Optimize Marketing Budget with Marketing Mix Model

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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 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 show the impact of these channels on sales. In this case study, we summarize various marketing mix models available for marketers by analyzing their strengths and weaknesses. In particular, we focus on regression models, influence maximization models; agent based models and empirical methods used by marketers.

Introduction

Marketing mix modeling (MMM) is the use of statistical and analytical tools to quantify the impact of marketing decisions of 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. A successfully implemented marketing mix model provides 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

MMM 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. It provides insights on following:

**Identifies Performance Drivers**

MMM identifies the drivers of performance and segregates them into internal (advertising, media selection, trade promotions) and external factors (pricing, seasonality, 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 incremental revenue and quantifies their individual impact. It also compares the ROI for different line items in marketing budget.

**Optimizes Marketing Spend**

By determining past impact of various media channels (Television, Internet, Mobile etc.) on revenues, MMM provides insights to reallocate resources to form 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 the decisions. It answers questions like what is the optimal allocation of marketing and sales funds, how budget reallocation influence revenues and profits, how will it affect the competitive position of organization etc.?

**Understand Trade-offs**

MMM helps managers in understanding the trade-offs they face by identifying marketing activities that effect organization differently i.e. ones that impact revenue (short-term) 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
Regression Models
Regression techniques are the oldest to have been used for marketing mix analysis. They are easy to build and work efficiently for simple marketing campaigns. Using regression analysis, MMM quantifies the impact of individual marketing activities on revenues and profitability. It isolates the impact of various internal (advertising, promotions etc.) and external factors (seasonality, competition etc.) and quantifies the relative returns of different marketing mix variables. It also facilitates what-if-analysis to predict the impact of various marketing variables on revenues and allows companies to form an optimum mix.

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 revenues. These equations can be linear (price and sales) or nonlinear (carryover effects of advertising). Marketing effects are rarely simple and involve complex relationships like interaction among media channels, carryover effects, diminishing returns of media etc.

It is assumed that there exist threshold effects of advertising i.e. 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 particular media vehicle (say radio) is not as effective as a dollar spent on other vehicle. Apart from 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 aired. It is assumed that at least some of them are perceived in future periods. These complex relationships between various marketing variables require us to construct a nonlinear objective function as follows:

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

Where A, C & E are coefficients of sales from channels C1, C2 and C3 respectively

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

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

Inspite 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 a medium to influence people or generate interest about an idea or a product. To understand the extent to which such ideas are propagated and adopted by people or identify those set of individuals who have maximum influence, we can make use of influence maximization models. Influence maximization is the process of identifying set of influential individuals (or set of nodes) in a social network that has maximum influence in the network.

We can apply this model to the problem of allocating budget among media channels such as TV, radio, internet etc., and identify channels that have maximum influence. We consider the entire setting as a bipartite graph with a set of influential nodes (channels) on one side and set of potential targets (customers) on the other. We assume that each channel has a threshold capacity to influence customers and the budget allocated to a channel is dependent on channel’s capacity. The channel or 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 considerable technical and statistical knowledge to use them and the emergence of new online media have only added to this complexity. As a result, managers still employ empirical methods and rely on simple heuristics for resource allocation. Percentages of sales method, judgmental forecasts of marketers are some of the methods employed by marketers in formulating marketing mix. There is another methodology which identifies crucial factors and assigns weights to each of them by their importance. The combination of channels which gather the highest score is selected (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 situations or by all organizations.

Table 1 - Selection of Channel Based on Maximum Score Achieved

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weights</th>
<th>Television</th>
<th>Magazines</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Market - 20 to 30 Years</td>
<td>0.30</td>
<td>0.25</td>
<td>0.15</td>
<td>0.25</td>
</tr>
<tr>
<td>Coverage</td>
<td>0.20</td>
<td>0.15</td>
<td>0.12</td>
<td>0.16</td>
</tr>
<tr>
<td>Speed</td>
<td>0.20</td>
<td>0.18</td>
<td>0.13</td>
<td>0.18</td>
</tr>
<tr>
<td>Cost of Channel</td>
<td>0.15</td>
<td>0.16</td>
<td>0.12</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.64</strong></td>
<td><strong>0.55</strong></td>
<td><strong>0.71</strong></td>
<td><strong>0.71</strong></td>
</tr>
</tbody>
</table>

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

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 clients globally which include Fortune 1000 companies, business conglomerates and other large and mid-sized entities. Our clientele are located in the US, India, Australia and Europe.

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.

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