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A Shotgun Marriage of Mathematics and Marketing?

Top corporate management is dedicated to the continuing search for better ways of doing business. Over the years this search has uncovered many new and valuable tools —scientific factory management, budgeting, marketing research, data processing, and many others.

Today, much attention is being given to mathematical tools, variously called operations research, management science, or business mathematics. All indications are that this approach is rapidly finding a place in the management of many firms, especially in production, inventory control, and warehousing. Mathematical models are set up to describe common business situations, the intent being to provide a framework for analysis and prediction in areas where the complexity of many variables defies comprehension by the mind alone.

To date, the marketing department seems to have found mathematics of little assistance, and top management may well be wondering whether the reluctance to use it comes as a result of (1) basic inconsistencies between the new tools and marketing problems or (2) a built-in reluctance on the part of marketing executives. Stated more cogently, is there any justification for the

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skepticism with which marketing executives seem to be greeting the use of mathematical models?

My contention is that there is indeed justification, which stems primarily from the lack of realism among model builders (mathematicians) and from a lack of understanding and involvement by marketing executives with this new science. Whether mathematics will ever play a significant role in marketing is yet to be determined.

Does this view make marketing executives laggards? Should top management push more to stimulate a speedup of the learning and involvement process? In some firms the answer is yes, but generally it must be no, for the simple reason that mathematics is not yet ready for such a shotgun marriage. There are powerful and devastating roadblocks to communication between mathematicians and marketers, and, until they are diminished, any forced application to marketing operations will *reduce* efficiency, not increase it. These roadblocks to communication arise from the very nature of marketing and the top marketer's task, from the mathematical techniques and processes themselves, from oral and written mistakes made by mathematical researchers, and from the sometimes rather unscientific posture of the mathematical scientists.

BLOCKS ARISING FROM NATURE OF MARKETING

Model Inability to Handle Creativity

Mathematical models work best when applied to mechanical functions, where all significant variables are tangible and quantifiable. But the top marketing executive would probably say that his major function is creativity. As the editors of *Sales Management* recently said: "Marketing's greatest strength is also one of its greatest weaknesses. Its greatest strength is change; in fact, the amount of successful innovation a marketing organization can spawn is often a measure of its success."[1]

Such striving for change is motivated partly to put the company a step ahead of competition, partly to match change introduced by competition, and partly to call the significant turns in an industry before they happen. Yet the driving persistence of the need for change and innovation seems to have avoided the onslaught of mathematics, for the time being anyhow. As might be expected, the executive will perceive little assistance from mathematics on this important marketing function. He may find models to assist in allocating the media budget, but he probably will not find models to develop ideas for new products or over-all promotional platforms.

Even the general area of decision making must be greatly stretched to permit the premise that "Marketing management can be viewed simply as the continuing attempt to recognize and solve specific marketing problems."[2] If decision-making techniques are necessary, for example, to determine the next innovation in a particular industry, then the executive would most assuredly be interested in mathematical models. At present, however, they seem to offer little promise in this critical aspect of marketing.

In sum, change, creativity, and innovation are the essence of marketing, and the executive might be pardoned his belief that models are fine in selected mechanical areas of marketing, but not in these most critical ones.

Model Inability to Handle Goals

A basic premise in the development of most mathematical models is that they relate the

[1] "Significant Trends," *Sales Management* (Aug. 21, 1964), p. 81.

[2] H. V. Roberts in R. E. Frank, A. A. Kuehn, and W. F. Massy, eds., *Quantitative Techniques in Marketing Analysis* (Homewood, Ill.: Richard D. Irwin, Inc., 1962), p. 3.

goal of the enterprise to the topic under study. Such goals (for example, maximization of long-term or short-term profits, or sales) must be few in number since they serve as constraints in the system of equations.

The executive's problem is to understand how one or a few such tangible goals can be selected from a complex system of goals to control the calculation. The goals sometimes become quite personal, and are usually geared to blend the desires of several individuals, including the executive and others in the firm whose feelings must be considered. They also change frequently, as organizations themselves change.

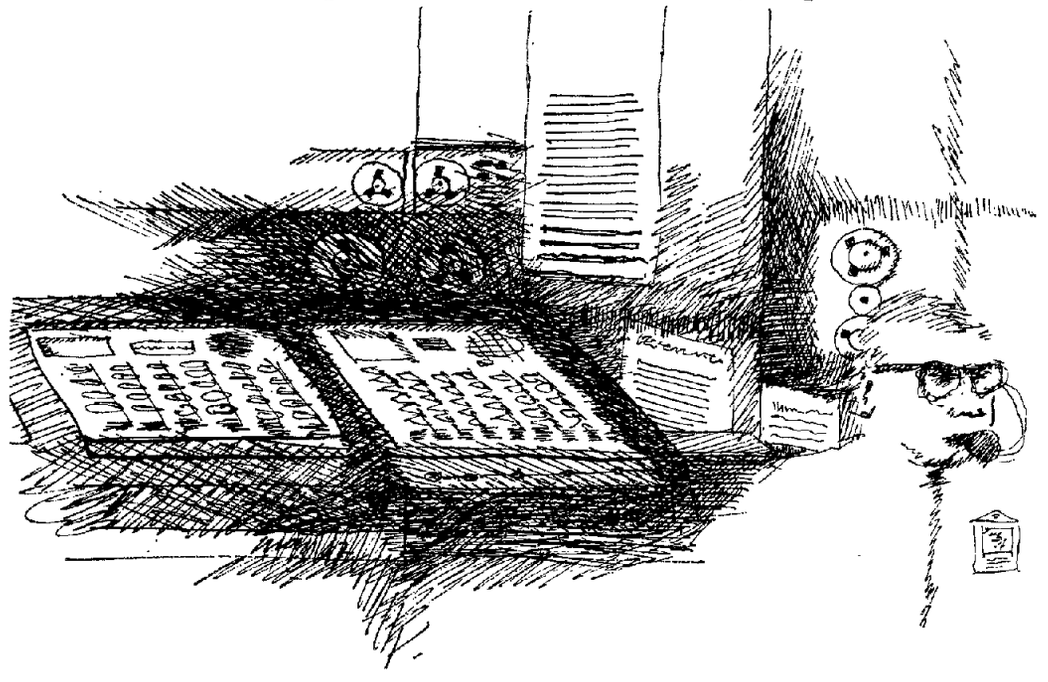
Faced with this dynamic complexity of goal structure, model builders remain undaunted, insisting that goals be spelled out and quantified. The attitude seems to be, "The equations must go on"—but the marketing executive may have left at intermission.

Difficulty With the Human Factor

In two respects, current attempts at selling mathematical models for use in marketing seem to ignore the human problem. First, reports concerning the widespread adoption of model building among business firms indicate no awareness of the many human reasons for such programs; rather, they infer that the socially acceptable motivation of increased business efficiency is responsible.

But other motivations are possible, too. Has the pride of the president ever been the basis for a new system? Was there a desire to impress the board of directors? During lush times, is there motivation from the "We can afford it" school? Does it ever happen that a firm installs a computer system for the routine handling of accounting data, and then, finding huge unused capacity, decides to use this idle time? Finally, has any department or division head ever used a new tool like mathematics in an effort to polish his image among his peers or impress higher management? To the extent that the latter reasons prevail, business use of models is not a testimonial to their helpfulness.

Second, every operating marketing unit consists of people, with the usual collection of strengths, weaknesses, doubts, insecurities, drives, and ambitions. Even the best scientific solutions to problems must still go through the human wringer before they can be used; in fact, the problem statement it-



self, and much of the data and assumptions used in the calculations, must pass through human minds and hands before the calculations can even start. If problem solutions, like organizations, can be made to work if people want them to work, what, on balance, is the contribution of the new science to the enterprise? Might the executive be pardoned a concern over the aseptic, research laboratory solutions to his problems?

INAPPROPRIATENESS OF CASE HISTORIES

Mathematical enthusiasts are rapidly overcoming the problem of a lack of case histories drawn from the marketing field. All too often in the past, illustrations have been drawn from nonprofit areas such as the government, the military, and so forth. To the marketing executive, there is little connection between managing a nonprofit operation and staying alive in his business; the sooner he hears of relevant marketing case histories, the sooner will his interest heighten.

MATHEMATICAL TECHNIQUES

It is, of course, impossible to differentiate unequivocally between problems in applying a particular technique and the problems of understanding those who attempt to explain the technique. In the case of mathematical models, a few matters at the core of the new approach cause difficulty, and would not change appreciably whoever was doing the explaining.

THE PROBLEM OF ASSUMPTIONS

Mathematical techniques of problem solving face the age-old problem of assumptions, no less than other scientific techniques developed over the past twenty-five years or so. The matter is widely discussed, even in the mathematical literature itself. Marketing executives are easily repelled by "assistance," which, as they see it, simply is not practical. For instance, a lengthy article on model building, published a few years ago, listed the various mathematical approaches available, and began an explanation of the first one (matrix algebra) as follows: "Past records show that on the average it takes ½ hour of sales effort and $1 of advertising expenditure to produce a sale in the first market; ¼ hour . . . in the second market. . . ."[3]

This type of statement, perhaps necessary for construction of a matrix algebra model, would appear strange to most marketing executives since, though they might dearly want such information, they simply do not have it.

C. West Churchman, a staunch proponent of mathematical models in marketing, recently put the danger this way: "Hence, there must be a real concern about the reliability of mathematical models . . . one great risk of being able to think rigorously is that we may continue to go down the wrong pathway, forgetting the assumptions that started the thinking process in the first place."[4]

Although further development of mathematical techniques may eliminate most of these troublesome assumptions, a peculiar tendency still remains in the thinking of model builders that assumptions are necessary to achieve understanding by executives, that a complete model is too complex for comprehension. If so, models may fail to gain executive acceptance for some time.

EXCESSIVE DETAIL

Whereas it is frequently necessary to assume away a particular aspect of a marketing problem, it also appears necessary to simply

[3] Philip Kotler, "The Use of Mathematical Models in Marketing," *Journal of Marketing* (October, 1963), p. 32.

[4] In Peter Langhoff, ed., *Models, Measurements and Marketing* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1965), p. 35.

ignore many of these matters. In one case, a researcher was trying to analyze the effects of advertising; after posting the variables he had selected for study, he mentioned several peripheral effects such as the effect on the attitude of salesmen, on retail distribution for the product under study, and on the desired company image.

Regarding these latter effects, he said, "These details constitute a major nuisance from the point of view of the analyst. . . . They clutter up the problem."[5] An executive, grounded in the concept that good brand managers and good sales managers stay on top of every situation at all times, might not feel comfortable in a problem analysis that ignores significant details in such a manner as this.

Danger of Generalizations

Less tangible, but more prevalent and potentially more dangerous, is the strong tendency for models to imply broad generalizations regarding cause and effect. This tendency might seem alarming to the marketing executive who is very much aware he lives in a world where cause and effect, like parallel lines, never seem to meet. Though he puts forth the causes (with help from competition and the economic system generally) and must live with the effects, clear lines rarely seem to connect one with the others. Models should not oversimplify these relationships.

Continuing Lack of Necessary Data

Regardless of the skill in developing appropriate marketing theory, regardless of the dexterity used in developing mathematical equations that represent this theory, and regardless of the speed of computers in handling the equations, the matter of data inevitably remains. Since the executive knows he rarely has the data he wants, when he wants it, and in the form he wants it, how can he visualize complex equations using data he cannot find, or cannot afford himself? With research reports giving the clear impression that data currently constitute the principal roadblock, the executive may understandably wonder where the needed millions of statistics are going to come from.

Inability to Handle Alternatives

Mathematical researchers take a stand on the claim that various systems of equations, combined with probability theory, can handle a limitless range of alternatives in any given marketing problem. Although this view is perhaps true, the marketing executive may be a student of the "diminishing returns" school, which wonders where, along the road of complexity, mathematics passes this critical point?

Moreover, these executives know that quality counts more than quantity; one good idea, thought of at the last moment, will cause the collapse of weeks and months of careful calculations on previously available alternatives. If model systems can be built to offer practical flexibility, an important need will be satisfied.

The Danger of One Weak Link

Even though a particular system of mathematical analysis may have been worked out in great detail, an executive might not feel certain that there wasn't one weak link in the chain of reasoning or processing, one statistic assumed because it was not available, one spurious cause-and-effect relationship, or one bad guess regarding the probable reaction of competition. Where is the control over the system? What outside party understands it well enough to offer independent appraisal?

[5] William J. Baumol in Wroe Alderson and Stanley Shapiro, eds., *Marketing and the Computer* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), p. 204.

Problem of Predetermined Answers

One recent report on mathematics in marketing described the results of research designed to detect the presence of any carry-over effect in advertising. But in the process of developing the equations, relationships had been so established that a carry-over effect had to exist. The assumptions predetermined the conclusion, a fault not unknown to the executive who has spent years going over marketing research survey reports. In other instances, we see models of media scheduling, which require such a complete mass of data on costs, impacts, competitive schedules, and so forth that the task is one of computing, not modeling. The problem seems to be inherent in the approach.

Time Required to Solve Problems

A good mathematical model, once on the computer, can apparently spew out a hundred solutions to a problem while a nonmathematical analyst is looking for a pencil and paper. This is the frame of reference in which speed is discussed.

However, descriptions of model building are quite vague when it comes to the total time that went into structuring the necessary theory, fitting the model, gathering the needed data, and smoothing out the wrinkles to a point where the computer can take over. One gets the impression that this time can be quite lengthy indeed, as much as a year in some instances. During this period when mathematical models are going through their technological shakedown, executives may be getting badly mistaken impressions of their time efficiency.

MISTAKES IN PRESENTATIONS

Problems arise even if we assume an executive mental *modus operandi* attuned to models, and if we assume no problems inherent in the techniques themselves. The greatest remaining communication barrier of all is, perhaps, the barrier traceable to mistakes made by overenthusiastic proponents of mathematics as they attempt to explain their new technology. These mistakes take many forms.

Accusations of Gross Inefficiency

Presentations supporting the use of mathematical models in marketing offer overwhelming and irresponsible condemnation of current marketing practices—overwhelming because it seems to be the premise at the start of every such presentation, and irresponsible because almost never are the standards presented by which the researcher reached his conclusions regarding marketing's efficiency. Virtually every such presentation begins with the explicit or implicit reference to the inadequate tools and processes by which problems are currently being solved, and the millennium that mathematics will soon bring about.

Experienced marketing executives have lived through too many eras of problem-solving innovation to fall victim to this type of overenthusiasm. (Remember the first year of motivation research?) But, be it understood, this is not to defend inefficiency! Rather, the executive would be right simply to ask critics of current marketing decision making to document their denunciations with more than sweeping generalizations regarding intuition, seat-of-the-pants reasoning, and so on. Where is the evidence that a sales manager paying his men a straight commission is inefficient? Where is the evidence that soap companies are inefficient in the selection of TV shows? Where is the evidence that prices are wrongly set?

The marketing executive might ask, "Where lies the burden of proof?"

Threat to Job Security

Given the fact that marketing executives do not really understand the newer techniques

of data manipulation and model building, what might be their reaction to a statement such as the following:

"The disruptive force of computers is accentuated because it is focused largely on white collar and managerial segments of organizations. Managers may have been casual during the first Industrial Revolution about the effects of new technology on hourly workers, but it is not likely that they will be as casual about a new technology that may eliminate or drastically modify some of their own jobs."[6]

How can executives possibly want to learn management techniques from those who say or imply that their machines and equations will sometime replace the executives themselves? Whatever the ultimate effect, the immediate emotional reaction is hardly a healthy one for mathematics.

In the same vein, rather like a prelude to ultimate demise, are found the widespread implications and accusations of incompetence. Incapable executives must surely face difficulty holding on to their jobs during the next revolution; to see what executives are currently having to face, consider the following quotations:

"Now there is one thing that may block acceptance of a model that deserves special attention; this is stupidity or ignorance. The manager may be incompetent to understand the implications of the model, or he may be ignorant of some things the scientist has discovered."

"Broad social experiments are associated with great social upheaval, unrest and revolution. Experiments in the activities of the firm are likewise attainable only at considerable risk and managerial resistance."

". . . intuitive decisions are made today when adequate data is available. These decisions are dramatic, but only as they highlight incompetence."

"This delay [in using computers in marketing] may be due to the marketing executive's fear of a strange and unfamiliar tool, a widespread belief that marketing problems do not lend themselves to computer-oriented management science techniques or the monopolization of existing computer facilities by executives from the other functional areas of the business."

[6] William R. Dill in *Marketing and the Computer*, p. 224.

"It would be tragic if instinctive, ego-protective phobias were to obstruct and delay the natural line of development in this field."[7]

A marketing executive has more than his share of critics and feels a daily stream of economic, political, and social criticism. He certainly will not welcome yet another adversary, especially if it comes bearing accusations of phobias and inefficiency, to say nothing of incompetence and stupidity. The idea of his being a marketing sinner is repugnant, and he can be expected to fight such attacks actively. Nor will he submit to the belief that unless he heeds the call to science (and immediately) he will be pastured to the tape-splicing room.

Finally, we might anticipate the executive's reaction to an implication in one of the quotes above (heard frequently) that he is falling behind his counterparts in other divisions of the firm, such as production and finance. For a man who earnestly believes his sales force and his advertising keep those other divisions operating, this might indeed be anathema.

Disagreement on Definitions

Although not unique to mathematical model building, it is a fact that the new field seems to be confused regarding terminology. In time, as the dust settles, this problem will subside to minor squabbles among active participants, but in the meantime conflicting definitions abound. Weinberg said recently:

"From this it becomes apparent that we may have as many definitions of management science as there are practitioners. Although I do not want to add to this confusion, for the purposes of discussion, I would like to define management science as follows. . . ."[8]

[7] The preceding quotations, in order of appearance, are from C. West Churchman, Peter Langhoff, and Guy-Robert Detlefsen, in *Models, Measurement and Marketing*, pp. 35, 18, and 210; and Wroe Alderson and Stanley Shapiro, and Martin K. Starr, in *Marketing and the Computer*, pp. v and 64.

[8] Robert Weinberg, *Marketing and the Computer*, p. 101.

Add to management science the various definitions for models, operations research, quantitative techniques, and so on, and chaos can prevail. An executive needs a modern marketing dictionary at his side when reading the newer techniques, as will be demonstrated later, but his struggles would be aided by some standardized over-all headings.

PUBLICITY AND PROGRESS

Researchers in the mathematical field are tempted to oversell their progress, as will be discussed; granting for the moment that contributions have been genuine, the executive might well be confused concerning the specific functional areas in which these contributions have come about. On the one hand, he hears of advertising evaluation, over-all marketing program systems, and so on. On the other, he reads that most of the actual successful applications have come forth in the logistical area—inventory, warehousing, and the like. Media scheduling will surely be in this camp soon, but, even with some current work completed, it seems a fact that mathematics has a great distance to travel before it moves in on the truly executive-level marketing problems.

IRRESPONSIBLE OVERSELL

Emerging schools of thought, in perhaps all of man's endeavors, have overzealous adherents who frequently lose perspective in citing the advantages of their new approach. Therefore, it should not be surprising to note their presence in the field of mathematical model building:

"Without the systems approach to marketing . . . companies will go on being production-oriented or finance-oriented, lacking an adequate intelligence mechanism to orient themselves to the market."

"In less than one minute the computer will produce the sales forecast for 1960."

"[The] lag in application of computers and related techniques to marketing decision-making is now swiftly being overcome."

"[Critical Path Analysis is] a powerful tool to ensure the successful launching of a new product. . . . It is a giant stride taken by management science."

"What our befuddled marketing executive doesn't have, and isn't even aware he needs, is a way of handling the facts at hand in a logical sequential way. Nor does he understand the process by which he arrives at a decision. Someday—probably much sooner than most realize—he will have both, and more."[9]

These statements, and many more like them, run as a thread through most writing on this subject. Even though a given piece of research may be concerned only with an early trial of a technique, there is a tendency to generalize both in terms of applicability and regarding the extent of success. Exceptions can be made, of course, and most researchers in the field make a perfunctory bow to scientific posture somewhere during their discussions. A completely candid description of progress, however, is difficult to find.

The most perplexing part of it all is not the occasional unrestrained comment in the press or at a meeting; these are momentary enthusiasms. Rather, the concern for marketing executives comes in reference to assessments of current actual practice in use of the techniques. Are they in widespread application or not? If so, let bona fide surveys of management practice establish this fact.

Equally deceptive is the occasional habit of including the newer mathematical techniques in with a group of long-standing marketing research techniques (calling them tools of quantitative analysis) and then proclaiming the widespread use of the bun-

[9] The preceding quotations, in order of appearance, are from Wroe Alderson and Stanley Shapiro, and R. J. Aboucher, in *Marketing and the Computer*, pp. 7 and 31; *Printers' Ink* (July 13, 1962), p. 21; Yung Wong, "Critical Path Analysis for New Product Planning," *Journal of Marketing* (October, 1964), p. 59; and *Printers' Ink* (March 12, 1965), p. 15.

dle. This is an actual disservice to marketing executives, who—right or wrong—look to use of a new technique by other firms as a clue to whether they should give the item a closer look themselves. They want information, but they would like it to be accurate, unbiased, and reliable.

Failure to Tell Full Story

For some reason, reports on mathematical models suffer from exclusion of information that would greatly help a marketing executive accurately assess the usefulness of models in his operation. Such omissions are of five types.

False Starts and Failures Granting that researchers would rather report successes than failures, perhaps it should not be surprising that virtually no reports are made of the latter. Mathematical research must have yielded negative answers more often than is reported, and, if marketing is to become more of a science, the negatives must share billing with the successes. This, most would agree, is a hallmark of science.

One outstanding example of forthrightness in the reporting of research on mathematical techniques in marketing was a recent article that should be required reading for anyone interested in the field. Alfred Oxenfeldt, almost in diary form, relates his experiences in trying to develop a demand function for analyzing the sales of TV sets. Although he was able to retain his conviction that mathematics has a fine place in marketing, he nevertheless was willing to report an amazing story of false starts and ultimate failure.[10]

Applicable Limitations Just as it is common to rarely report total failures, so is it common to be selective in describing the limitations surrounding any particular piece of research. Examples abound, but for marketing executives one recent case would be of interest.[11] This study used a model to show the superior economics of having salesmen paid a commission based on products' gross margins rather than total sales.

This alternative has been argued for years, and executives would logically be interested in the outcome of the research. But nowhere in the report was there recognition of such factors as complexity of routine commission calculation, the desire to keep margins confidential, conflict with the salesman's general drive toward "getting the order," and others. Research reports should address *all* applicable and important limitations.

Costs of This Research Though stressing the cosmic speed of calculations on today's computers, research reports in this field rarely mention costs. That they should is suggested by the following: "'We go through an industry like a swarm of locusts through a wheat field,' says (John) Handy, who admits he would never have installed a computer system had he known that it was going to cost $300,000."[12] For a company executive who wants to take his firm into a reasonably broad program of mathematical model building, what should he plan on as a probable expenditure for the first two or three years? What will the continuing costs be if the research produces usable programs? Such estimates should include some figures for the indirect costs of lost executive time during the period of learning and experimentation. Short of having this type of information, an executive who has read of the huge investments made by DuPont, Ford, and others might well wonder about his position vis-à-vis mathematics, with a total budget of, say, $10-15 million.

[10] Alfred Oxenfeldt, "Scientific Marketing: Ideal or Ordeal?" *Harvard Business Review* (March, 1961), p. 51.

[11] John V. Farley, "An Optimal Plan for Salesmen's Compensation," *Journal of Marketing Research* (May, 1964), pp. 39-43.

[12] *Business Week* (March 6, 1965), p. 98.

Evaluations of Solutions Several years ago the author was involved in research to determine the applicability of a new mathematical technique for use in sales forecasting. After several false starts, the method reached "operational" status only because so much time and effort were put into it that monthly calculations seemed warranted. Since the previous system of calculations was continued, it was rather surprising some time later to hear this case cited as an example of the successful application of this new technique.

Virtually no reports of mathematics in marketing cite the opinion of line marketing executives whose judgments the models were set up to help, although opportunities for it abound. For instance, a recent report showed how operations research introduced "the concept of measurement and logical analysis in sales problems which had been previously considered amenable only to intuitive treatment."[13]

These problems were of sales force supervision and control, subject to more than intuitive treatment since the turn of the century, and the firm's sales managers were certainly well aware of this fact. But nowhere were their opinions of the new methods stated, an omission that might be of concern to marketing executives.

The Staying Power of Solutions Also missing in the reports from researchers in this area is any information regarding the staying power of these new applications. Even when a new computational process appears to pass muster in a firm and becomes operational, what is its status a year or two later? Five years later? Can the techniques stand the test of time in a marketing organization faced with explosive change, both within the firm and in its market place? Whether yes or no, the marketing executive could make a better appraisal if he had this information.

[13] A. A. Brown, F. T. Hulswit, and J. D. Kettelle, "A Study of Sales Operations," in Frank Bass and others, eds., *Mathematical Models and Methods in Marketing* (Homewood, Ill.: Richard D. Irwin, Inc., 1961), p. 397.

EXCESSIVELY TECHNICAL LANGUAGE

Top marketing executives occupy powerful positions in their respective companies, and thus are besieged regularly by people selling something—an idea, a new technique, a person. Not only have they learned to look beyond the window dressing invariably put around these presentations, but, to put it bluntly, they have learned not to be fooled by trappings.

Since they know there is apt to be an inverse relationship between the amount of window dressing and worth of the proposal, what is their reaction on this score when they meet up with mathematical models? Reading and listening to researchers in this field can be likened to a trip through the Land of Lavish Labels. Every idea, no matter how important, seems to require a new label.

To cite just one example of the many available, a recent paper on models contained the following words:

Group 1 Those that are probably meaningless to the nonmathematical executive

normative	associated payoff
admissible states	posterior analysis
outcome matrix	preposterior analysis
sequential set	sensitivity analysis
nonzero probability	states of nature
utility theory	choice of criterion
tree diagram	computer simulation
Bayesian	minimal regret
cognitive	supersedure
Laplace criterion	antecedent stages

Group 2 Those that the executive might think he understands but will not, at least in the context of mathematical models

decision theory	stage of complete ignorance
optimization	dynamic programming
components	conditional payoff
optimal	joint occurrence
rational decision	original payoff entry
continuous variable	prior judgments
random sequence	

multistage decisions	recursive
delay	problem context
maximize his minimum payoff	unique events
prior analysis	prescriptive
future states	systematic
personalistic view	suboptimization
incremental	expected value criterion
prior probabilities	collectively exhaustive
marginal probabilities	power principle
hypothesis testing	decision matrix
substantive knowledge	observed evidence
uncertainty	degree of discrimination
criteria of choice	flexibility
conjunction	equiprobable
maximum criterion	discriminatory power
betting odds	objective probabilities
discounting	time dimension
feedback	development planning horizon

This is, of course, a problem in communication, since a company interpreter will be necessary to help implement any system using such a vocabulary. Can a marketing executive ever hope to feel comfortable in this environment?

Unfortunately, words are not the only problem along this line; formulas or equations also rank high as communication blocks. Not that this is insurmountable, since the interpreter can again handle the details of a project within a company, sparing the executive the task of understanding the mathematics. But, beyond the fact that executives have a knack for failing to properly utilize research which they do not understand, the mathematical researchers themselves may be so absorbed in their work that they fail to appreciate the speed with which the chasm between themselves and executives is widening.

For instance, a recent technical article in the *Journal of Marketing Research* offered no less than forty-four complicated mathematical formulas. As a journal for specialists, this may be expected, but the author said: "... the equations developed are sufficiently tractable to enable their day-to-day use by busy managers."[14]

[14] R. L. Mela, "Sales Budgeting for Controlled Growth Objectives," *Journal of Marketing Research* (May, 1965), p. 138.

If the field of mathematical models is to progress according to the plans of its advocates, marketing executives must somehow find the time, interest, and inspiration for digging into this highly technical material. Although the task must somehow be made as simple as possible, one wonders whether it is the nature of mathematical science to offer a comprehensible simplicity in concept or communication, and, if not, what are the implications relative to its ultimate place in business management?

POSTURE OF MATHEMATICAL SCIENTISTS

As a capstone perhaps to much of the foregoing, and building specifically upon several ideas covered in the third section (mistakes made in oral and written communications), we come to the matter of appraising a science by the yardsticks of science. The brief nature of this article precludes an exhaustive investigation on this score, but an executive's attitude toward mathematical models might be easier to anticipate if thought of in the context of the question: Is he really being offered a science?

Certainly an early step in any application of scientific method is appraisal of existing apparatus or methodology. How well is a function currently being performed? To date, marketing mathematicians seem to show more interest in testing a new application than in appraising current performance.

Second, blunt accusations concerning a current state of inefficiency in marketing do not become those who would be called scientists. Nor do the incautious predictions concerning the near-future widespread adoption of these methodologies.

Finally, the field of science seems to offer two posture types regarding the merits of research findings themselves: (1) the "scientist-scientist" who simply reports his findings, with minimal editorial comment, and lets them tell their own story; and (2)

the "promotion-scientist" who can hardly find the breath to report his findings, so interested is he in making their import clear. The scientist-scientist is sometimes accused of being so skeptical of his own work that he is its severest critic.

Which does the executive see in the forefront of the work on mathematical models in marketing? How many research presentations can he approach with assurance that he is the object of information, not influence? Is it possible that researchers in this field are so convinced of the ultimate dominance of mathematics in marketing that they see their problem as one of "what next," rather than "whether next"?

Assuming that more of a truly scientific posture will eventually prevail in this dynamic new field, one should be in a position to predict a gradual broadening of understanding concerning models, their demise as a "hot" press item, and more frequent reports of concrete payout. Only then will marketing executives undertake a widespread test of their operational character; and only after this assessment will we know their ultimate place in this art-science complex called marketing.

THE SEEMING stability of the modern marketing structure is an illusion. For instance, the number of retail firms appears to remain substantially unchanged from year to year or to increase modestly with the expansion of the economy. On January 1, 1960, there were approximately 1,998,000 firms engaged in retail trade. Exactly one year earlier there had been about 1,977,000 such businesses. This apparently modest increase of 21,000 retail firms was actually the result of 162,000 new establishments entering the retail field and 141,000 such firms closing for various reasons. On the basis of this fairly representative turnover, the life expectancy of a retail store is just short of fifteen years. In depression circumstances, it would be much less. Somewhat more stability is observed in the wholesale field, but the mortality rate of all marketing institutions is phenomenally high.

—*Martin L. Bell*

MARKETING: CONCEPTS AND STRATEGY