MANAGEMENT SCIENCE IN MARKETING: STATUS AND PROSPECTS*

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Background

The practice of administration in marketing has been handicapped by a type of cultural lag. In every phase of marketing operations the application of systematic methodology to the management task has trailed by approximately one generation the experience in the field of production. Recognition of the causes of this lag helps to explain the current state of management science in marketing and will contribute to an understanding of future prospects and opportunities. This understanding has relevance for advances in the science and its application, on one hand, and in management's willingness and ability to use a scientific approach to making marketing decisions, on the other.

The existence and dimensions of the relatively backward state of management science in marketing were clearly delineated in the first issue of the Institute's journal. In the Smiddy-Naum paper, "Evolution of a 'Science of Managing' in America," with one minor exception the pattern of historical development of a scientific approach was documented by either (1) progress specifically grounded in production experience and applications, or (2) advances in general administrative practices with a strong orientation toward production. The work of Taylor and his associates began with the machine and the workflow. The Gilbreths were also production-based in their studies of combinations of worker skills and machine operations. Progress in the construction of an organized methodology of management techniques and in the generalization of conclusions from observation and experiment in the decades between the two great wars was generally oriented in the factory or used the production process as a take-off point for reaching the general management level. Only in recent years have the tasks of marketing management been approached with the tools of a systematic methodology.

Many of the causes of this historical pattern can be readily identified. The Industrial Revolution was organized around a power-machine-workflow-worker complex. The primary opportunities for realizing its initial potentials were in production where repetitive activities were carried on in concentrated work areas, inviting observation, adaptation, experiment, measurement, and control. A good share of production managers came to their jobs from engineering backgrounds. They were systems-minded, products of a rationalistic philosophy, accustomed to think in terms of predictability, measurement, and control.

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Moreover, the problems they faced were sufficiently stimulating to provoke an imaginative response.

This intellectual set provided a favorable environment for looking at the tasks of production management in terms of productivity and efficiency, and for assessing performance in terms of (1) physical inputs and outputs, and (2) dollar costs and revenues. As a natural result, the science of cost accounting was developed initially in the production area. The information produced by systematized cost records was a further incentive for rationalizing management. It identified opportunities for improvement of performance, and it yielded more or less precise measures of results. The entire line of development helped to create in recent years a favorable environment for the application of more powerful tools of analysis, drawn principally from mathematics and statistics, leading to a pronounced trend toward rationalizing many types of decision making.

Against this brief over-view, the contrasts in marketing stand out clearly. There has been no revolutionary force in marketing comparable to the introduction of the power-driven machine in production. Many marketing activities are carried on over extended geographic areas. They lack the simple repetitive characteristics of factory production. They are not easily measured and controlled. To a much greater extent than in production they involve people dealing with people (and it is worth reminding ourselves that even the more limited human element in production has been a continually frustrating factor for management). The managers of marketing activities generally have not come to their assignments from educational and business experiences of an engineering rationalistic cast. One dominant influence in the marketing process—the consumer—is outside of management's direct control and is only partially, and until now usually unpredictably, susceptible to manipulation and influence. Cost accounting was not introduced into marketing at an early stage. When it did begin to make its way it encountered serious application difficulties because of (1) nonstandardization of operations, and (2) the presence of overhead and joint costs to a degree seldom discovered in production situations. Finally, the influence of the salesman and the possibility of escaping from profit-squeeze situations by price manipulation and product differentiation have tended to divert attention from efforts to improve management's performance by the development and application of systematic methodology to decision making.

Status

The status of scientifically-determined management practice is not uniform throughout the field of marketing. It will be useful, therefore, to consider individually the more important operating and functional areas. For purposes of this review, the range can be surveyed from what is generally regarded as the most advanced sector—marketing research (conceived as focusing on problems of market measurement)—through marketing costs and price policies to the relatively backward area of sales promotion programs, still largely dominated by cut-and-try and inspiration.

Throughout this discussion the concept of "management science" or "scien-

tifically-determined management practice" will be treated without definitional rigor. At the current stage of management practice in marketing little is gained from precise conceptual demarcation. The frame of reference adopted here is simple and broad: what progress has been made toward defining and applying a methodological approach to management problems, thereby laying a foundation for (1) defining alternative management strategies; (2) formulating techniques for maximizing and minimizing, or optimum seeking; and (3) controlled experimentation leading to generalization and predictability?

Marketing Research

Scientific management in marketing is most advanced in marketing research—the description and measurement of markets for products and services. The advanced status can be identified in (1) the methodology of research, both quantitative and qualitative; and (2) the use of research findings in management decision making. The state of current achievement is impressive when one recognizes that marketing research as an organized activity is not more than forty-five years old and that the first year for which we possess a Census of Distribution is 1929.

The field has recognizable sub-categories with different achievement indices.

(1) *Generalized fact collection.* This area is bulwarked by the activities of the federal government, but is supported also by research programs of state and local governments, trade associations, foundations, educational institutions, and a number of private companies (notably in the publishing and advertising industries). In retail distribution there is a well-developed institutional taxonomy: types of business firms, volume of business (including historical trends and market shares), operating costs, productivity. Wholesale distribution has not attained the same descriptive status, while manufacturers' marketing operations are largely unknown territory. There is also a growing documentation of product ows. It is worth observing that in addition to the impressive quantity of data collected, the many deficiencies in quality have been recognized (in scope, purity, and consistency over time) and work is under way to remove them.

As might be expected from the nature of the information yielded by these generalized fact-collecting activities, management uses it less as a direct guide in decision making than to establish benchmarks from which specific market measurements can provide extensions for determining policies and evaluating performance.

Two research opportunities of critical importance can be identified, as well as others somewhat less urgent. The first major opportunity grows out of the time-lags (between the period to which data apply and the date of their publication when they become available as raw material for decision making) that characterize practically all generalized fact-collecting programs. These lags vary from weeks (in the case of some sample-based data on business activity) to years (in the case of the Census of Business). One obvious result is that a substantial proportion of management decisions in marketing is made on the basis of grossly fragmentary or stale information. The quality of decision making

could be improved if mathematical and related techniques could contribute to the development of short-cuts that would sharply reduce time-lags between collection and publication. Somewhat more subtle is the possibility that the availability of current data would invite management's attention to a field for decision making which is now substantially ignored because market phenomena are not promptly quantified through established reporting channels.

The second major research opportunity is in the improvement and extension of techniques for reporting and interpreting consumer and business plans and expectations. We are on the threshold of discovery with respect to ascertaining consumer purchase plans for durable goods and business investment plans for plant and equipment. Unresolved problems of theory and technique hamper rapid progress and stand as a challenge to management scientists. We need better reporting. We need better understanding of what is reported. We need a more sophisticated grasp of the linkage between plans and actions, including understanding and measurement of the factors that cause changes in plans and expectations.

(2) *Measurement of specific markets.* A large number of complementary techniques have been developed in the last two decades for measuring past and current purchase performance of customers. Some of these proceed from economic aggregates (gross national product, national income, disposable income, etc.) to product markets to brand share-of-market calculations. Others are constructs from single-firm data. Sampling techniques have been applied to the movement of certain classes of merchandise through retail channels (as in the well-established Nielsen surveys of grocery and drug outlets, and, more recently, in efforts to devise comparable methods for some hard goods categories). These produce data on retailers' sales and inventories by time periods, in geographic-area, type-of-store, product-class, and individual-brand detail. Sampling has also been used to explore consumer purchasing, through direct interviews and pantry inventories, relying on both continuous panel and one-time survey groups.

Other aspects of customer behavior related to market activity have been measured: radio and television listening patterns; brand familiarity; advertising readership; institutional attitudes (toward brand names, toward retail stores, toward shopping services).

Management has introduced these data into a broad range of marketing decisions, thereby effecting a partial substitution of scientifically-determined choice of policy and strategy for the improvisation of the business "artist." This gain in the rationality of decision making has been particularly marked in the distribution of consumers' goods, and within this genus, most notably in the species of convenience goods, distinguished for high frequency of purchase at low prices. The range of decisions so influenced includes those dealing with: (1) product policy (introduction, change, and abandonment of products; packaging innovations; and, to a limited extent, price determination); (2) channels of distribution; (3) intensity of distribution (number and types of sales outlets); (4) amount and character of advertising; (5) composition of the sales promotion "mix" (advertising, sales efforts directed at dealers, display, etc.); (6) adjustments

of sales promotion efforts to seasonal purchase patterns; and (7) management of inventories through the distribution stream.

The methodological foundation is strongest in the area related to the physical distribution of merchandise. It retains weaknesses or unresolved technological disputes in the exploration of cause-effect relationships in multi-factored market situations, such as the definition and prediction of consumers' responses to changes in sales promotion programs in market settings indeterminately influenced by activities of competitors. It is least satisfactory, as a basis for management decision, when applied to non-purchase activities (such as reading or listening to advertising) in an effort to relate them to either promotional budgets or sales experience. Individual and social psychology have significant contributions to make in this area.

(3) *Forecasting market potentials.* The greatest interest in recent market research activity has centered on the problems involved in forecasting. Techniques of statistical extrapolation have been explored rather thoroughly, and their inherent deficiencies for other than steady-state situations are well understood. The experimental frontier is the introduction of techniques of psychological exploration—the entry into the foggy world of attitudes, plans, and expectations. Objective appraisal of the current status of management science in this area might perhaps conclude that (a) the major possibilities of achievement have been generally defined, (b) some of the more obvious problems of methodology have been brought to experimental test, and (c) the ratio of potential to achievement is still very high. We see the first flow of a fascinating literature touching on such topics as habit as a governing factor in consumer purchase decisions, the measurement of attitudes and their influence on purchase patterns, the time horizons of purchase planning, the relation of purchase plans to their execution, the influence of expectation on behavior, and others.

The products of statistical extrapolation—including long-range and mid-range economic forecasting—are an important element in management decision making, particularly in capital budgeting. In the area of plans, expectations, and attitudes, however, management has not passed beyond a stage of awareness that a tool is being forged of great potential significance in the future. In view of the complex technological difficulties still to be resolved, particularly those involved in time series analysis under relatively uncontrolled conditions, one can assess this management attitude as sound. The time for application is still ahead.

Marketing Costs

Considerable progress toward scientifically-determined management has been made in some parts of the general area staked out by the phrase "marketing costs." It will be useful to consider the extent and significance of the achievement under three headings: (1) cost determination, (2) cost control, and (3) cost as a factor in decision making.

(1) *Cost determination.* All who have wrestled with cost issues recognize that in complex organizations cost determination is never definitive and is always

arbitrary. To achieve a reasonable level of descriptive uniformity, a willingness to accept standards is required. There can be no doubt that marketing has lagged behind production on this count. Again in this area, as was noted with respect to the field of institutional taxonomy, the retailing sector has taken the lead. The cooperation of the larger department stores with such academic institutions as the Harvard Business School, as well as with the department store trade group, the National Retail Dry Goods Association, has resulted in a valuable uniform chart of expense accounts and an accumulating historical record of cost performance over an extended period of time. For many specialized types of retailing, trade associations, Dun & Bradstreet, and certain supplying wholesalers and manufacturers have helped to establish a comparable record of considerably shorter duration. For some types of wholesaling—the drug trade is probably the outstanding example—a comparable body of cost data is available. But for distribution by manufacturers, considered as a whole and for individual commodity classes, we have still to accomplish the initial step of securing agreement on (a) a comprehensive range of activities to be included as marketing operations, and (b) a classification of accounts among which costs can be distributed.

(2) *Cost control.* Curiously enough, in view of the retarded stage of development, marketing management, particularly in wholesaling and manufacturing, generally places greater emphasis on cost control than on cost determination (in the sense of agreement on a generally applicable chart of accounts and the collection of consistent cost data over sustained periods of time). As might be anticipated, this attitude often results in a pattern of expense-oriented decisions that are backward- rather than forward-looking, designed rather more to seek the maintenance of existing cost levels than to relate expenses to revenues marginally or as part of comprehensive product distribution plans. An even more critical issue is suggested by the thesis that a servo-mechanism approach—self-influencing correction fluctuating around a predetermined standard—is neither the optimum nor the practical working target. It is more important to develop cost data and to house them within a cost control system that exerts continuing pressure toward lower cost levels than to determine standards that provide base lines from which to measure variances. In the existing circumstances, realistic flexible budgeting procedures are not frequently encountered. Nor are many managements in a position to stipulate levels at which costs shall be controlled that reflect considerations of characteristic performance of standard functions either in the same industry or in distribution generally. The management issues are further complicated by the absence of techniques for measuring the benefits of cost-supported actions. The prime target remains the confrontation of gains and costs at the margin. In this context, perhaps the most devastating criticism of the state of management science in marketing is that administrators are supplied with information on neither marginal costs nor marginal revenues. Finally, the absence of standards as a foundation for controlling and reducing costs creates exceedingly difficult problems in pricing intrafirm transfers of products. Management's control of operations within vertically-integrated busi-

ness structures can rarely be described as scientifically-determined, as Joel Dean observed in his recent *Harvard Business Review* article ("Decentralization and Intracompany Pricing," July–August, 1955).

(3) *Cost in decision making.* A simple summation of these comments on cost determination and control suggests that marketing management is not in a position to make broad use of cost information for rational decision making. No more striking illustration of the truth of this conclusion, particularly in the administration of manufacturers' marketing activities, can be found than in the recent history of manufacturers' operations under the pricing strictures of the Robinson-Patman Act. The records of Federal Trade Commission investigations of alleged discriminatory pricing practices (among other provisions, the act places on manufacturers the burden of proving that quantity discount schedules can be justified by realized economies in manufacturing and distribution expenses) and informal comments of marketing administrators agree in suggesting the rarity of the company that has established cost data related to scale of operations. Almost equally rare is the seller who has determined and analyzed selling costs by type of customer, size of order, frequency of sales contact and order placement, and comparable expense-influencing factors. In the absence of this type of cost information, rational selection of customers, management of salesforce activities, and pricing of optional sales services are virtually impossible.

Formulating Price Policies

Many observers of marketing will agree in the judgment that the area of price policy is in a period of transition from limited to extensive reliance on scientifically-determined decision making. The substantial price literature originating in economic theory, coupled with the high visibility of price phenomena and the growing availability of published price data, has encouraged fundamental research. The principal gap—which is now beginning to be bridged—lies between the formulation of internally consistent and logical theory on one side and empirical exploration on the other. The target of research is increased information, not on the shape of the static demand curve of economic theory—a grossly simplified and misleading concept in terms of realistic price-making—but rather of the multi-layered and time-phased demand structure knowledge of which is the essential foundation for dynamic price-making in imperfectly-competitive and uncertain markets. The principal problem is the establishment of statistical control of multiple determinants of demand that obscure systematic analysis of price-sales relationships extending over time.

A variety of techniques have been brought to bear on this central problem: (1) controlled experiment (as in local area testing); (2) determination of buyers' alternate costs (particularly applicable for producers' equipment where engineering estimates of potential savings are feasible), and (3) multiple correlation analysis (applicable where historical records provide a base for studying multivariable factor relationships over extended time periods). All have clearly-

defined fields for relevant application. The principal requirements in the period ahead are an attitude of empiricism on the part of marketing management and, on the part of economic analysts, an imaginative grasp of the practical limitations imposed by market pressures.

Managing Sales Promotion Programs

The backward state of management science in the administration of sales promotion programs is pointedly demonstrated by the fact that nowhere in the literature of marketing can one discover rules of general applicability or a research methodology that will provide answers to such common questions as the following (which can be visualized as addressed to his sales and advertising managers by the president of a company manufacturing a line of consumers' hard goods sold through wholesale and retail channels):

How much money should we spend on advertising next year?

What is the best division of the total advertising budget among the various available media?

How can we make rational decisions with respect to complementary budgets for advertising and other sales activities in local areas?

The existing array of popular decision rules for setting advertising budgets is self-revealing: (1) a fixed percentage of last year's sales (or this year's sales forecast), the percentage usually determined by historical precedent or industry pattern; (2) a fixed number of dollars per unit sold last year, or forecast to be sold this year; (3) "what we can afford"—which in practice usually turns out to be the fixed-percentage rule modified by recent profit performance and short-term profit forecasts. No marketing manager seriously defends these procedures. There simply is no better practice available.

The underlying cause is no mystery. With the prime exception of organizations that sell direct-by-mail and use no other promotional or distribution channel, and the partial exception of manufacturers of grocery and drug products who purchase sales performance reporting services, manufacturers do not know how to establish direct cause-effect relationships between sales promotion outlays and sales to ultimate consumers. A panoramic variety of measures of indirect relationships are available. These include measures of magazine and newspaper readership of advertising; measures of radio and television audiences; and measures of consumer familiarity with brands, slogans, and copy themes. There is also, of course, the raw information on what was spent and what was sold, with such a gossamer bridge between the two as the interested parties may be willing to construct. But the problems introduced by questions of more or less in total, or alternate allocations of the total among different media, are not answerable through existing methodology.

The over-all effect on the character of decision making is clear. First, past experience exerts a dominating influence on current decisions. There is a tendency to go on doing what has been done as long as the results are generally favorable. Second, in the absence of successful experience there is a disposition to ape the

performance of competitors. Third, if neither of these seems to work well, a new advertising agency is engaged. Any management scientist can make his own calculation of the extent to which optimizing is practiced in such a setting.

Prospects and Opportunities

Considered against the background of the progress in management science in the direction of production and in the organization of general management activities, this review of marketing is not an impressive story. But the reverse of the coin is a picture of opportunity. Nor are interest and incentive lacking among executives responsible for distribution. They have two spurs: (1) however imprecise they may be, all measures of marketing costs agree that they represent in the aggregate from fifty to fifty-five per cent of total costs paid for commodities by consumers; (2) crude research suggests that "labor" productivity in marketing is low and is not recording gains comparable to those secured in production. The opportunity for scientific management is further increased by the dynamism that has distinguished marketing operations in recent years. Changes in marketing institutions and market structures have occurred at a rate unequalled in earlier periods, and with these changes has come an experimental attitude on the part of management, a disposition to question established practices.

Predicting the specific gains that will be achieved in establishing a scientifically-determined administration of marketing is much more difficult than identifying opportunities. Reference can be made to only a few obvious areas in which the prospects are unusually good for advances in the application of the scientific management way of approaching administrative problems.

We are witnessing an upheaval in marketing structures and institutions. This revolution is most visible to observers in retailing, where it is allied to the development of metropolitan areas, to almost universal ownership of the automobile, to the high cost of personal service, and to increased leisure time, to name only a few of the influences. But it is also occurring deeper in the organization of commodity distribution. Here its effects are being felt, with less spectacular impact so far as the public is concerned, in wholesaling and in manufacturers' sales operations. Channels of distribution, horizontal and vertical integration, product diversification, and linkages of the production-inventory-sales stream are all experiencing dynamic change. The earlier discussion in this paper concludes that many of the elements essential to a rational administration of this change are lacking. There is a challenging opportunity for (1) the definition of costs connected with alternate strategies (including opportunity costs), and (2) the use of cost information in decision making. In this area, merely bringing marketing management to the position already secured in production management would be a gain of great significance and value.

In the measurement of markets, quantitative techniques have made considerable progress both in theoretical development and in practical application. Study of the motivational foundation of spending patterns (plans, attitudes, expectations) is just getting under way. It needs imaginative interdisciplinary support

to establish valid propositions and a theory of influence and prediction. More than parenthetically, it also needs guardians of tact and wisdom to protect this infant sphere of knowledge from premature and uninformed exploitation by advertising executives and sales managers, an unfortunate development that now threatens. Again, the opportunity is substantial for a significant gain in the application of scientific management practices.

The field of sales management viewed in its broadest terms—including the direction of personal sales activities and the integration of advertising with other sales functions—presents a third major opportunity for management science. Primarily what are needed are methods for grappling with multivariable situations as they occur in the world rather than the single-variable methods of classic laboratory science. Hopefully, it should be possible to start with qualitative or rough quantitative approaches and gradually develop tools of greater precision. This suggests the use of mathematical models in both their qualitative and quantitative aspects. Techniques grounded in mathematics, notably including linear programming, search theory, and game theory (particularly non-zero sum multi-person games) have outstanding potential contributions. Marketing budgets involve commitments on too large a scale to permit executives to continue to accept historical patterns in a management world in which rational exploration of alternative strategies and planned optimizing are becoming standard operating procedures. This suggests a potentially welcome cooperative attitude from management. The embryonic studies now in progress and the techniques now being developed may foster still further scientific advances which will lead to a fruitful marriage between practical necessity and opportunity for research.