"Bridging the Marketing Theory-Practice Gap with marketing Engineering"

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Bridging the Marketing Theory-Practice Gap with Marketing Engineering

Abstract

New developments in marketing management support systems have provided the marketer with a rich supply of tools that can enrich decision-making. In this paper we describe the concept of Marketing Engineering, an approach to solving marketing problems, popularized by Lilien and Rangaswamy (1998). We describe how Marketing Engineering harnesses marketing data and knowledge to facilitate decision making. We provide several illustrations of the successful application of the marketing engineering concept. We also summarize developments that we believe will further encourage the adoption of the marketing engineering concept and tools for both teaching about marketing decision making, and for improving the practice of marketing decision making.

Key words: marketing engineering, marketing models, MDSS, marketing practice.

Introduction

In the past few decades, the field of marketing has evolved into a distinct academic discipline and a profession for practitioners. The marketing field has produced many important concepts (e.g., segmentation, positioning) and developed methodologies for translating concepts into practice (e.g., focus groups, perceptual maps). Yet, many senior managers believe that marketing is intrinsically art and experience, and is not amenable to the systematic approach to decision making that characterizes such management disciplines as finance, production, and logistics. This belief suggests that there is a gap between marketing theory and marketing practice. At the same time, the current competitive environment calls for more sophistication in making marketing decisions. It is no longer enough to justify marketing programs and expenditures purely on the basis of a "strategic rationale," or simply as "costs of doing business." Increasingly, marketing is viewed as an investment in the company's future – as a way to attract and maintain profitable customers. Viewed as an investment, marketing plans have to cross the same budget justification hurdles that other investments do.

Interestingly, over the years, the marketing field has also produced a number of successful decision models and decision support tools that facilitate more sophisticated thinking about marketing problems. Such models can help develop marketing strategies and plans, and help determine the potential value of implementing those plans. Yet, until recently, these models have only been available to those few managers who have been motivated to search for and locate them.

However, with the wide availability of computers and emerging user-friendly software implementations of marketing decision models, there is increasing interest among managers to use these models for both strategic and tactical decision making. A new area of marketing is emerging which helps to combine data, knowledge, managerial judgment and computer techniques to facilitate decision making, which we call *marketing engineering*. In our view, marketing engineering is an important instrument for bridging the gap between marketing theory and practice. In this paper, we define marketing engineering, summarize the trends that favor its growth and adoption by managers, articulate the potential benefits and costs of adopting the marketing engineering approach, and illustrate a few successful applications of this concept at several leading companies. Along the way, while we highlight some important research findings, we will see that we currently know little about either the "why" or the "how much" the marketing engineering benefit is. We conclude with some thoughts on how the marketing engineering concept will evolve in the near future.

The Marketing Engineering Opportunity

Marketing managers make ongoing decisions about product features, prices, distribution options, sales compensation plans, etc. In making these decisions, managers choose from among alternative courses of action in a complex and uncertain world. Like all decisions that people make, marketing decision making involves judgment calls. Most traditional marketing decision making, while sometimes guided by the concepts of our literature, has been largely based on managers' mental models, intuition, and experience.

In many cases, such mental models may be all that managers need to feel psychologically comfortable with their decisions. Yet, mental models are prone to systematic errors (Tversky and Kahneman 1974; Russo and Schoemaker 1989; Bazerman 1998). While we all recognize the value of experience, that experience is unique to every person, and there is no objective way to choose between the best judgment based only on the experience of different decision-makers. Experience can also be confounded with responsibility bias: sales managers might choose lower advertising budgets in favor of higher expenditures on personal selling, while advertising managers might prefer larger advertising budgets.

Consider an alternative approach to the mental model for a decision involving setting advertising expenditures: managers might choose to build a spreadsheet decision model of how the market would respond to various expenditure levels. They could then use this model to explore the sales and profit consequences of alternative expenditure levels before making a decision. The systematic translation of data and knowledge (including judgment) into a tool that is used for decision support is what we call *marketing engineering*. In contrast, relying solely on the mental model of the particular decision-maker without using any support system, is what we refer to as *conceptual* marketing. A third option would be to let the decision support tool make the decisions itself. For example, CoverStory (Schmitz, Armstrong and Little, 1990) automatically analyzes scanner data. If a marketer would directly follow CoverStory's recommendations, we would call this *automated marketing*. Bucklin, Lehman and Little (1998) foresee considerable opportunities for the computer taking over many of the traditionally human tasks associated with marketing decisions. However, given the intrinsic complexity of marketing problems (many instruments, a large number of environmental factors, including competition, and substantial uncertainty in each of these factors), we believe that for many marketing decisions, the combination of marketing support tools and the judgement of the decision maker is best. This is the philosophy behind the marketing engineering concept.

There are many well-documented examples of successful applications of the marketing engineering concept, including:

ABB Electric, a manufacturer and distributor of power generation equipment, wanted to increase its sales and market share in an industry that was facing a projected 50 percent drop in demand. By carefully analyzing and tracking customer preferences and actions, it determined which customers to focus its marketing efforts on and what features of its products were most important to those customers. It credits its ability to go from 4% market share to over 40% market share, while raising its profitability in a declining market to its marketing engineering application of *choice models* (Gensch et al., 1990).

Marriott Corporation was running out of good downtown locations for new full-service hotels. To maintain its growth, Marriott's management planned to locate hotels outside the downtown area that would appeal to both the business travelers and weekend leisure travelers. The company designed and developed the highly successful *Courtyard by Marriott* chain using the marketing engineering tool called *conjoint analysis* (Wind et. al., 1989).

Syntex Laboratories was concerned about the productivity of its sales force. In particular, managers were unsure whether the size of the sales force was right for the job it had to do and whether the firm was allocating its sales-force effort to the most profitable products and market segments. The company used a marketing engineering resource sizing and allocation tool to develop sales-force deployment strategies that added over $25 million in annual profits compared with its strategic plan (Lodish et al., 1988).

These three examples all involve a messy problem, a model, some data, managerial judgment and a successful, profitable outcome for the firm. Exhibit 1 is an overview of the marketing engineering approach to decision making: using an interactive computer model to help transform objective and subjective data about the marketing environment into insights and implementation of decisions.

[Insert Exhibit 1 about here]

Although marketing engineering encompasses all the elements shown in Exhibit 1, we will focus on the marketing engineering approach to transform information and insights into decisions. The idea of

using computer models to enhance decisions is not new. Researchers and practitioners have long developed and implemented powerful systems that facilitate decision making in real world marketing settings. (For case studies and examples, see Little 1970; Assad, Wasil, and Lilien, 1992; Lilien, Kotler, and Moorthy 1992; Rangaswamy 1993; Wierenga and van Bruggen 1997). Yet, until recently, much of the knowledge about marketing decision models resided in specialized academic journals or required considerable technical expertise to use (primarily by specialized consultants). As a result, despite their potential value, these models have not seen the extent of use suggested by their potential.

Recent advances in computer hardware and software now make it possible to put marketing engineering in the hands of every marketing manager. In fact, hundreds of commercially available canned software decision aids are now available (see, for example, the Directory of Marketing software in *Marketing News***,** April 13, 1998). The growth in software availability suggests that managers are beginning to embrace marketing engineering. Several trends favor the wider acceptance of these tools:

High-powered personal computers connected to networks are everywhere: Like other professionals, marketing managers are increasingly depending on computers to perform their jobs. A senior marketing executive told us recently, "Ten years ago in my department, we had lots of people and very little software. Today we have lots of software and very few people." These computers are being networked with other computers through local area networks (LANs) and, in some cases, connected to external computers and databases all over the world through wide area networks (WANs), such as the Internet.

The volume of data is exploding: The automatic electronic capture of data related to transactions with customers and the growth of interactions and exchange via the internet is generating massive amounts of potentially useful information about the preferences and behavior of customers. In a sense, abundance of data can sometimes be a bigger problem than a lack of data. The amount of Point of Sales (POS) data that can be collected by means of retail checkout scanners, for example, is enormous. Ing and Mitchell (1994) estimate that a single store could generate around 50,000 transactions per day. These transactions may involve 25,000 to 30,000 SKUs for a (US) supermarket and up to 1,5 million SKUs for a department store, often leading to 10-20 gigabytes of marketing data per week. It requires great skills, advanced analytical capabilities, sophisticated information technology, and superior organizational capabilities, to transform these data into actionable marketing knowledge. While available data has grown exponentially, the human brain has not advanced in a comparable manner to process and interpret these data (Simon 1997). Managers need new methods, and technologies, such as marketing engineering, to make decisions in data-intensive environments.

Firms are reengineering marketing: Today's corporate mantra seems to be "flatter organization, ad-hoc teams, outsourcing, strategic relationships, and reduced cycle times." In this environment, firms are reengineering marketing functions, processes, and activities for the information age. In the reengineered firm, centralized decision making, characteristic of traditional hierarchical organizations, is giving way to decentralized decision making that is characteristic of entrepreneurial organizations. As a consequence, marketing managers are increasingly dealing directly with market information and using computers to do tasks that were once done by staff support people. Increasingly, companies are also requiring marketing expenditures to be justified in the same way as other investments, and meeting similar financial hurdles.

Marketing engineering is a way to capitalize on these trends. Clearly, markets are not controlled settings where careful observation will permit unambiguous understanding and precise actions. But neither are they so complex as to defy understanding. They fall somewhere between these two extremes. Marketing engineering enables us to capture the essence of marketing problems in well-specified models, and it improves our ability to make decisions that influence market outcomes.

Wierenga, van Bruggen and Staelin (WVS: 1999) provide a detailed review of the literature on the effectiveness of marketing engineering (Marketing Management Support Systems (MMSS), in their terminology). They report that there is substantial evidence that MMSS can increase firm profit and other measures of performance. However, this success is not universal. Several antecedents of MMSS success emerge, such as support from top management, cognitive style and experience of the MMSS user, and fit of the MMSS with the decision environment. Often, it is not clear what people mean by success of an MMSS. Some success measures include the extent to which the MMSS was actually used by decision-makers, the effect of an MMSS on market share, profit, forecast accuracy and decision confidence and the acceptance of the system's recommendations by management. WVS highlights five factors that determine the success of a marketing management support system. These are, (1) the *demand* for decision support, (2) the *supply* of decision support (the decision support offered by the MMSS, (3) the *match* between demand and supply, (4) the *design characteristics* of the MMSS, and (5), and the *characteristics of the implementation process* of the MMSS. Together with the dependent variable, *success* of the MMSS, these factors constitute the main building blocks of the framework presented in Exhibit 2.

[Insert Exhibit 2 about here]

WVS suggest that the match between the demand side (the decision processes to be supported) and the supply side (the functionality of the management support systems employed) is the primary driver for the potential success of an MMSS. They distinguish between the *potential* success of an MMSS and its *actual* success, and posit that the extent to which success is realized depends on the *design characteristics* of the MMSS and the *characteristics of its implementation process* (Davis 1989; Alavi and Joachimsthaler 1992). The cited paper gives details on the framework, providing a rich discussion of why we expect the future of marketing engineering to be bright in the next several years. Our discussion above suggests that we are seeing positive trends on the demand side (Box 1: shorter product life cycles, flatter organizations with distributed decision making), as well as on the supply side (Box 2: computers, data, networks and software) leading to better matches (Box 3). These matches determine the *potential* success of an MMSS. However, whether or not this potential will materialize depends on two sets of factors, *design* characteristics (Box 4) and *implementation* characteristics (Box 5). Superior system designs (Box 4) along with what we will argue below are factors favoring broader implementation (Box 5) all are driving MMSS or marketing engineering success.

The Benefits of Marketing Engineering

The wide availability of spreadsheet software, such as Excel and Lotus 123, has made it easier to work with mathematical representations of marketing phenomena. For example, marketing spreadsheets typically include planned marketing expenditures and the associated gross and net revenues. However, in most cases, the model developer does not establish a relationship, within the spreadsheet, between marketing inputs (e.g., advertising) and sales revenues. Thus, marketing inputs only impact net revenue as a cost item. We refer to such spreadsheets as "dumb" models. They make little sense as marketing models because they are silent about the nature of the relationship between marketing inputs and outputs. For the spreadsheet model to make sense, the model developer must define objectives and variables explicitly and specify the relationships between variables. In a "smart" model, an equation or “response model” will be embedded in the spreadsheet. The manager can then look at the effect of advertising on both sales and revenues to see if increases or decreases in advertising can be justified.

The data, software and managerial environment are facilitating marketing engineering. But we must ask if decisions are really improved by the use of such models. One way to look at the evidence is

to consider the data in Exhibit 3, showing that models improve the consistency of decisions, which in turn improves the accuracy of prediction.

[Insert Exhibit 3 about here]

Exhibit 4 lists variables experts often use to predict the academic performance of graduate business students, (the first row of Exhibit 3). The formalized intuition of experts captured in a simple linear model outperforms the experts themselves! Accuracy here improved from 19 percent correlation with the actual student performance to 25 percent correlation. An explanation for this improvement is that the decision model more consistently applies the expertise of the experts to new cases.

[Insert Exhibit 4 about here]

The third column in Exhibit 3 lists the accuracy of an "objective" linear regression model. For the academic performance study, the independent variables for the regression model were the same factors used by the experts, but the dependent variable was a known measure of the academic performance of the graduate students. The predictions in this case were based on a holdout sample of data to which the objective model was applied. For this model, the correlation of predictions with true outcomes was 54 percent. Exhibit 3 also shows the average correlations between predictions and true outcomes across several studies. We see that subjective decision models had an average correlation of 39 percent with true outcomes as compared to 33 percent for the intuitive mental models. For more details about these studies, see Camerer (1981), Goldberg (1970), and Russo and Schoemaker (1989).

These results point to a few interesting conclusions: (1) When managers can build an objective model based on actual data, they will generally predict the best. However, in many decision situations, we do not have data that show the accuracy or the consequences of past decisions made in the same context. In such cases, the next best option is to codify the mental model decision-makers use into a formal decision model. The calibrating of response models using the decision calculus method (Little, 1970) is a way to formalize the mental models of decision-makers. (2) Among these three types of models, the least accurate is the mental model. However, on average, all three types of models had a positive correlation with the truth, while a model with random predictions would have zero correlation with the truth. (3) Managers should focus their attention on finding variables useful for prediction but should use decision models to combine the variables in a consistent fashion.

The studies listed in Exhibit 3 focus only on forecasting tasks. Other studies have examined performance in such managerial tasks as resource allocation and employee recruitment (Chakravarti, Mitchell and Staelin, 1979; McIntyre, 1982; Gundersen, Davis and Davis, 1995). Although many of these studies show that the use of decision support tools generally enhance performance, this is not always the case. Indeed some studies show that decision quality worsened as a result of using decision support tools (for a review see Sharda, Barr and McDonnell et al. 1988). We need more studies to fully articulate the value of decision models, especially to identify how and why they influence the decision making process.

Managers recognize that models are incomplete, and therefore, they correctly believe that model results cannot be implemented without being modified by judgments. If model results are to be tempered by intuitive judgments, why not rely on judgments in the first place? The latter conclusion, however, does not follow from the first. As Hogarth (1987, p. 199) notes, "When driving at night with your headlights on you do not necessarily see too well. However, turning your headlights off will not improve the situation."

Decision support tools and mental models should be used in conjunction, so that each works to strengthen the areas where the other is weak. Mental models can incorporate idiosyncratic aspects of a decision situation, but they also overfit new cases to old patterns. On the other hand, decision models are consistent and unbiased, but underweight idiosyncratic aspects. In a forecasting task, Blattberg and Hoch (1990) found that predictive accuracy can be improved by combining the forecasts generated by decision models with forecasts from mental models. Further, they reported that a 50-50 (equal weighting) combination of these two forecasts provided the highest predictive accuracy.

The decision support tools used in marketing engineering can be both data-driven and knowledge-driven. A data-driven support tool can answer "what-if" questions, based on a quantified market response model (Lilien and Rangaswamy 1998, (L&R) Chapter 2). A knowledge-driven decision support tool captures the qualitative knowledge that is available about a particular domain. An example is the ADCAD expert system for advertising design (Burke et.al., 1990).

There are other benefits to the marketing engineering approach, such as permitting the exploration of more decision options and decision options that are farther away from "base solutions" (van Bruggen, Smidts and Wierenga 1998), assessing the relative impact of different marketing decision variables, facilitating group decision making and updating subjective mental models (L&R).

Notwithstanding the evident benefits of the marketing engineering approach, its adoption and use are far from universal at this moment. In the next section we will discuss possibilities for changing this.

From Promise to Realization

Several factors may foster the transition of marketing engineering from being a promising approach used by a select few to its wider adoption in managerial settings. Here, we focus on three factors: (a) End-user modeling, (b) User training, and (c) Marketing Engineering over the Internet.

(a) End-user modeling. Decision models in marketing range from very sophisticated models that are developed by a team of experts to those that can be quickly put together by an individual (end user) with a basic knowledge of marketing and marketing engineering. Many large scale marketing models have been put together by teams of experts and such applications will continue. At the same time, the wide availability of desktop computers will encourage development and deployment of end-user models. To be successful, end-user modeling requires a good fit with the abilities and preferences of the particular decision maker, direct accessibility, adaptability, and the possibility of obtaining quick answers, as many real-life marketing problems have sever time constraints (WVS).

End-user models have the following key characteristics (Powell 1996):

- The modeling process is initiated and completed by an individual who has to deal with a business problem. The user is rarely a technical analyst or a modeling specialist. The objective of the modeling effort is to gain a better understanding of the specific decision problem and the alternative courses of action available to the user.

- The modeling effort is nonmathematical in nature, although the underlying models themselves may be mathematical. The user relies on graphics, spreadsheets, and canned software to put together a model to reflect his or her understanding of the business problem.

- The user develops the model under budget and time constraints, and it has the characteristics of a good engineering solution, namely, do as good a job as you can, cheaply, and with what you can obtain easily. The modeler uses whatever information is readily available along with a healthy dose of creativity. The model itself may be less thorough and scientific than models developed by academic researchers or by professional management scientists. Judgment plays a big role in generating inputs to the model and in interpreting the results.
- The models are often used for generating directional insights, rather than for providing specific numerical guidelines. In contrast to full-blown decision support systems (e.g., a hotel's or an airline's yield management system), end-user models often produce outputs that are more useful for the general patterns they reveal (e.g., the feasible range of prices) than for a specific output.

Exhibit 5 summarizes these and other differences between end-user models and high-end models. Success with end-user models may provide the impetus for managers to develop organization-wide

implementations of the models in the form of decision support systems that are linked to corporate databases.

[Insert Exhibit 5 about here]

(b) User Training. As we will illustrate below, some of the big benefits from marketing engineering are being realized through end-user modeling. Indeed, two of us (L&R) have developed a marketing engineering end-user tool kit that is facilitating the technology transfer challenge. A key element associated with the necessary training is to embrace learning by doing.

Exhibit 6 gives an outline of a 3-day executive program course that we teach using the marketing engineering concepts. The exhibit gives the philosophy of the course and outlines several of its benefits. The material has been adapted to advanced undergraduate programs, MBA and Executive MBA programs. Firms, such as Kodak Medical Imaging, have made this form of training mandatory for all marketing-related employees. Wharton's New Product Development Executive program has adopted a subset of the material (Lilien and Rangaswamy, 1999) geared to be an analytic supplement to the more conceptual material typically taught in such programs.

[Insert Exhibit 6 about here]

A salient characteristic of the marketing engineering toolkit is that it is immediately amenable to application. Hence, managers can apply the concepts of segmentation, targeting, positioning, resource allocation and the like to their own businesses in real time during training sessions. Managers see the potential value of such exercises for "anticipatory learning," about what might happen under various realistic scenarios facing them. And MBA students can apply the concepts to problems that they conceptualize during the semester and successfully conclude projects of real value during the course, as the following example illustrates:

> *Case Example: Sales Force Sizing and Allocation at MM Inc*. We referred to the Syntex Labs case above. The ME book and software (L&R, 1998) includes the Syntex Labs case and related software to help students determine how many salespeople Syntex should hire during the following three years and how they should be allocated across market segments. Students also have access to video tape testimonials by Syntex management (Senior VP, Marketing and Company President) indicating that the use of the model provided $15 million in profit above the

firm's strategic plan (although they also indicated that if they had been wiser in using the model, they could have made more than twice that amount!)

We applied the judgmental response model/Syntex approach to a company we will call MM Inc, (disguised name), an industrial materials supplier, that was investigating the appropriate size and allocation of one of its US sales forces. The current situation was that US sales were around $100 million and MM currently employed 78 salespeople who worked out of 14 sales branches.

We ran a one-day judgmental response session (see L&R, pp. 249-255 for details) with 16 senior sales reps, national sales managers, marketing managers and marketing research analysts. After a 1½-hour introduction session, we broke the group into 4 subgroups, each of which built a response function for 3-4 sales branches, essentially answering the following questions

What would sales be in three years at this branch with:
No sales force representation?
One fewer sales representative?
The same number of sales representatives?
One more sales representative?
A very large increase in the number of sales representatives?

With these and a few other model-inputs (market sizes, growth rates, profit margins), we ran a number of model cases and showed that:

- Two of their (14) sales branches were significantly overresourced while three of the others were underresourced.

- Profits could be increased by 4% simply by reallocating representatives from overresourced to underresourced branches

- An additional profit increase of 7% (for a total of 11%) could be made by adding 25-30 representatives.

These results proved to be robust with respect to many sensitivity analyses we ran with respect to profit margin, response function estimates, market growth rates and the like. On basis of this experience, the team decided to propose a major increase in sales force staffing to the board at a meeting that was scheduled two weeks after the modeling work was completed. The team also decided to use the approach with another, related salesforce that was approximately twice the size of the one they had just studied.

And this entire process took place in 1½ days!

We presented the MM case to a group of MBAs after they had just run the Syntex Labs case to illustrate the immediate and practical value of the marketing engineering approach. Such a direct application provided great credibility and motivation to the students who are faced with understanding how to address a complex decision situation with tools that involve nonlinear optimization.

(c) Marketing Engineering on the Internet: We expect that the trend towards end-user computing will become stronger with the wider adoption of the Internet. As more managers begin to use the Internet as a resource for their day to day decision making (e.g., for getting information, communicating their decisions), it is likely they will also be more inclined to use decision models that are accessible on the network. With the growing use of the Java language, more sophisticated interactive modeling is appearing on the network. While many of the existing models on the network address simple problems, such as computing mortgages or calculating the market value of a stock portfolio, more sophisticated models are on the horizon and many sophisticated marketing models are available on the network 24 hours a day. In fact, most of the models in L&R will be available on the Internet by mid 2000, requiring nothing more than a browser to access and use.

Marketing Engineering in Perspective

So, what is the marketing engineering scorecard? Marketing engineering provides demonstrable value in the field and in the laboratory. Indeed, some recent research (Lilien, Rangaswamy, Starke and van Bruggen, 1999) testing specific marketing engineering models in a laboratory situation suggests that:

- Marketing engineering resource allocation models improve objective market results (profit) achieved by the users.
- Model use changed the basis of allocation decisions (e.g., shift focus to growing products, profitable products, switchable customers, etc.), and model users make decisions that shift them farther away from "status quo" decision options.

So far we have learned many important lessons from our experience with how managers work with marketing engineering tools. The most important ones are the following:

End user software allows rapid prototyping: Markets are changing so quickly that decisions must reflect quick adaptation rather than careful optimization. Thus, to be useful, decision aids must be capable of rapid prototyping. Even when a full-blown marketing engineering project is not feasible, trying out a model on a smaller, related problem can provide managers with useful insights and document the potential opportunity cost of not doing a full-scale study.

Software empowers. Our experience and our experimental results suggest that managers can explore more strategic options and options farther away from the "status quo" than they view with more traditional approaches. The software also has a favorable impact on the decision processes and learning that occurs in this decision environment.

Empowerment has its downside: The deceptive simplicity of using much current software and the presumed scientific credibility of the underlying models gives users a false sense of security. We have observed two interesting situations: students and managers with strong quantitative backgrounds are often drawn to the technical aspects of the results and sometimes miss the big picture. Those with weak analytical skills either ignore model results and go with their intuition or accept the results uncritically. The best outcomes we have seen come from groups that include people with different levels of analytical abilities who pool their efforts while questioning and supporting one another. These groups use the model results as one input into a decision process that also includes common sense and judgment.

Marketing engineering means better marketing: Marketing engineering is NOT about the models and the tools. Rather, marketing engineering allows marketers to take advantage of data, information, and computer models in making important marketing decisions. It is a systematic process to help people improve decisions, and the outputs of that process are better decisions.

Marketing engineering demands judgment. Models are simplified and incomplete representations of reality. Models developed to support strategic decisions (e.g., positioning) usually provide insights concerning the directions of actions but often no specific guidelines; while models developed to support operational decisions are both narrow and specific (how many sales calls should a salesperson make to a given account in the next quarter?). In using both types of models, managers must temper the model results by using their own judgment. For strategic decisions, managers must use judgment to translate broad guidelines into specific actions. For operational decisions, managers must use their judgment to fine-tune specific recommendations to fit with the overall strategy of the firm.

These insights about the benefits, the process, the costs the benefits, and the future of marketing engineering are preliminary and demand much more research than we have outlined here. Marketing engineering is not a panacea and the approach may not be appropriate for everyone or in every situation. But as we dig more deeply into the research implications implicit in Exhibit 1, we will have a better understanding of how best to use marketing theory and technology to improve marketing practice through marketing engineering.

A View of the Future

We are near the end of the era when firms could gain competitive advantage merely by having market information. Today, large firms have access to more market and customer information than they can use. More information can obscure rather than enlighten. In a project called "Dying for Information," Reuters Business Information (1996) carried out a survey among 1300 managers in the U.K, U.S.A., Australia, Singapore and Hong Kong. They found that managers in environments where they are receiving increasing quantities of information find that environment very stressful and 49% of the managers interviewed said that they were often unable to cope. They reported ill health and suffering personal relationships along with other symptoms such as paralysis of analytical capacity, increased anxiety and self-doubt, and a tendency to blame others. Having too much information, without the proper systems for scanning the information and finding what is important and what can be discarded might be just as dangerous as having too little information.

To gain the most value from information, firms are trying new approaches: (1) They are using computer and communication technologies to make relevant information available in a timely manner to their entire workforce, using procedures such as Knowledge Discovery in Databases (KDD) and data mining with neural networks and genetic algorithms. (2) They are developing new ways to help employees use specialized knowledge (e.g., marketing engineering) to convert information into more effective decisions and actions. Marketing engineering approaches that include firm-specific knowledge (e.g., a customized conjoint analysis model) can help firms to transform market information into superior products. Such uses of information are not transparent to competitors and not likely to be replicated by them, leading to competitive advantage. Information has value only if you use it to drive decisions and actions. As Barabba and Zaltman (1991, p. 3) put it, "competitive advantage resides increasingly in how information is used rather than in who has information."

Many firms are putting together a new corporate activity called Marketing Information Systems (MKIS) to support and enhance enterprise-wide performance using marketing information. Although the concept of MKIS has existed for a number of years (see, for example, Kotler 1966), the scope and potential value of the present-day MKIS is far greater than was envisioned in those early days.

MKIS, typically located within the marketing department, is charged with harnessing marketing-related information and distributing and facilitating its use within the firm. Even as the marketing function seems to be in decline, the marketing concept itself appears to be gaining wider acceptance in firms (Doyle 1995). Marketing is becoming an enterprise-wide activity, rather than the exclusive domain of a specific department. Firms see MKIS as a way to use marketing information to make everyone in

the firm realize that they must be more responsive to customer needs and wants and to the competitive environment.

Historically, a major function of information systems has been to provide timely access to information. MKIS can now integrate end-user decision models with traditional information systems to enhance the firm's ability to use marketing engineering. At least six current trends favor this integration of information. Firms are

1. Investing in the infrastructure they need to develop and maintain extensive corporate databases (data warehouses) and are implementing Enterprise Resource Planning systems,
2. Using online analytical processing (OLAP) to integrate modeling capabilities with databases,
3. Deploying intelligent systems to automate some modeling tasks,
4. Developing computer simulations for decision training and for exploring multiple options,
5. Installing groupware systems, such as Lotus Notes, to support group decision making, and
6. Enhancing user-interfaces to make it easier to deploy even complex models more widely.

Glazer (1991) has tried to predict what might occur in the next decade or so because of the increasing availability of information and the decreasing cost of processing that information; he expects

> shorter and less predictable product life cycles,
> a shift in power from sellers to buyers,
> more focus on product profitability and less on share,
> more (and less formal) alliances,
> more focus on cooperation and less on competition, and
> greater reliance on decision teams whose members simultaneously process shared information.

All of these changes demand rapid and coherent marketing decisions, supported by the marketing engineering approach. Shorter product life cycles mean that analysis has to be both quick and sound. Increased buyer power means that companies must better understand buyer values to succeed in the market. An emphasis on profitability means that marketers must focus on setting objectives. Alliances and cooperation mean that we need newer models to support these multiple decision-makers. And the increase in team decisions means that groupware will increase in importance.

These trends will drive the marketing engineering imperative. Increasingly we will be relying on marketing engineering approaches, perhaps available through the internet, so that better informed, disciplined marketing decisions can be made anywhere, anytime by anyone.

While the marketing function in companies may decline in importance in the years to come, marketing can only increase in importance. Years ago Peter Drucker pointed out that marketing is too important to be left to marketers; that statement is even more true today.

Marketing engineering links marketing theory and marketing practice. In marketing, practice without theory teaches little while theory without practice means even less. Decision-makers, pressured to understand and operate in complex and risky markets, increasingly depend on the concepts and tools of marketing engineering. Marketing engineering can serve as channel through which the insights and knowledge produced by marketing scientists can be distributed to practice. For example, the executives we teach invariably try out software using some of their own data and immediately see the relevance and the benefit of the marketing engineering approach. The pressure for academics to show greater relevance for their work is increasing academic interest in marketing engineering as well. These two pressures point to an exciting marriage of convenience that should lead to improved tools for practitioners and interesting problems for academics to work on. As with all successful partnerships, both stand to gain.

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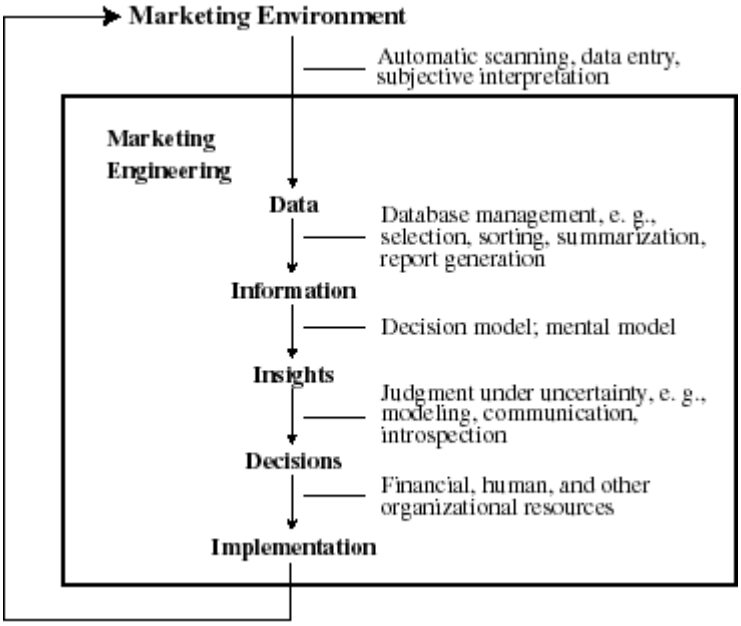

Exhibit 1 The marketing engineering approach to decision making helps transform objective and subjective data about the marketing environment into decisions and decision implementations.

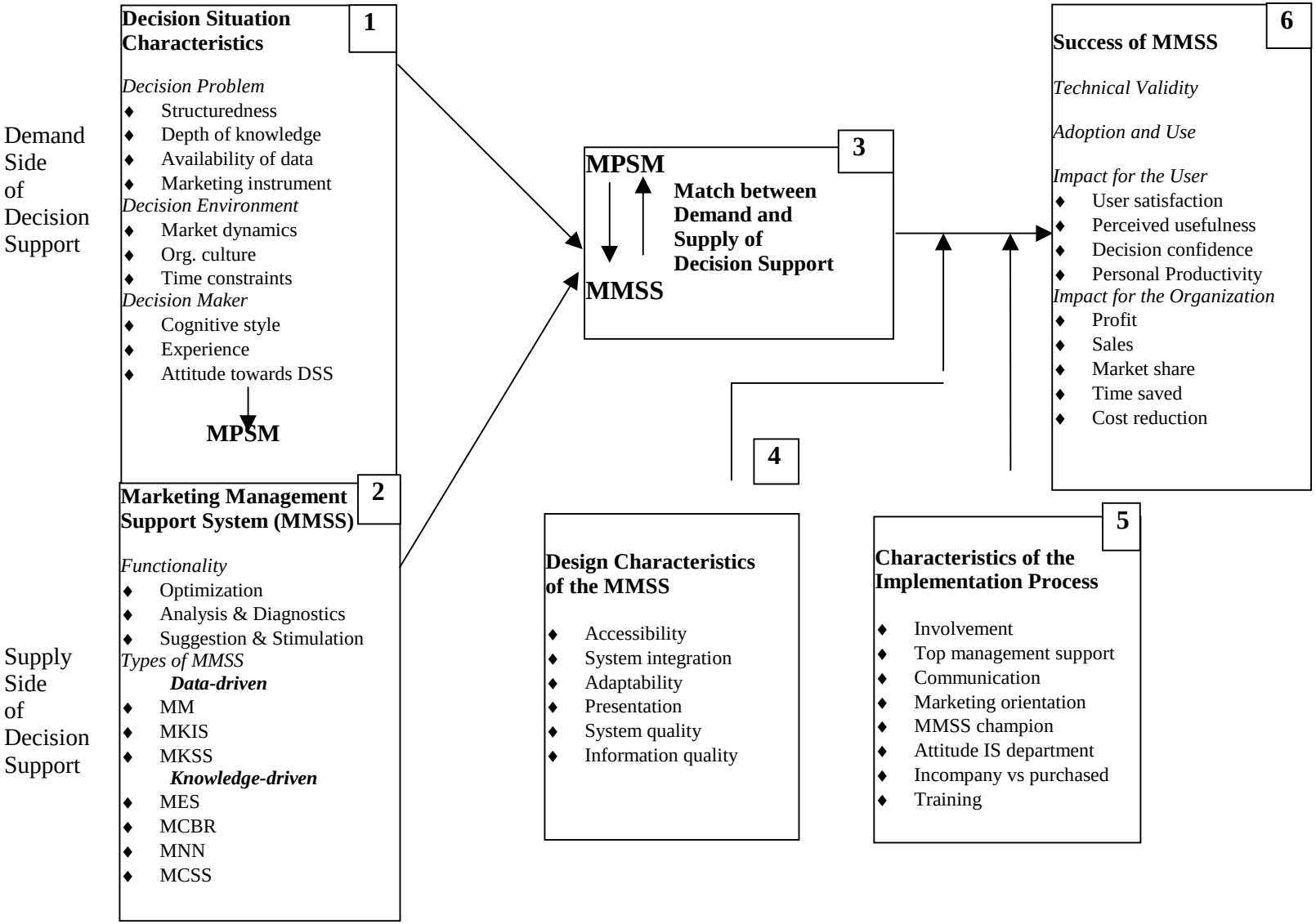

Exhibit 2 Integrative framework of the factors that determine the success of a marketing management support system.
Source: Wierenga, van Bruggen and Staelin 1999.

Types of judgments experts had to make	Mental Model*	Subjective Decision Model**	Objective Decision Model***
Academic performance of graduate students	.19	.25	.54
Life expectancy of cancer patients	-.01	.13	.35
Changes in stock prices	.23	.29	.80
Mental illness using personality tests	.28	.31	.46
Grades and attitudes in psychology course	.48	.56	.62
Business failures using financial ratios	.50	.53	.67
Students' ratings of teaching effectiveness	.35	.56	.91
Performance of life insurance salesman	.13	.14	.43
IQ scores using Rorschach tests	.47	.51	.54
Mean (across many studies)	.33	.39	.64

*Outcomes directly predicted by experts.
**Subjective Decision Model: Outcomes predicted by subjective linear regression model, formalizing past predictions made by experts.
***Objective Decision Model: Linear model developed directly from data.

Exhibit 3 Degree of correlation with the true outcomes of three types of models, showing that even subjective decision models are superior to mental models, but that formal, objective models do far better. *Source*: Russo and Shoemaker 1989, p. 137.

Appli-cant	Personal Essay	Selectivity of Under-graduate Institution	Under-graduate Major	College Grade Average	Work Experi-ence	GMAT Verbal	GMAT Quanti-tative
1	Excellent	Highest	Science	2.50	10	98%	60%
2	Excellent	Above avg	Business	3.82	0	70%	80%
3	Average	Below avg	Other	2.96	15	90%	80%
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
117	Weak	Least	Business	3.10	100	98%	99%
118	Strong	Above avg	Other	3.44	60	68%	67%
119	Excellent	Highest	Science	2.16	5	85%	25%
120	Strong	Not very	Business	3.98	12	30%	58%

Exhibit 4 Input data for all three models, namely, mental model, subjective decision model, and objective decision model, used for predicting the performance of graduate students. See first row of Exhibit 3. *Source*: Russo and Schoemaker 1989, p. 132.

	End-user models	High-end models
Scale of problem	Small to medium	Small to large
Time availability (for setting up model	Short	Long
Costs/benefits	Low to medium	High
User training	Moderate to high	Low to moderate
Technical skills for Setting up model	Low to moderate	High
Recurrence of problem	Low	Low or High

*Low for one-time studies (e.g., Marriott Conjoint Study) and high for models in continuous use (e.g., American airlines Yield Management system).

Exhibit 5 Two extremes of marketing decision models: end-user versus high-end models. Although the marketing engineering approach applies to both types of models, we focus on end-user models in this book. *Source*: Stephen G. Powell 1996.

Power Tools Help You Make More Effective Marketing Decisions,
Based on More Information, in Less Time

Today, many of us have a flood of information coming our way, more computing power on our desktop than we ever thought we'd have. But we are still making decisions the "same old way." This seminar introduces a new set of easy-to-use, desktop "power tools" which can enable marketers to make more profitable decisions--everyday.

SEMINAR OBJECTIVES

To enable managers to understand how desktop computer models can help make better use of market knowledge in making decisions.
Participants will learn how to:

Download, enter, and use computer tools in a variety of business decision situations.
Apply these tools working with real marketing case examples of their profitable use.
Better utilize data you already have in navigating decisions faced everyday in the business marketplace.

This three-day program features:

Interactive discussion of key concepts.
Action learning cases
Hands-on experience applying computer tools.
Analysis of video illustrations of these tools in action at leading firms.
Syndicate assignments, readings, networked learning.

Includes comprehensive notebook, textbook, and tutorial manual with case examples illustrating use of each tool; and CD-ROM with twenty-six software tools in areas such as:

Choice models
Conjoint Analysis
Cluster/discriminant analysis
GE/McKinsey portfolio analysis
Perceptual mapping
New products analysis and forecasting
Decision analysis
Geodemographic analysis for site selection
Marketing resource sizing and allocation

More...

Exhibit 6 Marketing engineering training program outline, featuring end-user modeling and learning by doing.