 32, No. 2 (September), pp. 553-582.
- Farley, John U. (1964), "An Optimal Plan for Salesmen's Compensation," *Journal of Marketing Research*, Vol. 1 (May), pp. 39-43.
- Farley, John U. and Donald R. Lehmann (1986), *Meta-analysis in Marketing: Generalization of Response Models*. Lexington Books: Lexington, MA.

- Gensch, Dennis, Nicola Arersa, and Stephen P. Moore, (1990), "A Choice Modelling Market Information System that Enabled ABB Electric to Expand Its Market Share," *Interfaces*, Vol. 20, No. 1 (January/February), pp. 6-25.
- Grossman, S. J. and O. D. Hart (1983), "An Analysis of the Principal-Agent Problem," *Econometrica*, Vol. 51 (January), pp. 7-45.
- Guadagni, Peter M. and John D.C. Little (1983), "A Logit Model of Brand Choice Calibrated on Scanner Data," *Marketing Science*, Vol. 2, No. 3 (Summer), pp. 203-238.
- King, William R. (1967) *Quantitative Analysis for Marketing Management*. McGraw-Hill: New York.
- Kotler, Philip (1971) *Marketing Decision Making: A Model Building Approach*. Holt, Rinehart and Winston: New York.
- Lilien, Gary L. and Philip Kotler (1988), *Marketing Decision Making: A Model Building Approach*. Harper and Row: New York.
- Lilien, Gary L., Philip Kotler and K. Sridhar Moorthy (1992), *Marketing Models*. Prentice Hall: Englewood Cliffs, NJ.
- Little, John D.C., Leonard M. Lodish, John R. Hauser and Glen L. Urban (1993), "Comment on Hermann Simon, 'Marketing Science's Pilgrimage to the Ivory Tower.'" In Gilles Laurent, Gary L. Lilien and Bernard Pras, eds., *Research Traditions in Marketing*. Kluwer: Norwell, MA.
- Little, John D.C. (1979), "Aggregate Advertising Models: The State of the Art," *Operations Research*, Vol. 27, No. 4 (July/August), pp. 629-667.
- Little, John D.C. and Leonard M. Lodish (1969), "A Media Planning Calculus," *Operations Research*, Vol. 17 (January/February), pp. 1-35.
- Lodish, Leonard M., Ellen Curtis, Michael Ness, and M. Kerry Simpson (1988), "Sales Force Sizing and Deployment Using a Decision Calculus Model at Syntex Laboratories," *Interfaces*, Vol. 18, No. 1 (January/February), pp. 5-20.
- Montgomery, David B. and Glen L. Urban (1969), *Management Science in Marketing*. Prentice Hall: Englewood Cliffs, NJ.
- Moorthy, K. Sridhar (1990), "Theoretical Modelling in Marketing," Working Paper, University of Rochester.
- Moorthy, K. Sridhar (1993), "Competitive Marketing Strategies: Game-Theoretic Models." In Jehoshua Eliashberg and Gary L. Lilien, eds., *Handbooks in Operations Research and Management Science: Marketing*. Elsevier Science Publishers B.V.: Amsterdam.

- Parsons, Leonard J., Els Gijsbrechts, Peter S.H. Leeflang and Dick R. Wittink (1993), "Marketing Science, Econometrics, and Managerial Contributions." In Gilles Laurent, Gary L. Lilien and Bernard Pras, eds., *Research Traditions in Marketing*. Kluwer: Norwell, MA.
- Rangaswamy, Arvind (1993), "Marketing Decision Models: From Linear Programs to Knowledge-based Systems." In Jehoshua Eliashberg and Gary L. Lilien, eds., *Handbooks in Operations Research and Management Science: Marketing*. Elsevier Science Publishers B.V.: Amsterdam.
- Schmitz, John D., Gordon D. Armstrong and John D.C. Little (1990), "CoverStory: Automated News Finding in Marketing" in Linda Bolino, ed., *DSS Transactions*. TIMS College on Information Systems (May), Providence, RI.
- Simon, Hermann (1993), "Marketing Science's Pilgrimage to the Ivory Tower." In Gilles Laurent, Gary L. Lilien and Bernard Pras, eds., *Research Traditions in Marketing*. Kluwer: Norwell, MA.
- Urban, Glen L. and Gerald M. Katz (1983), "Pre-Test Market Models: Validation and Managerial Implications," *Journal of Marketing Research*, Vol. 20 (August), pp. 221-234.
- Wittink, Dick R. and Philippe Cattin (1989), "Commercial Use of Conjoint Analysis: An Update," *Journal of Marketing*, Vol. 53 (July), pp. 91-96.