Market mix modeling for retail

An EXL whitepaper

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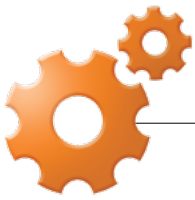Retail Analytics Practice

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Retail CMOs and marketing managers invest 8-10%[1] of their sales revenue into marketing. Their biggest concern is how to best allocate their limited budget into a wide range of marketing activities. In a market where competitors often upset a strategic plan, companies have to consider several key factors such as product launches, trade merchandising, media campaign quality, base erosion, products out-of-stock, consumer movement across channels, consumer response, seasonality, holidays, market growth, macro-economic factors and other elements before planning their spend allocation across the various marketing channels.

Therefore, there is a need for a comprehensive solution which will address these concerns and equip managers to create an effective investment plan.

Market mix modeling: a potential solution

A market mix model is a decision making tool that marketing professionals can leverage to figure out an optimal spend allocation. It is the process of quantifying the impact of each marketing vehicle in terms of ROI and effectiveness. Doing so can help create a roadmap for their future strategy by defining how to plan or adjust their marketing budget and channels, as well as other tasks such as creating pricing and distribution strategies and countering the competition.

This technique segments sales into base and incremental components. Base component indicates long term consumer preferences. Incremental components indicate short-term variations due to promotions, temporary price changes, and above-the-line (ATL[2]) and below-the-line (BTL[3]) media activities. It also provides the optimum execution levels of media activities while accounting for media saturation. This helps identify the best marketing channels to invest in, thereby creating effective media campaigns and setting better execution levels. Doing so also assists in running effective discount campaigns while avoiding base erosion, planning trade merchandising in modern
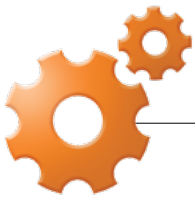
retail, creating channel-level strategies, maintaining the right distribution levels, evaluating price elasticity from the competition, as well as evaluating and countering the impact of competitors' promotions.

What can market mix modeling offer?

› Superior allocation

+ Identify the marketing channels such as TV, digital media or others that will result in maximum returns

+ Compare traditional marketing channels with emerging, cost effective ones to address the future needs and requirements

+ Explore which products, brands or markets are more sensitive to advertising and promotions. For example, TV campaigns designed for core brand-form might result in higher returns than a newly launched spin-off
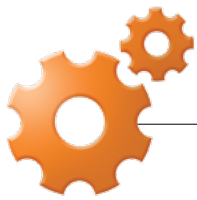
› Superior execution

+ Propose the right execution levels for highly effective marketing channels to avoid saturation

+ Investigate successful campaigns, their types or quality scores. For instance, this could track whether campaigns focusing on women in the18-30 years age group would result in higher awareness and returns

+ Compare campaign durations (10sec/20sec/30sec), cable networks (HBO/ABC/etc.), continuous versus pulsing advertising, in-season versus off-season campaigns, etc.

› Simulation & optimization

+ Forecast sales trend as per current marketing mix plan

+ Predict sales impact subject to a planned increase/drop in advertising/price

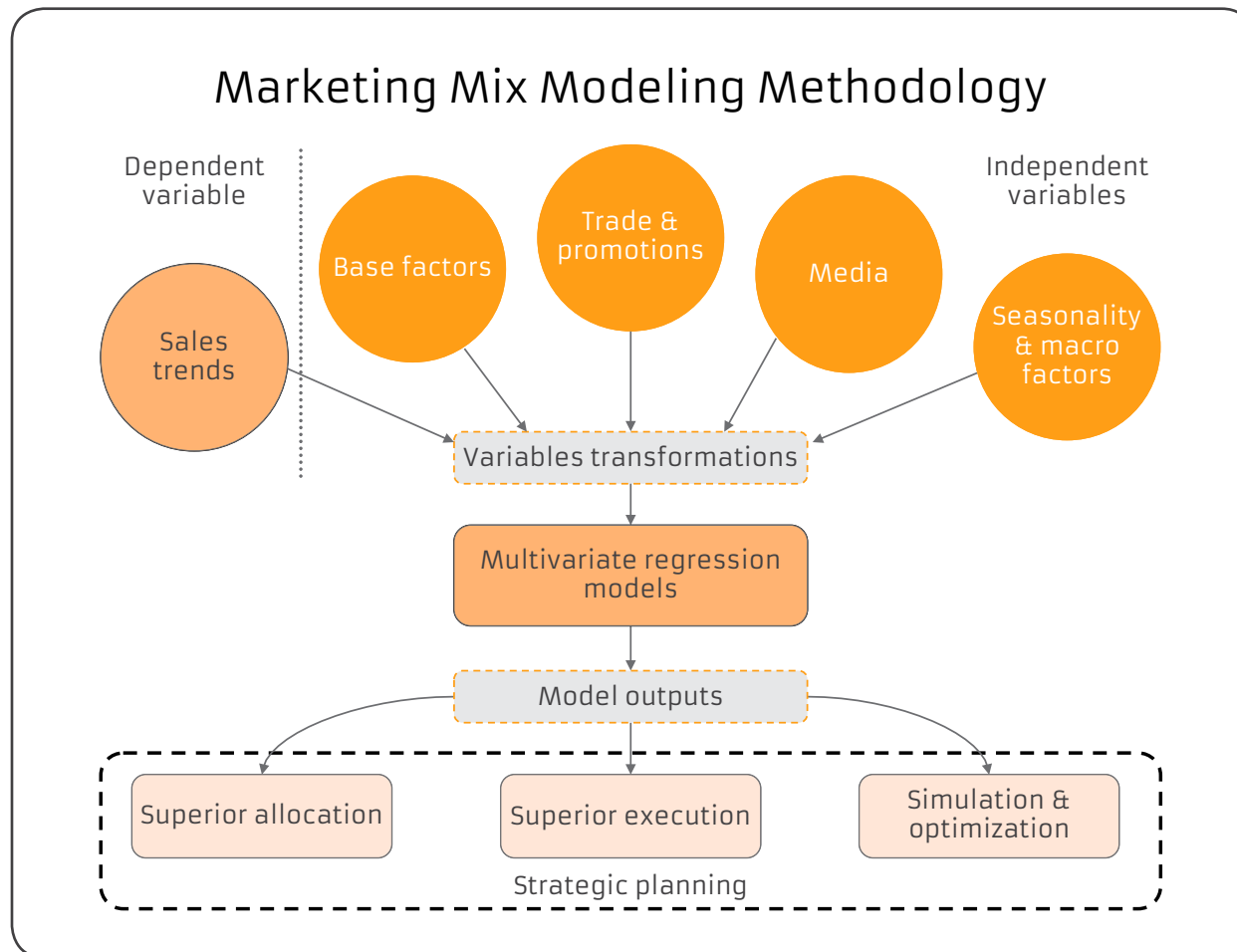+ Create an optimum marketing mix plan for achieving target revenue growth

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MMM methodology

Marketing Mix Modeling Methodology

Dependent variable

Independent variables

Base factors

Trade & promotions

Media

Seasonality & macro factors

Sales trends

Variables transformations

Multivariate regression models

Model outputs

Superior allocation

Superior execution
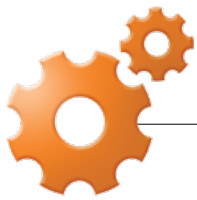
Simulation & optimization

Strategic planning

Figure 1

Key inputs affecting brand sales

In a competitive market, there are many factors which affect the sales revenue. Market mix modeling techniques examine the major factors which are responsible for explaining the sales variation in a given time period, typically a week or a month. These are categorized as:

Base factors: Sales metrics such as price and distribution are considered as base factors. Competitors' activities that are not in control of the manufacturers are often considered as base as well.

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Trade merchandising: The marketing activities driven by retailers in the form of display, feature, temporary price reduction, etc. Manufacturer also invests in maintaining a significant shelf share and SKU share in retail outlets.

Promotions: There are some promotions driven by the manufacturers in the form of promo packs, coupons, new launches, and other methods to promote their product in the market.

Media: Media advertising, in the form of various channels such as TV, digital media, radio or other mediums, is one of the marketing activities used by the manufacturers to drive their product into the market.

Sales seasonality and macro-economic: These are other factors which are also responsible for affecting sales revenue for overall market.
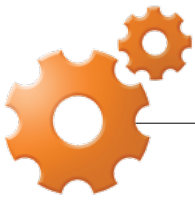
The table below lists the key factors within each category.

Category	Factors
Base factors	Price Distribution Competitive activities
Trade merchandising	Display Features Share of shelf Share of stock keeping units (SKU) Temporary price reduction
Promotions	Promo packs New launches Bundle packs Sampling Coupons
Media	TV advertisement Digital media Radio Magazines Newspaper Print
Seasonality	Holidays Temperature Precipitation
Macro-economic factors	GDP growth Per capita income Inflation Gas prices Unemployment

Table 1

Techniques for variable transformations

Splitting average price into base price & discounts

Factors that can affect a product's average price include the impact of a manufacturer's discount, the retailer's temporary price reductions and the stock keeping units (SKUs) level price difference. To evaluate the impact of promotional discounts and base price elasticity, it is important to divide the average price into (i) a base price component, that is how a brand is listed on price relative to other brands, and (ii) a promotional/ temporary

discount component. So, a market mix model should identify and distinguish both of these components to correctly specify and fully capture the effects of price.

Total distribution points

Just like price, the distribution of the product during the period under consideration will also affect the sales.

Splitting average price into base price & discounts

Price ($)

Base price change

A

Discount

a

b

Promo price

c

Week no.

— Average price   — Base price level

Figure 2: Illustration purpose only

Therefore, it is important to identify and account for the impact of distribution in the model. Total distribution point (TDP) is the indicator of the depth and width of distribution. Numerical distribution[4] and %ACV[5] (all commodity volume) are the popular distribution metrics capturing the width of distribution, however, it is critical to consider the impact of depth of distribution as well, which is usually represented by number of SKUs or share of SKUs metrics. TDP is the metric which captures the impact of both the metrics and can be represented as TDP = Average of %ACV X Average of SKUs. TDP share is also the other metric that captures the impact of competition.

Seasonality

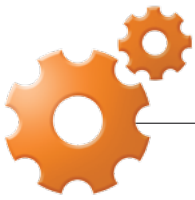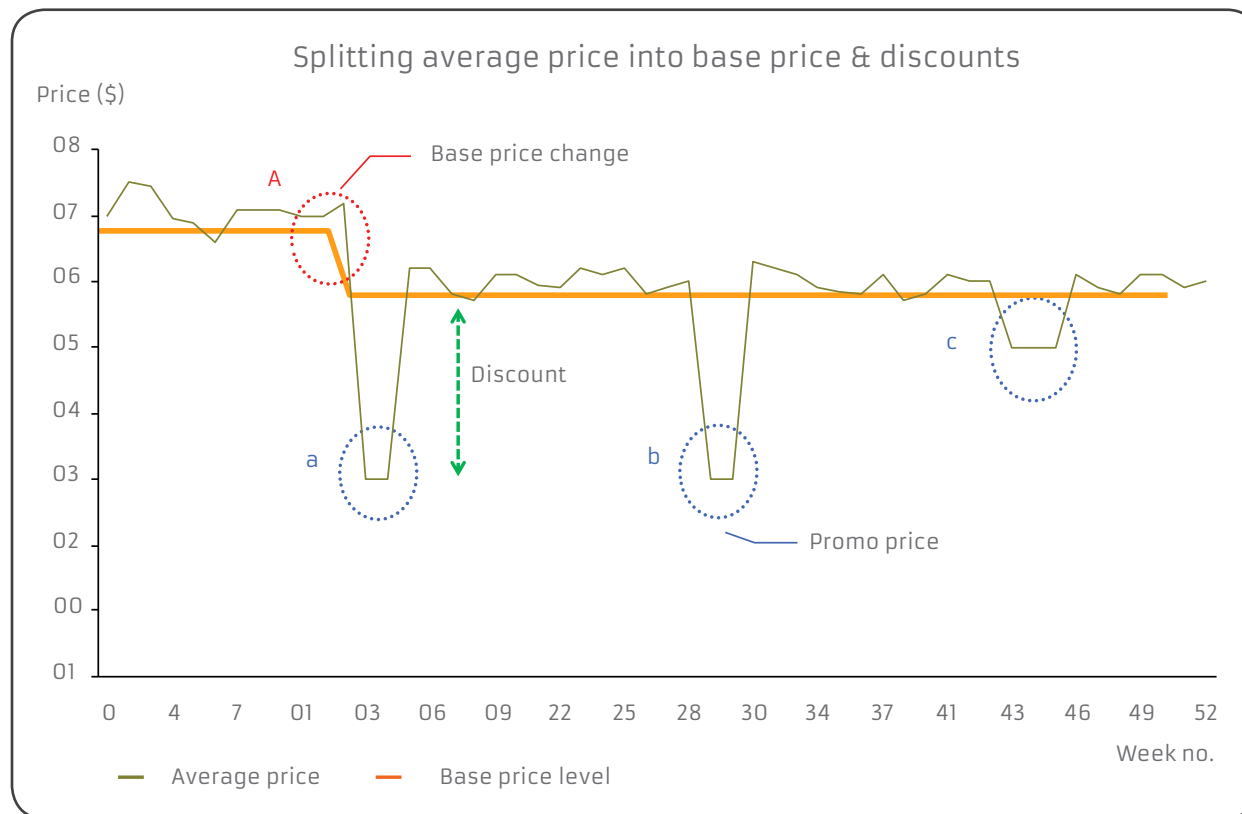Seasonality is a periodic repetition or cyclic variation in time series data. Due to seasonality, sales follow the same periodic variations. There are various factors which may lead to this phenomenon, such as holidays, moving holidays like Ramadan, payday, weather conditions, the start and end of school terms or the number of weekends in a month. Therefore, before quantifying the impact of marketing promotions, it is crucial to separate the impact of seasonality. Not doing so may lead to misguided recommendations.
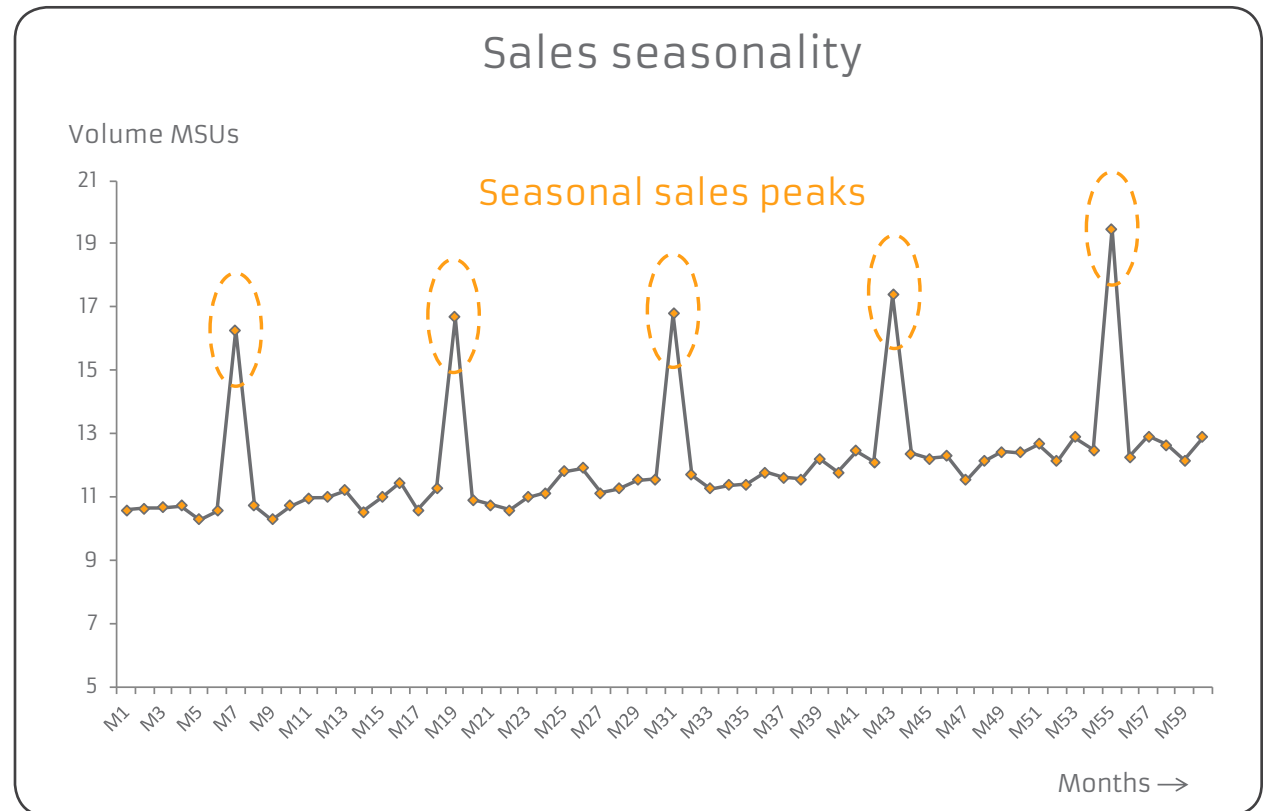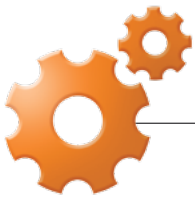

Figure 3: Illustration purpose only

Marketing promotions synergy effect

A synergy effect occurs when the total effect of marketing promotions is greater than the sum of their individual parts. When display and feature promotions run simultaneously in modern retail, it difficult to guess how their overlapping sales impact is even higher than the summation of their individual impacts. The answer lies in their synergy effect.
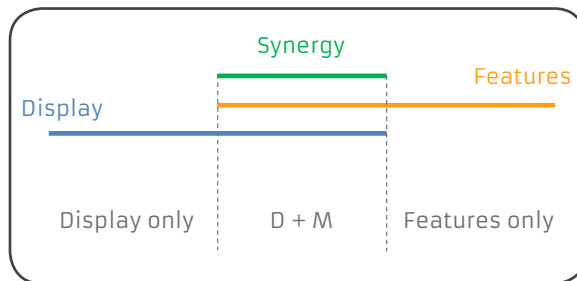

Figure 4: Illustration purpose only

Decay effect on media promotions

The effect of media promotions gradually fades from the minds of audience. Therefore, in any given period of observation, the effect of a media channel is sum of the effect of ongoing promotion and the un-faded/un-decayed part of all the promotions conducted in past. The decay effect can be mathematically modeled and is usually expressed in terms of the half-life of the advertising.

With the same concept, the media gross rating points (GRPs)[6] can further be used to derive adstock, which is defined to describe the prolonged or lagged effect of advertising on consumer purchase behavior. It is also known as 'advertising carry-over'. Mathematically, it is shown as:

$$Adstock_t = GRP_t + \alpha * Adstock_{(t-1)}$$; where α is the decay coefficient varying from 0-1 depending on the product, media, campaign etc.

In the below example, an advertising campaign has been running for four periods with equal GRPs. Carryover effect results in a higher adstock in the second week, which will be a summation of second week GRPs and the carried over part of the previous week's GRPs. Similarly a decayed adstock can be found even after not running the advertising GRPs after 4 weeks.
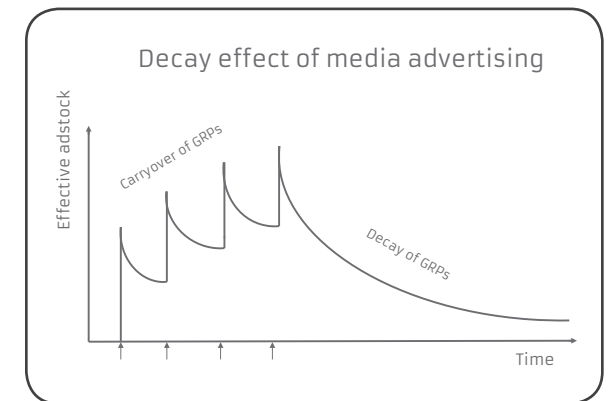

Figure 5: Illustration purpose only

Saturation effect on media promotions

The relationship between media adstock and sales impact is not linear. Increased increments in media support impacts sales with diminishing returns. A logistic function can map the media impact on sales. Media campaigns won't result in incremental sales despite high media GRPs, as it reaches saturation. A typical saturation curve for media effect can be expressed as:

$Y = A(1 - \exp(-BX^C))$; where X is the Adstock and B and C are parameters that define the saturation curve and A is the model coefficient.

The media saturation curve helps the business in identifying the optimal execution levels for maximum returns.
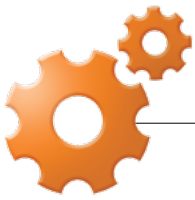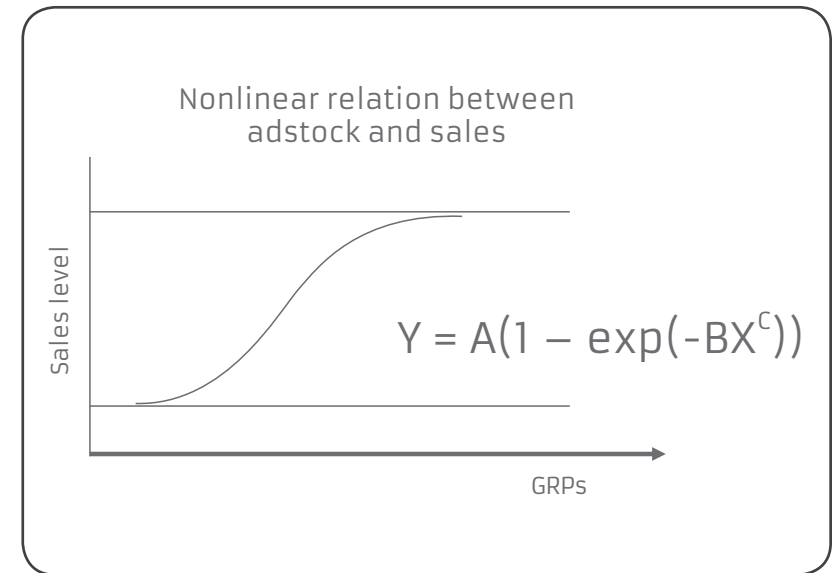

Nonlinear relation between adstock and sales

Sales level

$$Y = A(1 - \exp(-BX^C))$$

GRPs

Figure 6: Illustration purpose only

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Concept of diminishing returns

Advertising has diminishing returns to scale. In other words, the relationship between advertising and sales is nonlinear. The effect of 100 GRPs of advertising on sales may be lesser than twice that achieved with 50 GRPs of advertising. Typically, each incremental amount of advertising causes a progressively lesser effect on demand increase. This is a result of advertising saturation.
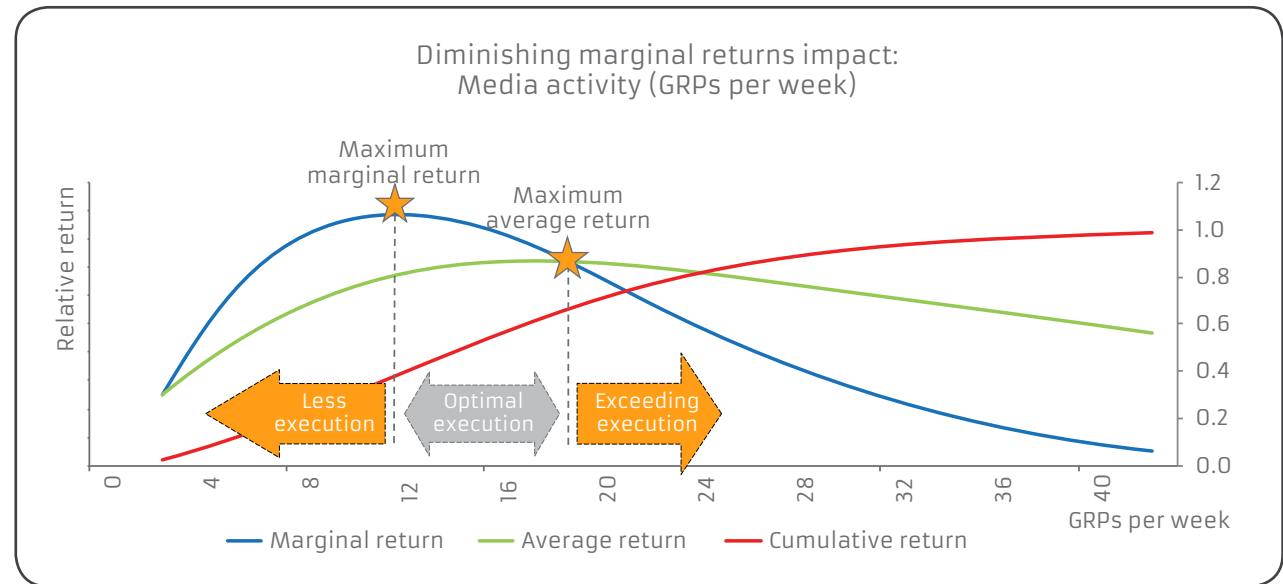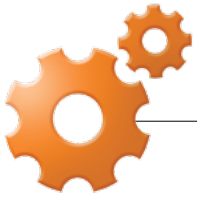
Diminishing marginal returns impact:
Media activity (GRPs per week)

Relative return

Maximum marginal return

Maximum average return

Less execution

Optimal execution

Exceeding execution

GRPs per week

— Marginal return   — Average return   — Cumulative return

Figure 7: Illustration purpose only

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Other key factors

Halo effect

The halo effect is defined as a customers' bias towards certain products due to their favorable experience with the other products made by the same manufacturer. The halo effect is driven by brand equity.

A classic example of the halo effect is the increase in MacBook sales during the launch of iPod. IPod focused marketing campaigns resulted in improving the brand equity of Apple, which was significantly reflected in increased sales of MacBooks.

There are some possible reasons which can explain this phenomenon, such as consumers relating the brand name to other products during the promotion rather than the sub-brand. Alternatively, the promoted product could be priced higher than the product which gains sales, or the promoted product has poor distribution.

Cannibalization effect

Cannibalization is defined as the reduction in sales of a manufacturer's existing product due to the new launch or promotion of another product. The new or promoted product eats into the sales of existing product of the same category. However, the manufacturer could gain in overall sales. Like other factors, it is important to identify and distinguish the effect of cannibalization in order to correctly estimate the impact of promotions.

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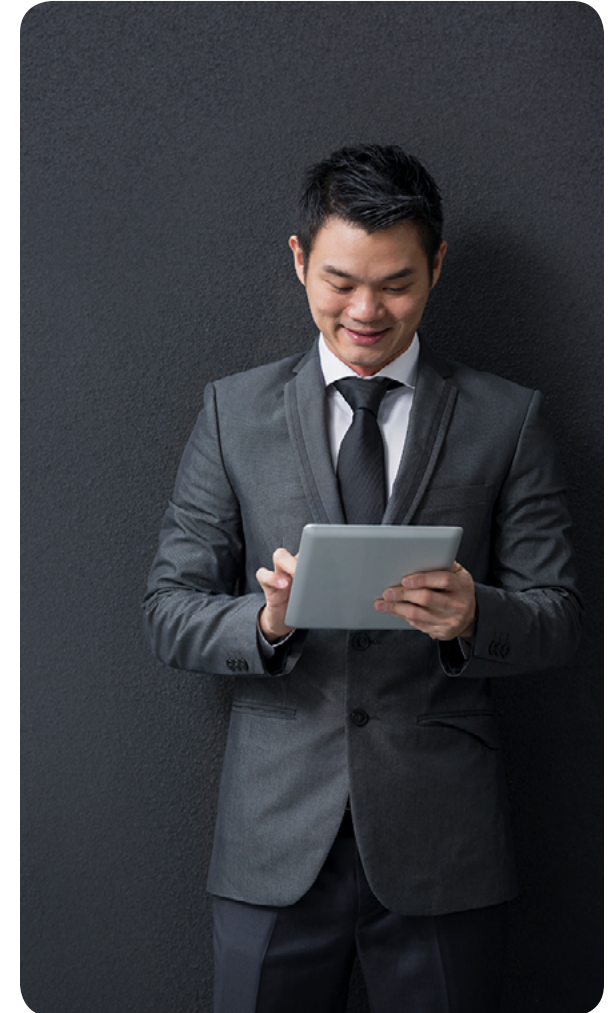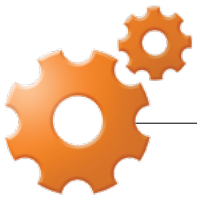
MMM outputs

Sales decomposition, contributions and Due-To's

In a competitive market, where a manufacturer is doing a number of marketing activities, it is important to identify the sales contribution of each marketing vehicle and identify the growth drivers which will enable better decision making for marketing managers. Here, the total sales can be decomposed into base and incremental sales, where incremental sales can further be decomposed into sales of each contributing marketing vehicle.

A typical weekly volume decomposition chart will look like below where all the sales peaks are contributed by marketing promotions.
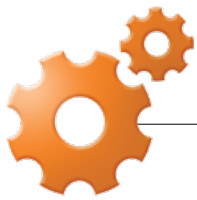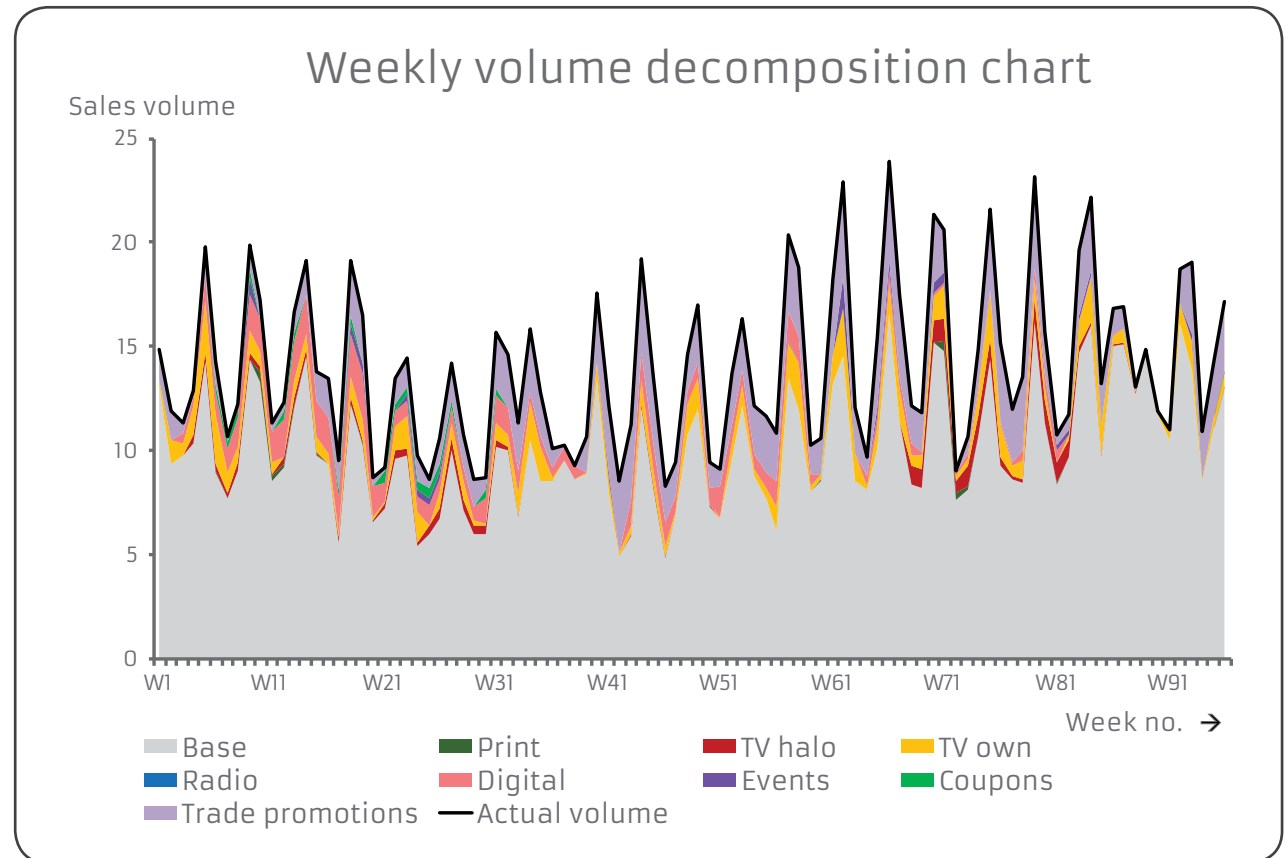

Weekly volume decomposition chart

Legend: Base, Print, TV halo, TV own, Radio, Digital, Events, Coupons, Trade promotions, Actual volume

Figure 8: Illustration purpose only

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The below chart shows the full year contributions of all marketing vehicles.
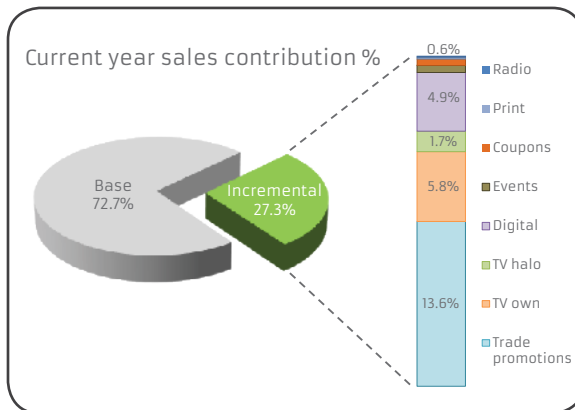

Figure 9: Illustration purpose only

A Due-To analysis explains the key growth drivers which are responsible for overall sales growth and by what amount. A Due-To growth rate analysis for a marketing channel is defined as the year-on-year growth in the sales contribution of that

channel. The below figure shows a Due-To analysis of key growth drivers that are contributing to the overall sales growth.
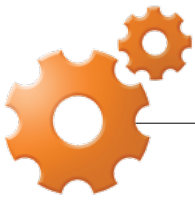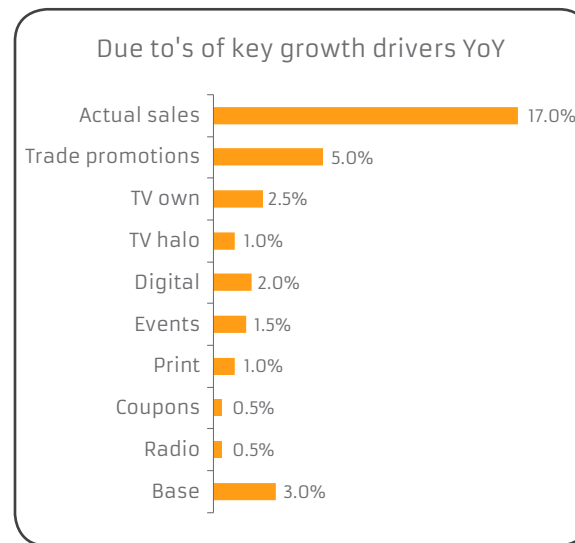

Figure 10: Illustration purpose only

Strategic planning

Model outputs provide contribution of each marketing vehicle, which along with marketing spends, provide marketing ROIs. It also captures time decay and diminishing returns on different media vehicles, as well as the effects of other non-marketing factors discussed above and other interactions like the halo effect and cannibalization. The model output provides all the necessary components and parameters required to arrive at the best media mix under any condition.

With the help of the model output, simulations can be run to optimize plans for various scenarios.
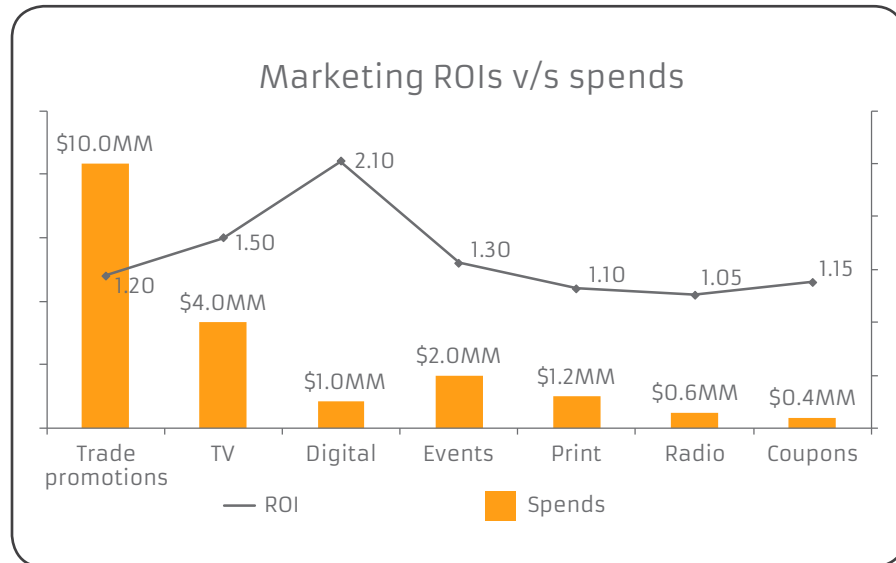
Marketing ROIs v/s spends

$10.0MM — Trade promotions (Spends) — ROI 1.20
$4.0MM — TV — ROI 1.50
$1.0MM — Digital — ROI 2.10
$2.0MM — Events — ROI 1.30
$1.2MM — Print — ROI 1.10
$0.6MM — Radio — ROI 1.05
$0.4MM — Coupons — ROI 1.15

— ROI   ▮ Spends

Figure 11: Illustration purpose only

Revenue increase opportunity at optimum spends allocation

Shift 30% of Variant2 trade spending to Variant1	$1.6MM
TV execution at optimum level	$1.3MM
Improve copy quality by 20%	$0.4MM
Increase 30sec TV campaigns to 30%	$0.6MM
Convert 20% of TV spends to Digital spends	$0.9MM
Cut trade spends by 5% & put it in Digital	$0.8MM
Increase Digital video campaigns to 35%	$0.4MM
Convert 25% of Radio spends to Coupons	$0.3MM
Total Revenue Opportunity	$6.3MM

Figure 12: Illustration purpose only

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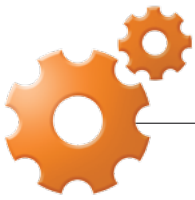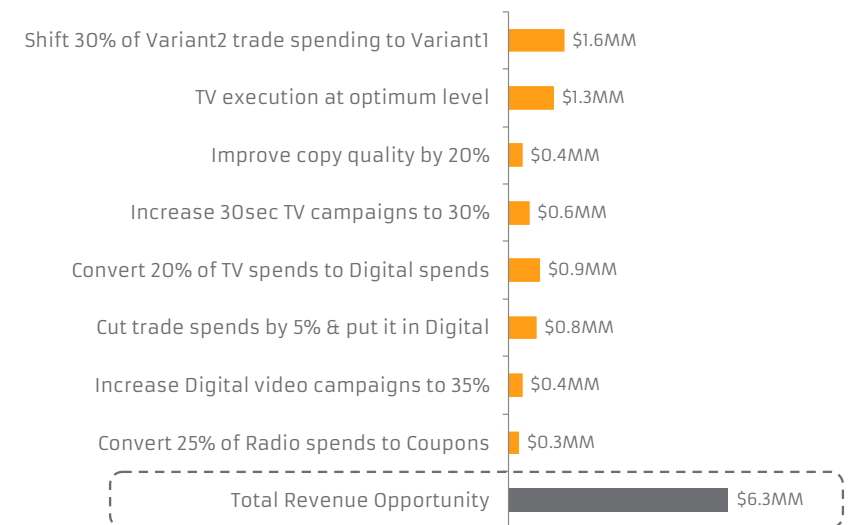
## Common challenges of implementing market mix models

Marketing managers and CMOs are quite aware of the market mix technique and its business related outcomes. However, they still face certain implementation challenges which sometimes restrict them from leveraging the process to meet their needs. The common challenges are:

> The process requires leveraging diverse set of data sources, which itself is a huge challenge. Related challenges include data quality and timeliness.

> For external data such as media data provided by some an outside agency, there are no standards of measurements followed. This sometimes creates doubts about the data's credibility and its utility when making decisions.

> Leveraging model outcomes to design a marketing strategy for a newly launched product or for an unstable or non-competitive market is also common challenge.

> Capturing the long term effects of advertising campaigns is often difficult, results in creating brand equity and is now a component of base sales.

> Making market mix recommendations actionable is often an operational challenge. Sometimes, achieving optimal execution for the proposed recommendations becomes a headache for the marketing planners.

However, these challenges can be overcome with proper planning and help of industry experts.

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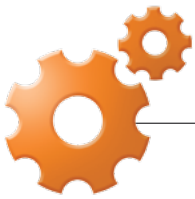
Conclusion

Marketing managers and CMOs looking to optimize their budget planning should ask themselves a few questions:

> Is the current marketing spend producing the right ROI?

> Are the right channels being used?

> Among these channels, is the allocation ideal?

If the answer to any of these questions is a no, it may be a good time to revisit the current market mix strategy. Optimizing this plan often requires a substantial analytics capacity and high-quality data sources. If these resources are available in-house, they can provide a head start on accomplishing this goal. However, retailers who attempt to build these capabilities up from the ground floor themselves often find it to be a lengthy and expensive process. Many turn to third-party experts for help when formulating the best ways of enhancing their marketing spend.

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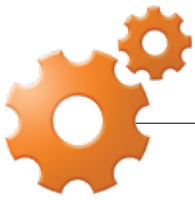
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1. http://n8marketing.com/mktg-budget.html

2. Above The Line (ATL) advertising is where mass media is used to promote brands and reach out to the target consumers. These include conventional media such as television and radio advertising, print and internet. This is communication that is targeted to a wider spread of audience, and is not specific to individual consumers. ATL advertising tries to reach out to the mass as consumer audience.

3. Below the line (BTL) advertising is more one to one, and involves the distribution of pamphlets, handbills, stickers, promotions, brochures placed at point of sale, on the roads through banners and placards. It could also involve product demos and samplings at busy places like malls and market places or residential complexes.

4. Numeric distribution is based on the number of outlets that carry a product (that is, outlets that list at least one of the product's stock-keeping units, or SKUs). It is defined as the percentage of stores that stock a given brand or SKU, within the universe of stores in the relevant market.

5. % ACV Distribution is often just abbreviated "% ACV," especially when talking about it verbally. It can generally be thought of as "% of stores selling," but with stores weighted based on their size.

6. TV awareness is generally quantified in terms of gross rating point (GRP), which is defined in terms of reach and frequency GRP = Reach X Frequency; Reach is % of customer watches the TV advertisement and Frequency is average number of times they actually watch the same advertisement

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