

Optimizing Marketing Spend with Marketing Mix Modeling



Perceptive**Analytics**

Data Analytics | Spreadsheet Modeling

New York • Boston • San Francisco • Hyderabad

[Perceptive-Analytics.com](https://perceptive-analytics.com)

(646) 583 0001 cs@perceptive-analytics.com

Executive Summary

Marketers in CPG industry are constantly faced with the challenge of allocating their fixed marketing budget among various marketing channels. Today's tech savvy customer no longer relies on traditional communication mediums like television, radio or magazines alone but uses a variety of digital channels viz., social media platforms like facebook and twitter, internet display ads, brand's website etc., to engage with the product. Marketers are therefore challenged to employ marketing campaigns that integrate traditional and digital channels by effectively allocating their marketing budget between these channels.

To achieve the above, companies have to rely on many of the marketing tools available today and create models that will show the impact each of this channel has on sales. In this case study, we summarize the various marketing mix models available for marketers by analyzing the strengths and weaknesses of each of them. In particular, we focus on regression models, influence maximization models; agent based models and empirical methods being used by the marketers. The success of these models will depend to a large extent on availability of accurate and specific data and a cross functional team that ensures integrity of data.

Introduction

Marketing mix modeling (MMM) is the use of statistical and analytical tools to quantify the impact of marketing decisions of the past and predict future sales impact of various mixes of marketing variables. Consumer Packaged Goods (CPG) companies are the first to have successfully embraced the concept of marketing mix modeling. Low contribution margins, increased competition and high customer switching placed pressure on CPG manufacturers and retailers to invest in data collection and analysis. As a result, these companies had access to large volumes of data which was both granular and sufficient for analysis. This helped CPG companies to apply various models to the data collected and draw insights to adjust their marketing mix accordingly.

Marketing mix models have evolved from early stages of simple linear regression techniques to complex set of models like agent based models and influence maximization models. This was needed because of the advent of new media vehicles, better data availability and complex media interactions.

The success of marketing mix modeling depends on the availability of accurate and sufficient data and a cross functional team that ensures integrity of data. A successfully implemented marketing mix model can provide the following benefits:

- It reflects upon past marketing decisions by calculating return on investment (ROI)
- It allows companies to optimize their marketing mix by forecasting the likely impact of changes to various marketing mix variables.
- It helps in distinguishing the reasons for the changes in business performance by isolating the impact of internal and external factors.

Strategic Impact of Marketing Mix Modeling

Marketing mix modeling quantifies the impact of individual marketing activities on revenues, volume and price perception. It calculates the relative ROI of various marketing decisions and helps management in forming an optimum marketing mix. Typically, it provides insights on the following:

Identifies Performance Drivers

MMM identifies the actual drivers of performance and segregates them into internal (advertising, media selection, trade promotions) and external factors (pricing, seasonality, economic trends etc.).

Quantifies Impact of Marketing Variables

Marketing mix modeling decomposes total revenue into base revenue and incremental revenue. It then identifies the factors affecting the incremental revenue and quantifies their individual impact. It also compares the ROI for different line items in marketing budget.

Optimizes Marketing Spend

By determining the past impact of various media channels (Television, Internet, Mobile, Magazine etc.) on revenues, MMM provides insights to reallocate resources to form an optimum marketing mix.

Performs What-if-Analysis

MMM helps in predicting the potential revenue effects of proposed marketing actions and provides insights on which to base their decisions. It answers questions like what is the optimal allocation of marketing and sales funds, how will budget reallocation influence revenues and profits, how will it affect the competitive position of the organization etc.?

Understand Trade-offs

MMM helps managers in understanding the trade-offs they face by identifying the marketing activities that effect the organization differently i.e. the ones that impact the revenue (short-term moves) and the ones that effect consumer's price perception (long-term effect on brand equity).

Marketing Mix Models Used

Large volumes of data, greater computing power and advent of new digital media have both necessitated and transformed the use of marketing mix models. Below, we discuss the following models available today and assess their strengths and weaknesses.

- Regression Model
- Influence Maximization Model
- Agent Based Models
- Empirical Methods

Regression Models

Regression techniques are the oldest to have been used for marketing mix analysis. They involve predicting the value of an unknown variable (sales) which is dependent on one or more known variables (price, media channel etc.). They are easy to build and work efficiently for simple marketing campaigns. Using regression analysis, MMM can quantify the impact of individual marketing activities on revenues and profitability. It isolates the impact of various internal (advertising, promotions, pricing etc.) and external factors (seasonality, competition, general market trends etc.) and quantifies the relative returns of different marketing mix variables. Apart from calculating returns, regression analysis also facilitates what-if-analysis to predict the impact of various marketing variables on revenues and allows companies to form an optimum mix by determining the best budget allocation.

For example, we can construct a regression equation that takes into account proportion of investments in different marketing channels and develop an algorithm to maximize total revenues. These equations can be linear (simple relationships like price and sales) or nonlinear (complex relationships like carryover effects of advertising). Marketing effects are rarely simple and involve complex relationships like interaction among different media channels, carryover effects of advertising, diminishing returns property of media channels etc.

It is assumed that there exist threshold effects of advertising i.e. there are advertising levels below which there is no sales response. Also it is assumed that advertising and sales exhibit diminishing returns which led to various researchers recognizing an s-shaped advertising

response curve i.e. they reach a point where an additional dollar spent on a particular media vehicle (say radio) is not as effective as a dollar spent on any other vehicle. Apart from the s-shaped response curve, there are carry over effects of advertising to be considered as well i.e. not all effects of advertising will be perceived in the same period in which they are aired. It is assumed that at least some of them will be perceived in future periods. For example a customer may see an ad in television in a week and research about the product and end up buying it in the following weeks. These complex relationships between different marketing variables require us to construct a nonlinear objective function. We can model these relationships by developing a nonlinear regression equation in the following manner:

$$\text{Sales}(C1, C2, C3) = A * b^{(a^f(C1))} + C * d^{(c^g(C2))} + E * f^{(e^h(C3))}$$

Where A, C & E are coefficients showing sales from channels C1, C2 and C3 respectively during the week

b, d & f are regression coefficients showing advertisement exposure for channels C1, C2 & C3 respectively

C1, C2 and C3 are the amount of marketing budget invested to each of the three channels

f(C1), g(C2) & h(C3) represent the carryover effects

We may change the proportion of budget invested in each of the channels and see the impact on total revenues. An algorithm can be used to automate the process of allocating different proportion of budgets to each of the channels. The allocation that maximizes the revenues can be selected as the optimum mix.

In spite of the benefits it offers, regression models become difficult to manage with increased complexity of marketing variables i.e. they cannot incorporate complex media interactions as it increases nonlinearities in the model. Also, these models are suitable for estimating short-term effect only and cannot incorporate long-term effects on brand equity.

Influence Maximization Models

A social network is a place where people share common interests, ideas and information. It is also a medium to influence people or generate interest about an idea, product or a service. If we want to understand the extent to which such ideas are propagated and

adopted by people or identify those set of individuals who have the maximum influence on their friends or followers, we can make use of what is called as influence maximization models. Influence maximization is the process of identifying the set of influential individuals (or set of nodes) in a social network that has the maximum influence in the network.

We can apply this model to the problem of allocating budget among media channels such as TV, radio, magazines, internet etc., and identify those channels that have the maximum influence. We may consider the entire setting as a bipartite graph in which there are a set of influential nodes (channels) on one side and a set of potential targets (customers) on the other side. We assume that each channel has a threshold capacity to influence customers and the budget allocated to a channel is dependent on the channel's capacity. The channel or the set of channels to which budget is allocated makes independent trials to influence customers in their network and the set of channels that influences the maximum customers can be selected as the optimum mix.

Agent Based Models

Agent based models analyze complex marketing patterns by simulating the behavior/actions of agents such as customers, competitors or organizations. Behaviors of individual agents are studied and sets of rules of behavior are developed. These sets are then aggregated to build a model that suits the needs of individual marketers. These models are particularly useful in incorporating characteristics such as word of mouth, social network effects, media interactions, consumer attitudes and behaviors that are too difficult to include in conventional or empirical methods. These models are very useful in designing social marketing campaigns. The major limitation of agent based models is that they are difficult to fit and manage and are subject to individual's judgment.

Empirical Methods

Marketing mix modeling requires managers to possess considerate technical and statistical knowledge to use them and the emergence of new online media channels have only added to this complexity. As a result, managers are still employing empirical methods and rely on simple heuristics for resource allocation.

Percentages of sales method, judgmental forecasts of individual marketers are some of the methods employed by marketers in formulating the marketing mix. There is also a

methodology which involves identifying the factors that are important in deciding the optimum marketing mix and assigning weight to each of them by their importance. The decision would be based on that combination of channels which gather the highest score for the factors that are most important for every occasion (Table 1). Even though empirical methods are easy to use and require less effort and money compared to other analytical models, they are subject to individual manager's judgment and cannot be applied universally in all the situations or by all the organizations.

Table 1 - Selection of Channel Based on Maximum Score Achieved

Factor	Weights	Television	Magazines	Internet
Potential Market - 20 to 30 Years	0.30	0.25	0.15	0.25
Coverage	0.20	0.15	0.12	0.16
Speed	0.20	0.18	0.13	0.18
Cost of Channel	0.15	0.06	0.15	0.12
Nature of Message	0.10	0.10	0.06	0.08
Competition	0.05	0.03	0.04	0.03
Total		0.77	0.65	0.82

For the factors identified in Table 1, Internet gathers the highest score followed by Television with a weightage of 0.77. These two media will rank as the most preferred for optimizing the marketing spend.

Key Factors for Successful Implementation of MMM

Success of modeling effort depends largely on availability of sufficient and accurate data. Data must be granular both in terms of classification and reporting frequency (weekly vs. monthly data). Also model's data architecture should be compatible with organization's IT architecture and aligned with company's internal processes. Other factors include a cross functional team to ensure integrity of data, flexibility to add new media channels as they emerge and the ability to deliver key insights at the right time to the right people.

Perceptive Analytics

Perceptive Analytics is a Data Analytics company, offering specialized services in Marketing Analytics, Data Visualization, Financial Modeling, Spreadsheet Modeling and Application Solutions. We serve large and medium sized companies in the US, India, Australia, Europe and Middle East.

We provide analytics solutions for optimizing marketing decisions. We offer solutions such as demand forecasting, promotion modeling, mark-down optimization, customer segmentation, and competition analysis. We adopt the right strategy and create marketing edge so you can create winning products, enhance sales and convert traffic into customers.

Contact

Chaitanya Sagar

Chief Executive Officer, Perceptive Analytics

cs@perceptive-analytics.com: +1 (646) 583 0001

Dinakar Jinna

Senior Analyst, Perceptive Analytics

dj@perceptive-analytics.com



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