Current State of Marketing Mix Models

A Report for the Council for Research Excellence

July, 2013

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Sequent Partners, June 2013

Objectives

Our objective is to provide the Council for Research Excellence an in-depth understanding of the principle methods currently used to estimate advertising ROI and take actions, such as budget allocations, on the basis of those estimates.

An impartial assessment is made of the strengths, weakness, opportunities and threats related to key aspects of the data, analytical techniques, and organizational processes employed.

We also initiate a process to define best practices and recommend priority areas for improvement.

Participants

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Modelers:
- Analytic Partners
- Concentric
- Hudson River Group
- Accenture
- IPSOS MMA
- IRI
- Marketing Evolution
- MarketShare
- Media Brands
- Mphasize
- Nielsen Catalina Solutions
- Nielsen
- OMD Brand Science
- ThinkVine
- TRA

Advertisers
- AT&T
- Avon
- Bristol Myers Squibb
- Colgate-Palmolive
- Conagra
- Condé Nast
- Kellogg
- Kraft
- LifeLock
- Nestle
- Pfizer
- Procter & Gamble
- Random House
- Schwab
- Staples
- Time-Warner Cable

Methodology

In order to delve deeply into the conversation about model inputs, techniques and applications, we conducted over 40 hour-long personal interviews among leading experts at modeling companies, universities and advertisers representing a broad range of sectors and specializations. To check the latest industry dialogue on the topic, the content of marketing science online groups was analyzed and we performed an extensive literature search using Marketing Science, MSI, INFORMS, ARF, and WARC.

Industry Overview

As the word picture suggests, advertising and marketing ROI are the focus of today's modeling efforts. That's not new. But what is new is how prevalent the media attribution and the ROI of new media are in the minds of the advertisers. This chart also foreshadows two of the biggest issues associated with modeling, speed and the difficulty of separating out direct and indirect effects.

But before we explore those issues in detail, let's look at the 20,000 feet view of the industry.

Modelers today operate in a competitive environment characterized by unprecedented complexity and sophistication. Modelers have a great deal of integrity and pride and are

genuinely motivated to make an impact and increase marketing efficiency. They are sensitive to criticism about their "black box" legacy and a perceived lack of transparency. In truth, our study shows that many modelers employ statistical techniques that have largely outstripped many of their clients' understanding.

It is also important to recognize that modeling and the science behind it are difficult and complex. There are many reasons for this: the statistics are complicated, the processes are highly variable, the data acquisition is messy. In short, this is an area where art and science rule equally.

Modeling practices have clearly evolved to address the complexity of the contemporary communications plans. Modelers routinely run separate models to assess advertising's impact at different phases of the consumer journey and strive to align the models with the advertiser's objectives. As one modeler said, *"the industry has begun making the shift from Analytics 1.0 to 2.0. There are new techniques and computer power that produce predictive and prescriptive outcomes."* Another put it ... *"The world is too complex for traditional modeling."*

Clearly, industry-wide, across all segments of the industry a wide range of sophistication and technical expertise exists. There are time pressures as well. Some modelers, constrained by timing and budgetary demands, find that relatively straightforward models fit their needs. Other modelers operating at the frontier, pushing boundaries and wrestling with direct, indirect, short-term, long-term, and interaction effects to provide a more complete view of the role and value of advertising. This suggests the field is dynamic, evolving, and challenging -- a perfect time to develop a guide to best practices.

US and Global Perspective

Many of the US modeling companies are global concerns and find that there are bigger challenges in many other parts of the world. In fact, it's possible these global technical and data acquisition issues could divert attention from the US, causing development here to stagnate.

The Age-Old Issue of Long Term Effects

Historically, models have only reflected short-term sales effects. *"Long term effects are hard,"* said one modeler. However, one of the greatest accomplishments of recent years is an increased focus on both indirect and long-term effects. Many modelers look at Return on Objectives as well as Return on Investment, and as such, account for "upper funnel" effects such as changes in

awareness, consideration, preference, and purchase intent. Modelers are using longer-term adstocks and examining advertising's ability to impact repeat purchase patterns.

While not standard practice, it is not unusual for modelers to address changes in long-term brand equity (measured through tracking studies) and customers' lifetime value.   These activities represent the leading edge of modeling technique and bode well for the representation of the full value of advertising.

However, while investigating, we were struck by how many modelers still talk about the "Ad Works" rule of thumb. This refers to "How Advertising Works," a study by Information Resources Inc., Chicago in 1992 and the study's finding that the long-term effect of advertising is twice the short-term effect. It's surprising that there are very few other research projects on this topic to cite and we think the advertising industry would be well served to stimulate and motivate further work in this area. *"It would be useful if there was some consensus around what the long-term effects of advertising are and how they are measured and modeled," s*aid one of the modelers we interviewed.

How Models Drive Advertising Decisions

Today, advertisers are using model results to drive advertising decisions. But there is quite a range of implementation styles. Some models are done once a year – like an annual check up. Others are done on a periodic basic. And some advertisers continuously model and monitor performance and use the models for decision support, as frequently as weekly! It's hard to characterize a single *typical* advertiser-modeler involvement.

The Role of Agencies In Modeling

Similarly, the role of the agency varies widely. It is *"much better than it was ten years ago,"* according to a modeler, but *"that's not saying much."* Some agencies are merely told the model results. Others are planning communication strategies informed by the model results and finally, there are some agencies or accounts whose level of interaction throughout the modeling process is ongoing. We heard this quite consistently through most interviews. "*The agency role varies with the client. We want to work with the agency, but it doesn't always happen. Twenty to thirty percent of the time, we have tight integration with agency through the entire process. But more often, we see the agency drop in to be informed. In other cases, the agency is excluded."* Another modeler commented, *"Agency*

involvement is all over the map – from a "get them the data" situation to a more intimate relationship. But even then, that relationship is always secondary to our advertiser contacts."

Creative agencies and marketing specialists do not appear to have a real seat at the table; they just provide data without fully benefitting from the learning. *"We often work with a promo, PR and creative agency. We need to get data from them and we usually work with a brand manager who gets everyone on the same page. That process works really well and it's getting better all the time."*

The proliferation of specialized agencies -- (PR, Promotion, Digital, Social, Creative, etc.) makes agency integration in the process more difficult for the modelers and marketers.

Modelers recognize this is a missed opportunity and wish there were more of a closed loop. *"We're missing the kind of perspective the agency might be able to lend to the model inputs – and the chance for insights to drive media strategy and tactics."*

Buy-in from upper management, CMO or even CEO, is critical to successful agency involvement in the process.

Models in Use

The modeling world has moved beyond the simple multiple regression techniques of the early days. Modelers strive to understand tremendously complex media interactions and the models they use reflect this growing complexity. The use of vector auto regression, structural equation models, Bayesian networks and digital attribution models reflect the complexity of the ecosystem today. Agent-based models and single source data analytics are also being used to address specific applications such as social networking, individual creative effectiveness and simulation.

Techniques evolved because *"marketing is working differently."* Data inputs are *"getting better, and fuel the more nuanced techniques"* said one modeler explaining the increased use of different techniques. This allows the modelers to *"choose the model based on the client's marketing mix and*

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their need for timing."

Models in Detail: Multiple Regression

Historically only multiple regression models were used in marketing mix analyses. These models are highly efficient and work well if campaigns are not overly complex. There are misattributions that can occur due to multi-collinearity when marketing factors are timed to run in lock-step such as advertising and promotions running in a coordinated schedule. These models can't reflect complex interactions such as social media increasing the engagement of a television commercial. Importantly, regression does not capture more than short-term effects. Brand equity or other forms of long term effects, cannot be incorporated into regression models. In addition, the regression technique can't accommodate the integration of consumer attitudes and behaviors antecedent to sales.

Models in Detail: Systems of Equation

Structural equation models, Bayesian networks, vector auto-regression models can all incorporate multiple brand effects. The benefit of these approaches is that they address funnel metrics such as awareness, consideration, preference and intention and reflect the complex interaction among these factors and with sales. Modelers can determine, for instance, whether there is a greater sales response to current advertising when consistent historical advertising levels have created a high level of brand consideration. These modeling approaches also better mirror the complexity of media interactions. For instance, they can account for TV-generated awareness and interest

which is manifested in online search, leading to a visit to the brand's website where a coupon is downloaded and subsequently used to make a purchase in a store.

Models in Detail: Agent Based Models

Agent-based models accurately represent the complexity of social networks as well other media interactions, patterns of consumer acquisition and retention, brand preference and other attitudes. They are useful for allocating resources across major corporate functions. Because "agents" act independently and probabilistically, ABMs avoid multi-collinearity issues. Further, agent based model simulations can incorporate consumer perceptions as driven by advertising and then consider the impact on sales. While agent based models have the greatest capacity to represent complex systems of human interactions, they are complex to fit and manage ... and can be subject to a fair amount of judgment.

Models in Detail: Single Source Data Analysis

Single source data analyses uniquely isolate advertising effects and make them more readily visible without complex modeling. It is a more transparent system. However the lack of a full complement of retail (price, promotion, distribution) variables makes these models incomplete with respect to the full marketing mix. They are used as specialized models to evaluate advertising in isolation. Given their acute granularity and large samples, these techniques can isolate effects of individual media and creative elements far better than other methods. Unfortunately, to date, the work with single source has focused exclusively on short-term sales effects.

Models in Detail: Cross-Channel Attribution

These models are used only in the digital world have no interaction with the rest of the marketing mix. We found a fair degree of controversy around the *last click attribution problem,* in which fair credit is not always given the full sequence of online touch points leading to a sale.

Multi-Collinearity

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One of the age-old issues in modeling is multi-collinearity -- a situation that ensues when marketing factors correlate strongly together and cannot be separated. This limits the model's ability to guide decisions. Modelers tackle this issue a variety of ways:

- They recommend "Test and Learn" and encourage clients to try a different mix in a few markets for a few months enabling the model to read the components separately.
- Greater granularity: sometimes the factors are not as strongly correlated at a more refined level of data. This is a strength of agent based models and single source, in particular.

As one modeler said, *"these days there are lots of things go on at once. It's very hard to separate. Our model has been as yet to decompose concurrent factors. To solve this, we recommend testing, or running ads in isolation, for example."*

Model Output Metrics

Most models recognize that advertising components are used to accomplish different objectives and in the best cases, a number of output metrics are considered. Both contribution margin-based returns and revenue-based returns are used to reflect short-term financial performance. This allows the modeler to align recommendations with business strategy – e.g., profit maximization may be the objective, or revenue maximization within minimum profit constraints may be the goal. Both types of ROI metrics (contribution margin and revenue-based returns) are required for this.

However, as most people are well aware, advertising may have other objectives in place of, or in addition to, financial goals. Only a limited number of modelers also utilize consumer metrics such as awareness, consideration, preference or intention, among others.

Advertising Data In Marketing Mix Models

Ideal advertising "model-ready data" has been identified in a number of industry initiatives: thorough, weekly campaign-level reach/frequency delivery by DMA for all media elements.

While many modelers are using actual delivered GRPs or impressions by market and week, this is not always the case. Sometimes they use "as-planned" or "as-bought" activity that can vary dramatically from the actual delivery. Sometimes dollars, rather than GRPs or impressions, are used, which confounds cost efficiency with weight.

We learned (again) that the media data acquisition process is sloppy, unnecessarily onerous and not standardized. The task of assembling the data required to feed and update models is so great that modelers have set up entire divisions to acquire high quality, complete data. We know of at least one case where as much as 70% of a senior-level modeler's time was spent tracking down and overseeing data inputs, and this is not unusual

Modelers, for the most part, consider traditional media data fine – they are not aware of any methodological concerns with TV, radio and magazines. The biggest concern in the input area is around digital – to varying degrees, paid and owned data are simpler to acquire and model, but earned remains a true challenge. There are issues with sentiment analysis and the interactions between all digital efforts confound the efforts. Geographic delivery is a key issue for some. There are no standard metrics for capturing social media. We discovered that Hispanic media pose no unique modeling issues for modelers and that other media elements like word of mouth or event marketing are not yet part of mainstream modeling practices.

We know most modelers are not media research experts. As such, though they are highly specialized in what they do, they can be unaware of technical aspects of media measurement and rely on data provided by the agencies. They don't know what they don't know.

We recommend the industry conduct a top to bottom audit of the true nature of all the media data used in the models.

It's clear there is much the media industry could do to simplify and standardize the media data acquisition process. We recommend the industry's attention be focused here, where the need is so great. This would ensure that the best possible data is used in every case and that differences in media data inputs are not driving differences in model outcomes.

There is no logical reason why industry standard, high quality, media data should not be available in near real time to fuel the ever increasing need for speed. The prevalence of new methods of analyzing big data suggests this may be possible for the first time.

Current State of Media Inputs In Marketing Mix Models

TV	GRPs by market and week are generally available; model at the daypart, length and campaign level when possible; three different data capture methods used across markets may introduce bias
Radio	New PPM TRP data available by execution, rolled-up to weeks for most markets, but not all markets; not widely recognized or in use

Print	Improvements made to provide best estimates of GRPs by market and week, recognized but not widely used
Mobile	Not currently modeled for the most part; quite a bit of work required
Social	Many metrics; struggling to find meaning
Digital	Most difficult; abundant data, attribution concerns; optimistic about OCR; area of most development work
WOM	Not typically included
Events	Not typically included
Hispanic	No unique issues

Here are some comments from the modelers relative to media inputs:

- *"Things are pretty good; they keep getting better. We have more data then we can deal with."*

- *"More traditional media are well measured, but emerging media is noisy – social, mobile, buzz. Doesn't always have the granularity needed to get the right metrics. There's a varying level of confidence with quality of data."*

- *I haven't heard of a lot of problems with traditional media. We look at dayparts and networks. Creative impact is being measured, but not broken out in models. We get data on circulars, deals and rewards from internal databases and we measure radio using dollars."*

- *"Digital is a big issue. We are left wanting in many areas. For example, recently, we could not obtain geographic data – impressions by market for paid search. There are ways to get that data, but not everyone is aware of them or has access. I've seen this time and time again -- a disconnect between the agency and their client in terms of what the agency can provide."*

- *"Digital has the advantage of lots of measurement – but it's too focused on last click attribution, not the top of the funnel."*

- *"Paid is the easiest to measure, but it's getting more complicated. Earned is important and solutions are on the horizon. Current services are usable. Sentiment is unstructured. Not sure how reliable because of the semantic challenges. Buzz is fine."*

- *"Social media is getting better now, but the history is not as available. More systematic tracking of social media would be better."*

- *"Online data is plentiful, but hard to get at (not in AdViews). There is not a lot of Mobile data and it's too small to tease out for CPG mix models. It creates a swamping effect and it's too experimental. Sometimes even display is too small – if it's less than 10% of the budget. We use Test vs. Control or "exposed" panel members for more tactical analyses."*

Marketer Fluency

It's important to note that there is a significant range of modeling and statistical fluency among marketers. Clearly, those involved in the discipline -- analysts/modelers at the advertisers -- understand the intricate techniques, data issues and applications. Their concerns are not that much different from the modelers themselves. Generally, these people operate either as in-house modelers or as purchasers of modeling services and interact with the modelers throughout the process.

Outside the analytics groups, however, marketers can be far less sophisticated users and have more traditional views about the impact of the models. The types of concerns they have are simpler, and more traditional – that modeling only provides a rear view mirror, that they are not certain models can really measure the ROI of their efforts, etc. Some marketers have only a passing knowledge of the data sources that drive the models and are not capable of addressing some of the more technical issues. They have learned to trust the modelers over time and assume the models are right. This suggests the marketers themselves, outside of the analytics team, are not in the position to provide much guidance to the modelers or the agencies supplying model inputs. The need for continued education and a two-pronged dialogue about data quality and model refinements is clear.

Organizational Issues In Modeling

Best in class modeling operations involve a cross-functional team and consistent involvement from the marketer, the modeler and the various agencies. These days, the finance department also plays a significant role in model application and adoption. They control the budgets and the

financial metrics and goals, and participate in decision-making. Involvement at the top of the company, by a CEO or CMO ensures modeling findings and recommendations are adopted.

One challenge we heard raised regularly was that marketers in some sectors are demanding unprecedented speed and the need for more real time solutions. As modelers strive to meet these needs, great pressure is placed on the data acquisition process and data quality sometimes suffers. For example, when time does not allow for actuals (post-buys), planned media weight will be used. We think there are solutions available in data acquisition that could accommodate increased cycle time without sacrificing model inputs.

Agencies can get lost in the modeling process. And agency work-products are certainly impacted. We did not see evidence of an established best-practice process involving the modeler, the marketer and the agency, to review model findings or to re-introduce a medium or initiative that did not do well in the model. "Test and learn," the typical response in a situation like this, is a good practice for easing a medium back in to a media plan while mitigating the risk, but the pace of the business and limited resources appears to preclude marketers from engaging in this practice as often as they might.

Strengths of The Current Marketing Mix Model Process

The integrity of the modelers tops the list of strengths of the current system. Modelers are continuously developing modeling techniques to cope with the increasing complexity of media. It is a dynamic time and there is a great deal of exploration and development. Organizationally, the support of highly engaged senior management will ensure the process operates to its fullest potential.

Weaknesses of Current Processes

The lack of media measurement expertise among some modelers is cause for concern. Pressured to produce results quickly, they may resort to the "best available data," regardless of whether it has the required granularity, variability or accuracy. They have to work hard to get good numbers – and the number and disparity of media data sources is a challenge to the industry. It causes a great deal of extra work and seems highly inefficient.

From a technical perspective, the inability to measure creative efficacy is a weakness. Of course, multi-collinearity challenges make this difficult, but the impacts of creative strategies and messages cannot be overstated. We consistently heard the appraisal that creative accounts for 60% - 70% of overall advertising effectiveness.

And finally, the fact that there are no generally agreed metrics for long-term advertising effects is a weakness that under estimates the contribution of advertising to business results.

Opportunities

Improved media data and improved systems for delivering campaign specific data to modelers are a very big opportunity. Though data acquisition has always been an issue, in this era of massive media complexity, the problem threatens to bog the process down and threaten the accuracy of model findings.

There are opportunities for a great deal of education. All around. Advertisers and agencies need to be more effective and demanding users and can only do so with a solid base of understanding of model inputs, possible outputs and other important modeling issues.

And finally, identifying best practices in applying model findings to day-to-day decision-making is another opportunity. Some companies are organized in such a way to ensure promulgation of findings throughout the enterprise and throughout the marketing and advertising development process. The whole industry could benefit from a deep look at organizations that have thoroughly embraced the application of model findings.

Threats

Improvements in modeling practices are threatened by the rapid pace of media evolution and increasing complexity. We noticed a certain amount of inertia operating in the industry that we attribute to this growing complexity. When a whole host of variables are changing, there is less interest in changing or evolving the models and we saw that there must be a strong reason to change. We worry that innovations in modeling and data acquisition will be stifled by a very human aversion to change and risk-taking.

The incremental time and cost associated with new data and exploration of new modeling approaches are also threats to the current practice. We are concerned about the practice of accepting model inputs and data of unknown origin and models/metrics that don't always provide the best measure of advertising.

Recommended Next Steps

1. We recommend that the industry address the media data issue by:

    o Assessing the data currently in use

    o Establishing best practices

    o Encouraging their development and

    o Auditing their use

2. We recommend and encourage open industry supported R&D:

    o Toward the measurement of long term-effects of advertising

    o Toward integrating measure of creative efficacy

3. We recommend the development and adoption of best-practices for organizational application of model results to advertising and media decisions:

    o Update ARF best practices

    o Engage the 4As and the ANA

    o Provide continual user education

About the Council for Research Excellence's ROI Committee

The Council for Research Excellence (CRE) formed its ROI Committee in early 2012 to develop research into an area that is top-of-mind throughout the media and advertising industries. Chaired by David Poltrack, Chief Research Officer for CBS Corporation and President of CBS Vision, the ROI Committee explores work that has been done in the area of advertising ROI and seeks opportunities to work with respected industry organizations including the Advertising Research Foundation (ARF) about possibilities for collaboration.

Chair
Dave Poltrack (CBS)

Committee Members
Michele Buslik (Targetcast tcm)
Laura Cowan (LIN Media)
Jeff Doud (Kellogg's)
Ed Gaffney (GroupM)
Jeffrey Graham (Twitter)
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Kate Sirkin (Starcom MediaVest Group)
Leslie Wood   (Nielsen)
Tom Ziangas (AMC Networks)

Richard Zackon (CRE Facilitator)

To see the Committee's latest research, please visit the ROI Committee page on the CRE website (www.researchexcellence.com).