Original Research Paper Statistics

A Research Paper on Mathematical Modeling in Marketing: Mainstream or Marginal Methodology?

Mr. PRATIK H. TRIVEDI ASSISTANT PROFESSOR SHREE NARAYANA COLLEGE OF COMMERCE AHMEDABAD

Prof. (Dr.) RAJSHREE G.Bhatt Department of Statistics, School of sciences, Gujarat University.

ABSTRACT

Marketing education is under the spotlight, with questions being asked about its responsiveness to industry needs. The academic and practitioner literature contains many criticisms of a perceived mismatch between academe and industry, suggesting that there might be too big a gap between academic leaders and industry followers.

The purpose of this paper is to investigate whether there is a gap between academe and industry in a particular skill area - mathematical modeling, to assist marketing educators in developing appropriate modeling courses. A small sample exploratory survey of senior marketing executives measured the perceptions of usefulness and frequency of use of 12 mathematical models that are taught in a Gujarat university course. Less than half of the models tested were perceived to have more than average usefulness and half were never used. Only four models (time series analysis, conjoint analysis, linear regression analysis and cluster analysis) were used to any extent. However, low usage was acknowledged as being primarily due to the lack of expertise by marketing staff.

The conclusion of this study is that modeling courses should emphasize general principles of modeling illustrated by case studies drawn from industry, which utilize a range of models. Such courses would help bridge the gap between theory and practice and help facilitate the merging of the academic and practitioner worlds.

KEYWORDS :

Introduction

In spite of the increased sophistication of marketing theory and of marketing planning tools, new product success rates have improved only minimally (e.g. Wind & Mahajan 1997). 80% of new products are failures - yet there are more than 3,000 published academic articles on diffusion processes alone (e.g. Engel et al 1995). Marketing has come under increased pressure to justify continual increases in budgets and to document tangible financial benefits to the organization. Schultz & Gronstedt (1997) suggest that failure to do so has led to the discipline being perceived as a 'suspect' activity.

Marketing education is also under the spotlight, with questions being asked about its responsiveness to industry. Tertiary education as a whole is under criticism. In India, government review and policy documents have, since the mid 1980s, called for education providers to (among other things) become "more responsive to industry … and a greater source of excellence in our society". These views, together with calls for greater accountability for research funding have been repeated.

Sheth & Sisodia (1999), in advocating that the relevance, if not the validity, of many well-accepted "law-like generalizations" in marketing theory should be challenged as they are not immutable, also note "the surprising paucity of instances in which academic research in marketing in the past two decades has resulted in widespread changes in business practice.

The academic and practitioner literature also contains many criticisms of a perceived mismatch between academia and industry (e.g. Ducoffe & Ducoffe 1990; Morris 1995; Ratfeld 1997). Some of the more severe criticisms (e.g. Lantos 1994) refer to the 'gulf' between marketing education and actual business practice, with the implication being that educators teach esoteric skills which are of no use in the 'real' world, and that we neglect to teach the skills that are needed.

What then is the role of tertiary education in marketing? We do not intend entering into the perpetual debate regarding whether tertiary education should be concerned with education or just training - and whether these two concepts represent a dichotomy or a continuum. Nor do we intend intense debate as to whether we lead or follow industry. If industry leads, there is a real danger of training for immediate industry needs rather than in developing talent for a volatile and intensively competitive future. Further, drawing standards from industry which, by the admission of even the most vocal proponents of education reforms, has "failed to excel" (Winning 1993) could be of dubious benefit. If educators lead by teaching more sophisticated skills and techniques (such as mathematical modeling) than are currently used within industry, will graduates be able to apply these skills once they enter the workforce? Is there too big a gap between academic leaders and industry followers?

The purpose of this paper is to investigate whether there is a gap between academe and industry in a particular skill area - mathematical modeling. From this, we seek to match the learning outcomes that can be expected of an advanced level mathematical modeling paper, in terms of both specific content knowledge and generic skills such as analysis and critical thinking, to industry's expectations of the skills and knowledge of an employable graduate. This paper reviews the literature on the strengths and weaknesses of mathematical modeling and reports on a survey of key marketing executives regarding the use and perceived benefits of such models.

The 'value' of mathematical models

Barnard & Smith (1989) noted low use of econometric modeling among marketing practitioners (only 23% of respondents from a survey of major UK advertising agencies claimed to use modeling regularly). These authors raised the question of why econometric modeling might not be adopted for regular use, and hypothesized (but did not test the hypotheses) that it may be due to the lack of technical expertise, and / or econometrics being judged as making no real contribution to marketing strategy, and / or the cost of acquiring the data and expertise outweighs its perceived added value.

The academic literature contains the work of many writers who are unequivocal regarding the value of models. For example, Clancy & Schulman (1992), in proposing that "it is better to fly a simulator than to crash the real thing", extol the predictive abilities of simulation testing in terms of risk reduction and improved marketing efficiencies. This view is echoed by Dembeck & Stout (1997) who state categorically that, through linear programming, it is possible to generate a solution that will result in the most efficient means by which to achieve a desired objective.

Lilien & Rangaswamy (1998) demonstrate the value of using computer based decision models in marketing decision making and advocate the need for marketers to complement 'conceptual marketing' with 'marketing engineering'. However, praise of mathematical modeling is not universal. Miller (1999, p 17) is critical of the value of traditional analyt-

ical methods when working with the types of large databases that are now obtained from scanner data and customer interactive marketing. He suggests that: "There isn't time to specify all possible models, define priors, intervene in the modeling process, review plots of regression residuals or evaluate variable transformations … or to review the many relationships that would be identified as statistically significant". While Miller advocates data mining, the process of searching large quantities of data to find patterns that are good predictors of future purchasing behavior, as an alternative to traditional mathematical modeling techniques, he also notes that the availability of data mining tools has preceded the development of guides to their proper application!

In contrast, Wind (1997) notes that the use and value of all forms of quantitative marketing research and modeling techniques vary widely by company and even within companies. He cautions that those who dabble with occasional studies are often disappointed with the outcomes. This therefore raises the question of whether current approaches to the use of such techniques are not effective - or whether the techniques themselves are inadequate.

Our exploratory study is intended to provide further information for the debate about the value of mathematical modeling to assist marketing educators in developing appropriate modeling courses.

Research objectives

- To investigate how useful a range of mathematical models taught in a New Zealand university course are perceived to be by senior marketing executives in New Zealand.
- To determine how frequently such models are used in marketing strategy and planning.
- To determine the main types of use of these models.Research methodology

A postal questionnaire was sent to all 87 members of the major Indian marketing organization, the Association of Indian Advertisers, in May, 2014. Reliance has as its members the major brand marketing organizations in India, including major Manufacturing companies, airlines, banks, petroleum, pharmaceutical and automobile companies. Respondents were all either marketing managers or marketing directors within their respective organizations. Usable responses were received from 19 executives, a 22% response. This low response rate may itself be an indicator of low interest in the use of mathematical modeling among marketers in India.

Results

The results must be regarded as indicative only, due to the low response rate and sample size. Eleven out of the nineteen executives had ever used mathematical modeling as a marketing strategy / planning tool. Table 1 shows the perceived usefulness and frequency of use of 12 specific models tested. Five out of the 12 models were perceived to be of more than average usefulness, with Time Series Analysis being perceived as the most useful followed by Cluster Analysis, Multiple Regression Analysis, Linear Regression Analysis and Conjoint Analysis.

Table 1: Perceived Usefulness / Frequency of Use of models:

Ranked by mean usefulness score (where 1 = not useful / never used, 4 = unsure / average and 7 = extremely useful / routinely used)

Model type	Usefulness (mean score)	Frequency of Use (mean score)
Time series analysis	5.2	3.8
Cluster Analysis	4.6	3.0
Multiple Regression Analysis	4.6	2.6
Linear Regression Analysis	4.4	3.2
Conjoint analysis	4.4	3.1
Factor Analysis	3.8	2.4
Juster Scale	3.6	1.7
Repertory Grid Analysis	3.6	1.2
Dirichlet Model	3.4	1.8
Negative Binomial Distribution	3.2	1.6
Fishbein / Multi-attribute	3.2	1.1
Bass Model	3.1	1.2

Half of the models (Juster Scale, Dirichlet, Negative Binomial Distribution, Repertory Grid Analysis, Fishbein / Multi-attribute, Bass) were never used. Of the most used models (by more than half of the respondents), Time Series Analysis was used mainly for trend analysis, Cluster Analysis for segmentation, both Multiple Regression Analysis and Linear Regression Analysis for trend analysis, Conjoint Analysis for attitude measurement and Factor Analysis for new product development and attitude measurement. Overall, trend analysis is the major application for the models tested. These results indicate there is a reasonable level of perceived usefulness of particular mathematical models, but a relatively low level of actual use.

Main strengths of mathematical modeling were seen as being the ability to decipher / report on large data sets, the ability to find causal relationships and new insights with complex data, and the discipline provided for the interpretation of data. The major weaknesses were seen as the time and resources needed to develop models in-house and, overwhelmingly, the lack of expertise among marketing staff.

Discussion and Conclusions

Our results indicate that there is a gap between academe and industry in the knowledge and use of mathematical modeling techniques. Given the relatively low usage of mathematical models in our sample, and general concerns regarding the ability of the techniques to improving marketing effectiveness, cynics must ask whether we should teach modeling techniques at all. We argue that, with a number of constraints, such courses are educationally sound, particularly when industry has acknowledged that the principle constraint on wider use of models is the lack of expertise among their own staff! It could also be said that the lack of accessibility of some models may militate against their trial by practicing marketers. Rangaswamy & Lilien (1997:83) note with some concern that "even after two or three decades after their introduction, there are no PC-based commercial software models for such well-known models as the Bass model for new product forecasting". This may account for the low usefulness scores shown for some of the models in Table 1.

Entry level marketing positions increasingly specify a degree as a prerequisite for consideration and we accept that, for the majority of our students, study is preparation for the world of work rather than for graduate level tertiary studies. A marketing qualification does not represent just 'job training'. McMullen (1998) suggests that graduates require both strong disciplinary knowledge and a number of key generic skills such as problem solving, managing information, effective communication and exercising judgments. These generic skills are seen as vital in helping graduates reshape and apply disciplinary skills and knowledge in the new and varied contexts that they will encounter in industry.

Her views are supported by an earlier Australian Higher Education Council report that advocates the following generic qualities in graduates:

"critical thinking, intellectual curiosity, problem solving, logical and independent thought, effective communication and related skills in identifying, assessing and managing information", together with " personal attributes such as intellectual rigor, creativity and imagination and values such as ethical practice, integrity and tolerance"

The acquisition of both a specific body of knowledge which is of relevance to industry, such as the strengths and weaknesses of mathematical modeling, coupled with the generic skills outlined above would appear essential for graduates to function in an increasingly complex competitive and changing work environment.

The benefits of teaching mathematical modeling include:

- development of expertise in dealing with complex,
- ill-defined problems and in developing practical solutions
- exposure of students to current research in a range of application areas
- development of critical analytical skills and the ability to communicate quantitative concepts effectively.

Teachers are confronted by the challenge of new developments in modeling techniques. These developments are so numerous that even specialists find it difficult to keep up (e.g. Carroll & Green 1995). In this article, the authors appear optimistic that new models would help to close the gap between theory and practice. In a follow up article (Carroll & Green 1997), they express disappointment that the gap remains - and may even have widened.

Sheth & Sisodia (1999) contend that marketing 'generalizations upon which some models are based should be revisited with a view to being either modified or enhanced because the context under which they were created is changing in fundamental ways. For example, diffusion-modeling frameworks such as Bass are seen as not modeling the determinants of the ultimate level of demand in the market. More seriously, they suggest that such models view the rate of adopting an innovation as an intrinsic characteristic of a market and of the innovation itself. By adopting "a static, almost fatalistic view of dynamic, evolving markets" (1999:76), they ignore many of the areas in which managerial action is crucial.

We contend that courses should be composed of general principles of modeling, how models can help reduce uncertainty in marketing planning and how they may aid in prediction and diagnostics. Theoretical principles should be reinforced with case studies drawn from industry to illustrate practical applications. This will help to bridge the gap between theory and practice and allow the worlds of practitioners and academics to start to merge. Such a view is consistent with Lilien et al's (1998a) proposition that modeling techniques can help improve the ability of marketers to make decisions. These authors (1998b), while advocating the benefits of modeling techniques, stress that these techniques do not replace intuition, reasoning and experience, but help marketers "profitably harness their intuition about the market without collecting expensive research data".

Thus, even if the models we use during mathematical modeling-based courses are not used in the students' working lives, the use of a range of models to illustrate the principles and applications of the underlying techniques is, we believe valid. Hands-on experience and practical applications of models by students to 'real' marketing problems will also help build the generic graduate skills that McMullen (1998) advocates. We therefore conclude that mathematical modeling merits being elevated from a probably perceived marginal status among marketers to consideration as a useful adjunct to mainstream marketing techniques.

References

1. Axelrod, R. (1984). The Evolution c$Cooperation, Basic Books, New York.
2. Basu, A., R. Lal, V. Srinivasan and R. Staelin (1985). Salesforce compensation plans: An agency theoretic perspective. Marketing Sci. 4 (Fall), 267-291.
3. Blattberg, R.C. and J. Golanty (1978). Tracker: An early test market forecasting and diagnostic model for new product planning. J. Marketing Res. 15 (May), 192-202.
4. Moorthy, K.S. (1 993). Theoretical modeling in marketing, J. Marketing 57 (April), 92-106.
5. Liiien, Gary L. and Philip Kotler (1983). Marketing Decision Making: A Model Building Approach, Harper and Row, New York.