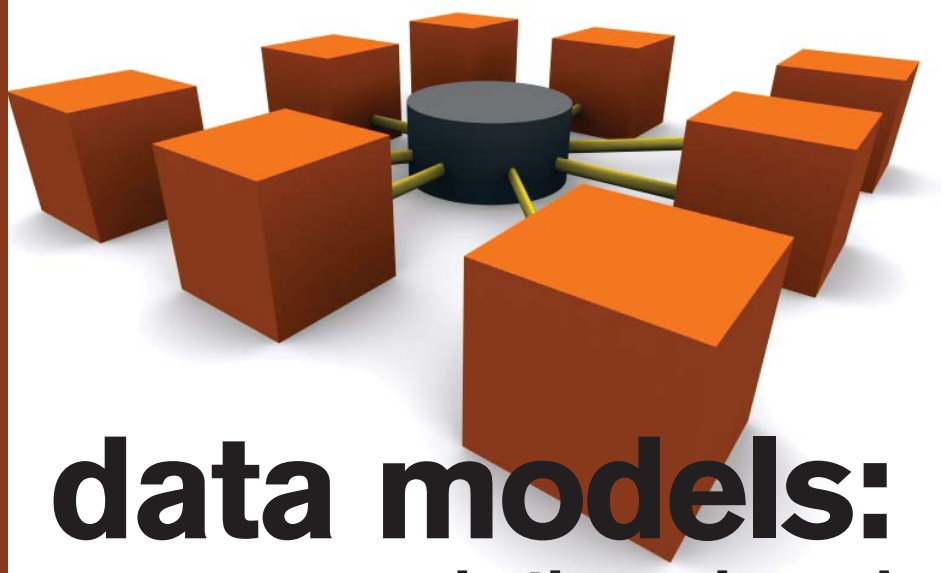
by Chuck Chakrapani, Ph.D.

Marketing mix models assume that several sets of variables contribute to ROI: the product, the price, promotional efforts, distribution channels, advertising media, and other such factors. The purpose of these models is to optimize a current set of marketing activities such that the expected ROI is maximized. For example, if an advertiser has $5 million to spend on advertising, how should these funds be allocated among different media – TV, print, radio, online and below-the-line promotions – such that the expected sales (ROI) as a result of these activities are maximized? Marketing mix models answer questions such as these.



data models:
marketing mix and optimization models

As an example, let us consider the different media in which ads may be released: TV, print, radio, point of purchase, and online. The question posed by marketers is how the company should spend its marketing dollars in these different media. Should the company spend more on online advertising than on TV advertising? What is the ROI on TV advertising as opposed to the ROI on online advertising? The answer to this question gets complicated when we consider the possibility that not all TV channels are the same. Will our return be the same if we spend the same amount of money on specialty as opposed to network channels? Will our return be different if the commercial is shown at different times? Will a TV ad that is rated by consumers to be a good one have a higher ROI? Marketing mix models may be structured to take into account such interrelated and hierarchical effects. They attempt to identify the individual contribution of each marketing element to sales and profits. Such identification enables us to combine the different elements of marketing mix to optimize ROI (sales and profits).

A marketing mix model is a statistical model (mostly based on multiple regression analysis) that quantifies the relationship between sales and the variables that drive sales, such as advertisement media weight and mix, consumer promotions, trade support, pricing, competitive activity, and seasonality.

Marketing mix models provide a means of estimating the impact of marketing activities. Strictly speaking, the input variables are marketing variables rather than marketing research variables. However, many of these marketing activities are measured by marketing and the variables the models are often built by marketing researchers. Marketing mix models also enable us to add measures generated by marketing research. Marketing mix models also enable us to add measures generated by marketing research. For example, research may identify through advertising pretesting that ad A was liked more by consumers than ad B. But does ad A result in higher ROI than ad B? If it does, then the increased ROI can be attributed to research that identified ad B to be superior. For these reasons, marketing mix models are considered a part of the marketing research discipline and are so treated in comprehensive handbooks on modern marketing research. (See for example, *Marketing Research: State of the Art Perspectives,* edited by Chuck Chakrapani, 2000; *The Handbook of Marketing Research,* edited by Rajiv Grover and Marco Vriens, 2006).

Marketing models typically use historical data to estimate the effects of different variables on sales and profitability. Regression type equations are developed, and the results are used in optimization models. Critics of marketing mix models argue that these models, even when they work, do not provide us with insight as to why certain marketing variables are more effective than others. For example, even if we identify that TV advertising works best when combined with in-store promotions, we still do not know why this is so. All we know is that, in the past, this combination worked. While valid, this criticism can be applied practically to most models in any field. We generally expect the patterns that held in the past to hold in the future, with the caveat that when condi-

tions change, so may the patterns.

Let's consider the effect of advertising. In simple terms, advertising can be treated as influencing sales. This can be written as a simple regression equation:

Sales = a + b (advertising expenditure)

While it is conceptually acceptable, in reality there are other factors to consider. For instance, advertising expenditure does not automatically increase sales, because it interacts with several other variables. Some of these are listed here.

1. Immediate effect: This is the effect that an advertisement has on immediate sales. Practically all mail order advertising concentrates mostly on this metric. However, for most advertising there is also a long-term effect.

2. Delayed effect: Delayed effect occurs for several reasons. Consumers are exposed to an ad late or delay their purchase or buys later due to immediate product unavailability or a long purchase cycle, and so on.

3. Spurt effect: Sales could be affected by the way ads are released. For instance, an ad campaign released in spurts followed by zero advertising can potentially have a different effect compared to ads that are released at constant intervals, even though the ad expenditure may be the same.

4. Competitive effect: Response to advertising is also affected by competitors' activities. If competitors release more attractive ads at a time when Company A is trying to get its message across, Company A's ad effectiveness is likely to be diminished.

5. Carryover effect: Advertising has long-term effects. For instance if Coca Cola stopped advertising tomorrow, its sales would continue to be strong for years to come because of the carryover effect of decades of vigorous advertising.

6. Content effect: The content of the ad – its creativity, the attractiveness of the offer, etc. – will also affect sales.

7. Media effect: The medium is an important component of the message. A product that is advertised in high quality magazines will have a different sales effect than a product advertised in mass market dailies, even if the advertising expenditure were the same.

To account for all these effects, we can build suitable marketing mix models. These models require advanced statistical knowledge, so I will not attempt to describe them in detail here. However, without going into the mathematics, here are some possibilities. To assess the immediate effect, we can build a multiple regression model such that variables such as advertising expenditure, quality of advertising, and message effectiveness become independent variables, influencing sales in a linear way. A multiplicative model, which uses a logarithmic transformation of the variables, can be used to account for the interaction among the variables in the equation. A multinomial logit model can be used to measure the pull of a given brand vis-à-vis other brands. Lagged models can be used to assess the delayed effects of advertising. Dummy variable regression can be used to capture the effects of quantitative (non-metric) variables.

We can similarly set up models to understand the effect of pricing. It is also possible to combine the effects of pricing and advertising on sales in the same model. Since it is impossible to describe these techniques adequately without going to mathematical and statistical notation, I will have to be content with just referring to these methods conceptually. An interested reader may want to refer to David Gascoigne's description of marketing mix models in my book, *Marketing Research: State of the Art Perspectives*, referred to earlier.

Marketing mix models seem to have worked best in CPG industries – consumable goods industries such as food and beverages, footwear and apparel, tobacco, and cleaning products. A reason for this might be that the basic marketing patterns in the CPG industry have followed traditional lines. Hence, historical patterns have been effective in optimizing the marketing mix. But the marketing process itself is going through major changes, and it is becoming increasingly necessary to go beyond traditional marketing mix models.

OPTIMIZATION (MATHEMATICAL PROGRAMMING) MODELS

Conceptually, marketing mix type models can isolate the effect of different marketing mix variables on sales and profits. This naturally leads to the question of optimization. For instance, if we develop a media mix model to estimate how much revenue would be generated by expenditure in each of the different media (TV, radio, print, and the Internet), then this information can be used to optimize the amount allocated to each of the media. Optimization models applied to the data will allow the advertiser to maximize the ROI by simply reallocating the ad expenditures. Optimization models are also referred to as "mathematical programming models."

Why reallocate the resources? If our model shows that one dollar spent on TV advertising generates ten per cent more revenue than dollar spent on other media, then why not allocate all advertising dollars to TV advertising? A little reflection will tell us that it may not be quite that simple. The differential advantage may not be linear in nature. Advertising in a given medium may have diminishing returns as we increase the advertising expenditure in that medium. Or there may be strategic reasons for wanting to be in a given medium to reach a specific audience. There may be many constraints like these in reality. It is for this reason that we need optimization models. (You may recognize that input to the model involves marketing research. As before, I'm skipping the mathematics behind the optimization models, since it does not add to the understanding of those who are not mathematically inclined. Those who are so inclined can find information readily in other sources.)

Mathematical programming models are used in other related contexts as well. In recent years, powerful database and statistical analysis techniques have become available to support customer relationship management (CRM). As a result, the depth and complexity of inputs relating to target marketing programs have increased considerably. For example, consider the question of how likely a consumer is to buy your product. In the database, information relating to probability of purchase may be available by offer, profitability, costs, marketing budget, restrictions on customer contact, and so on. Such information can point to the opportunities and constraints that define many marketing programs. A marketer needs to maximize ROI, given these opportunities, within several constraints. Mathematical programming techniques provide a way to optimize the ROI through targeting the offers that maximize the return, while taking into account the constraints associated with each course of action.

Marketing mix models and optimization models are increasingly carried out by marketing research houses and quantitative marketing research specialists. Since many marketing research houses measure impact of advertising, pricing, media and creativity, clients are often interested in knowing the effects of these metrics on ROI. The burden of proof falls more and more on the shoulders of marketing researchers. Marketing mix models and optimization models provide a means of measuring the impact of these metrics on ROI.

In the next few articles, I will discuss more elaborate linkage models – models that attempt to link sales and profits to marketing and research metrics.

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1/3 page (B)	2 1/4	x	9 1/2	$599.00
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