



NBCUniversal Advertising Effectiveness
Look Book Volume 2:

Marketing Mix Modeling



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Introduction

TV advertising is transforming. As TV, a mainstay of traditional media, undergoes a reinvention across advertising capabilities and the measurement of their effects, the marketer's mindset that it only delivers broad reach is outdated.

The reach of on-demand TV content on ad supported streaming platforms is up to 28% and growing¹. This can be attributed to Connected TV (CTV) making TV's addressable advertising comparable to all other digital capabilities. TV advertising, regardless of Linear or Addressable platforms, has the ability to convey brand stories in a way that directly influences consumer's brand perception and memorability, producing both short- and long-term effects.


The evolving media ecosystem and expanding data privacy laws are driving more media buyers to leverage Marketing Mix Modeling (MMM) to quantify ad impact and ROI. This top-down approach to measuring media effectiveness and efficiency of an overall media investment portfolio, is a critical component of media measurement.

When applying the MMM framework to analyze the ROI of various media channels, it's essential to adhere to several key considerations that underpin successful modeling efforts. These considerations include constructing a model that reflects the interplay of the full marketing mix, for example avoiding the isolation of TV and social media as independent entities. Additionally, the model should extend beyond capturing only the immediate impact of media placements, recognizing the vital contribution of advertising to long-term brand growth. Lastly, while optimizing cost efficiency is important, a narrow focus on achieving lower CPMs may prioritize short-term savings over the enduring health and effectiveness of the brand and its campaigns.

We believe there are 4 fundamental questions every advertiser must ask their MMM providers in order to implement a model that captures accurate performance results.

1. Does your MMM model treat CTV separately from linear TV or other digital (e.g. display)?
2. How is your MMM model accounting for the long-term effects of advertising?
3. How do you best leverage publishers' first party streaming data as the most reliable and robust media measurement inputs into your MMM model?
4. Are you leveraging multiple measurement solutions to validate the outputs you are getting from your MMM models?

¹ <https://www.kantar.com/north-america/inspiration/technology/percentage-of-us-streaming-households-drops-in-q3-while-cable-tv-declines-slowed>



We have developed this MMM Look Book to urge marketers to work with their marketing mix analytics providers to set up their models correctly and properly measure the relative contribution of Linear and CTV vs. other advertising options. There are several key factors that we believe need to be implemented and considered for reliable results when building MMM solutions for your organizations, which are the following:

1. Differentiate Types of Advertising.


As CTV is relatively new, we have identified, based on conversations with our agency partners, that some MMM modelers treat CTV as digital media and assign it similar model parameters as those used for display, social, and online video. This mislabeling greatly undermines the effect of CTV in driving business outcomes. Because CTV is a part of TV media, it carries the same quality of premium video content, playing a role similar to linear TV in driving full-funnel impact. In fact, many research studies show that CTV and Linear TV drive similar lift in ad recall, brand awareness and favorability.

Another common mistake is combining CTV and Linear in the MMM models. While they have similarities, they should be kept separate, because they offer different advantages. On one hand, linear TV offers very affordable GRP rates for broad reach content. On the other hand, CTV advertising is targetable, with audience members no longer viewing the same ads, instead receiving personalized messaging relevant to their needs and interests. Additionally, unlike on Linear TV, where viewers can fast forward ads on DVR, ads are usually non-skippable on CTV and can even contain a digital call to action.

2. Model Long Term Effects.

Media exposure can drive both short- and long-term effects. To elaborate, short-term refers to the effect within 3 months after the first media exposure, while long-term covers media effects lasting up to 2 years. Proven research shows that TV Advertising has positive, long-lasting effects on purchasing behaviors, not only driving business performance in the moment, but also establishing brand equity over time and strengthening business resilience during moments of economic decline². It is important that the modeling approach considers the impact of prior months' advertising on current sales, quantifying both the short-term and long-term impact of various media tactics to provide a holistic media effectiveness and efficiency estimation.

²[Profit Ability: the business case for advertising', Nov 2017, Ebiquity & Gain Theory](#)



Too often we see studies that only consider short-term impact, which yields misleading results for advertisers looking to optimize their media investment, eventually hurting their business and revenue in the end. In MMM frameworks, models should include media contribution to both short- and long-term sales to build brand equity. It is important to note that modeling long-term media effects to drive brand equity requires advertisers to have consistent brand equity metrics over time to support model development.

3. Seek Convergent Validity.


The industry is changing at a rapid pace, with the fragmentation of advertising options making it difficult to unpack ad effectiveness by platform and tactic. Each method, such as MMM, Multi-Touch Attribution (MTA), and Incrementality Testing, have their own strengths and weaknesses, but collectively offer the most informed view to show how well a given advertising approach works. To navigate this task effectively, organizations must embrace a validating feedback cycle.

MMM and Incrementality/Lift Tests are the foundational pillars of this loop, offering insights into the incremental net impact of media investments. The synergy between these two methods creates a robust validation mechanism. Incrementality tests serve as ‘reality checks’, ensuring that the estimated incremental impact derived from MMMs align closely with this ground truth. Incrementality/Lift Tests introduce the concept of ‘guardrails’. They help ground the impact and provide a reference point for assessing the effectiveness of media channels. This mechanism ensures that marketing decisions remain tethered to empirical evidence, reducing the risk of uncertainty and misallocation of resources.

As the third pillar, MTA thrives on collecting granular user-level data, providing insights into the intricate workings of media placements and tactics. However, as MTA delves into the user-level data landscape, it becomes increasingly susceptible to privacy regulations and data restrictions. MTA can benefit by leveraging the learnings from MMM and Incrementality Tests to guide its estimates effectively. By constraining the channel-level impact using insights from MMM and validating its results with Lift Tests, MTA ensures that its user-level insights align with these validated signals. This relationship between the methods offers the opportunity for balance and precision in optimization efforts.

4. Use the Best Data Possible.

Leveraging first-party data for impression measurement is pivotal in Marketing Mix Modeling due to its inherent accuracy and completeness. Unlike third-party sources, which may suffer from discrepancies due to sampling biases or data processing lags, first-party data reflects the true scale and granularity of consumer exposure to marketing campaigns. This direct measurement from owned channels eliminates the guesswork and potential errors associated with third-party reporting, ensuring that MMM analyses are based on data that accurately represents consumer interactions.



The advantages of using first-party over third-party are substantial. First-party data provides a more reliable input for modeling, free from the potential misalignments that can arise when using extrapolated or aggregated third-party data sets. When impression data is not accurate, MMM models can yield misleading ROI calculations, incorrect attribution, and suboptimal budget allocation decisions. In contrast, first-party data mitigates these risks by offering a clear and direct record of ad impressions, enabling more precise modeling of marketing spend effectiveness.


Adopting first-party data sources for media impressions is a strategic imperative for reliable MMM, ensuring that the insights drawn are reflective of actual delivery.

At NBCUniversal, we aim to equip our partners with a holistic understanding of how their ads are performing and underscore the value-add that we provide. We also believe that it is our responsibility to equip marketers with ideas and data that lead to the most accurate answers possible and are committed to sharing our knowledge and thought leadership on a range of data methods. We support both buy-side and sell-side measurement by sharing our ad serving data to NBCUniversal certified partners via data interoperable mechanisms.

To help advertisers achieve best measurement practices for MMM, NBCUniversal has three broad initiatives underway:

- 1. Leverage NBCU Data Interoperability Solutions:** NBCUniversal ad exposure data is available in our proprietary data clean room platform that enables privacy-minded measurement for advertisers and measurement vendors. For advertisers or measurement vendors that are not ready to use the data clean room, we also offer the option to use S2S (server to server) integration.
- 2. Automate MMM Data Feeds:** NBCUniversal is developing a data extraction tool for clients to export aggregated NBCU ad exposure data that can be used for marketing mix modeling without having to source through a third-party agency.
- 3. Provide MMM Guidance:** NBCUniversal will continue to provide guidelines and summaries of methods and measurement providers to help marketers identify the solutions that best fit their needs.

Our philosophy in measurement is that we will share what we learn broadly. The more effective advertising is across the board, the more value advertising brings to consumers and gives them what they need to make their best choices. To help you begin exploring this topic, we have compiled a set of key takeaways regarding TV advertising effectiveness modeling. We look forward to your feedback to best move forward this important part of the measurement transformation we are all underway with.



The key takeaways in this Look Book include:

- **CTV, Linear TV, and other forms of advertising must be represented as unique properties** to avoid conflating platforms that have characteristically different features and purposes. Understand how modelers separate and/or combine channels within their solution since this can greatly influence the outputs of the model.
- **TV media has an impact on the full marketing funnel to drive both short- and long-term sales.** Look for long-term effects of advertising, not only short-term to measure media effectiveness and efficiency. In MMM framework, modelers should model not only media contribution to short-term sales, but also long-term contribution towards building brand equity.
- **Media investment inputs used in MMM need to rely on robust and reliable media exposure measurement, especially for CTV media.** Use the best data through first-party integrations to facilitate the data for MMM.
- **Seek convergent validity to leverage multiple approaches** and have the most informed view of the relative effectiveness and efficiency of different advertising platforms.

This is only the beginning. You will see that as we built out this Look Book, we worked to clarify these challenges to help advertisers choose the best path forward, along the dimensions that matter most to you and the industry.



Measuring Advertising Impact & ROI

TV advertising, whether Linear or Connected TV (CTV), is designed with a clear purpose: to achieve effectiveness. It's not just about entertaining or informing; it's about imparting reminders, knowledge, and feelings that influence consumer and customer behaviors and mindsets in line with the advertiser's objectives. These goals are always linked to enhancing specific metrics through ad exposure, achieved in a financially efficient manner.

Effectiveness: At the heart of marketing effectiveness lies the concept of incrementality. This concept is crucial for understanding the causal impact of marketing actions on outcomes like sales or customer engagement. Incrementality guides marketers to look beyond superficial metrics and evaluate the real contribution of their campaigns in changing consumer behavior. The correct framing of effectiveness for MMM, MTA, and Lift Test measurement should always be grounded in understanding the incremental impact a marketing investment is providing.

Consumer and Customer: Identifying the right audience segments that can be influenced by marketing efforts is crucial for effective advertising. This requires an understanding of which segments are most likely to respond positively to specific messaging. This impact is known as the *response effect* of the advertising exposure on the consumer and varies at the individual level. When we consider outcomes effectiveness from the planning perspective, we seek the audience that collectively maximizes this effect. This audience response is the causal impact of the campaign.

Financial Efficiency: Evaluating whether the outcomes of an advertising campaign are proportionate to the investment requires an accurate understanding of both marketing effectiveness and incremental impact. A critical aspect is the correct measurement of Return on Investment (ROI), which must incorporate incrementality. Without this, many approaches risk inflating ROI by mistaking correlation for causation and including baseline outcomes that would have occurred organically. True ROI calculation factors in the incremental return provided by an advertising campaign, aligning financial outcomes with actual marketing effectiveness.

This Look Book on MMM explores methodologies, guidelines, and service providers that measure advertising effectiveness using concrete metrics like sales lift, customer acquisition and digital behaviors that are key to a successful consumer journey.

Starting in 2021, NBCUniversal issued an RFP calling on every measurement innovator to share with us their capabilities across six major categories: Audience Measurement, Audience Verification, Brand Measurement, Incrementality, Multi-Touch Attribution and MMM. Over the next couple of years, the Measurement Framework evolved into seven categories, also including Emotion. Below is the latest NBCUniversal measurement framework that covers every measurement category.

Measurement Framework V4.0 February 2023

Industry in state of flux, subject to change. Will be updated regularly. Companies are in alphabetic order by category unless certified. Partners are certified by category.

= NBCU Certified Measurement Partner

TRANSACTIONAL		IMPACT		BUSINESS PLANNING	
<p>1 AUDIENCE MEASUREMENT</p> <p>Currency</p> <p>comscore (Local) iSpot.tv (National, Persons Demo & Advanced) videoamp (National, Advanced)</p> <p>Currency Contenders</p> <p>IXERO LIVE comscore+ Nielsen ORACLE Advertising SAMBA TV tvsquared videoamp</p> <p>Streaming/Digital</p> <p>CONVIVA Akamai media.melon</p> <p>Content Quality</p> <p>Adelaide dumbstruck LUMEN MarketCast ORACLE Advertising RMT TVISION</p> <p>Media Planning & Optimization</p> <p>AMOBEE MEDIASCIENCE Cint CIVIS DV DoubleVerify escalent ER Extreme Reach FOURTHWALL FURIOUS INNOVD Ipsos IRIS.TV KANTAR Ocucom SAMBA TV streamhub tataru tvbeat Upwave</p> <p>Persons-Based TV Panel</p> <p>BEATGRID MEDIA Hypha Metrics immetrica Nielsen PanResearch TVISION</p>	<p>2 AUDIENCE VERIFICATION</p> <p>DV DoubleVerify IAS ORACLE Advertising kinetiq</p> <p>TV Monitoring & TV Ad Catalog & Video Ad Server</p> <p>iSpot.tv INNOVD FRESHWHEEL</p> <p>ER Extreme Reach EDO itech HIVE KANTAR kinetiq Nielsen VIZIO</p>	<p>3 BRAND MEASUREMENT</p> <p>dynata KANTAR loopMe LUCID a Cint Group Company MarketCast DISQO BEATGRID MEDIA escalent comscore INFILLION Nielsen Latitude prodege RAM Research and Analysis of Media Upwave YouGov</p>	<p>INCREMENTALITY MEASUREMENT</p> <p>Website Conversion Online/ Offline Sales</p> <p>DataPlusMath EDO iSpot.tv KOCHAVA NCSolutions SAMBA TV tataru tvsquared IXERO LIVE ABCS Insights ENGINE FOURTHWALL INMARKET KANTAR ORACLE Advertising</p> <p>Foot Traffic</p> <p>RPP SCIENCE FOURSQUARE NinthDecimal INMARKET nSpot PlaceIQ</p>	<p>4 SALES IMPACT (INDUSTRY SPECIFIC)</p> <p>Auto</p> <p>Polk S&P Global Mobility</p> <p>CPG</p> <p>CATALINA IRI Kroger NCSolutions Numerator</p> <p>Finance (Credit/Debit)</p> <p>affinity solutions Verisk Financial Commerce Signals</p> <p>HealthCare/Pharma</p> <p>Veeva Crossix IQVIA</p> <p>Insurance/QSR/Food Services/Wireless</p> <p>Nielsen Numerator</p> <p>6 BUSINESS OUTCOME GUARANTEE</p>	<p>5 MULTI-TOUCH ATTRIBUTION</p> <p>CATALINA iSpot.tv IQVIA neustar rockerbox Veeva Crossix videoamp Polk S&P Global Mobility Adobe CIVIS comscore DataPlusMath C3 Metrics FOURTHWALL KOCHAVA EDO NCSolutions KANTAR MARKETING EVOLUTION Nielsen tvsquared</p> <p>Marketing Mix Modeling</p> <p>ANALYTIC PARTNERS GAIN THEORY IRI KANTAR neustar Nielsen</p>
<p>7 EMOTION</p> <p>dumbstruck REAL emozo iSpot.tv Latitude MEDIASCIENCE real eyes RMT W BEING HIGHT System1 whip media</p>		<p>Identity Graph/Resolution acxiom adstra CHOREOGRAPH CONVIVA EPSILON experian LiveRamp neustar TRUOPTIK TransUnion truth{set}</p>			
<p>Content/ Attention/ Interactivity/ Social</p> <p>advocado EntTelligence INNOVD JUMP MarketCast sprinklr ThinkingRight LLC TVISION Adelaide BrightLine HIVE iSpot.tv LISTENFIRST RelishMix Talkwalker tubular zoomph</p>					



A Range of Methods to Understand Drivers of Sales Growth

NBCUniversal supports and finds value in a range of methods used for determining advertising effectiveness and efficiency. In fact, we encourage advertisers to seek convergent validity as no one class of tool is perfect or provides all the answers.

Marketing Mix Modeling (MMM): Originating in the 1960s, Marketing Mix Modeling (MMM) has evolved significantly from its initial focus on simple time series analyses of marketing variables. As marketing channels diversified and consumer behavior grew more complex, MMM adapted to include a broader range of data inputs such as macroeconomic factors, competitive actions, and digital metrics. Today, MMM utilizes advanced statistical techniques, particularly Bayesian methods, to integrate historical data and continuously refine estimates. Modern models are adept at managing data variability, providing explainable results, and offering robust confidence intervals, making them essential in data-driven decision-making under uncertainty. Furthermore, the use of MMM has shifted from quarterly/annual analyses to more frequent, even weekly, assessments, reflecting its growing agility and responsiveness to market dynamics.

Multi-Touch Attribution (MTA): MTA arose from the need to understand the increasingly complex digital customer journey. It analyzes the contribution of each touchpoint in the customer journey to conversions, offering a detailed view of customer interactions. MTA has advanced from simplistic single-touch models to sophisticated multi-touch models employing various statistical methods and machine learning, including logistic regression and neural networks. Despite challenges such as data fragmentation and privacy concerns, MTA continues to evolve with privacy-minded methods and a greater focus on first-party data. It's increasingly being integrated with broader marketing measurement frameworks like MMM, providing detailed tactical insights while adhering to overarching strategic boundaries.

Incrementality and Lift Tests: Lift Tests, particularly Randomized Control Trials (RCTs), are the gold standard for causal inference in marketing. Borrowing from medical research methodologies, RCTs in marketing rigorously assess the effectiveness of marketing interventions by comparing treatment and control groups. Innovations in RCT design have made them adaptable to various marketing contexts, including geographic splits and programmatic advertising techniques like Ghost Bidding. Where RCTs are impractical, quasi-experimental designs like synthetic control methods, interrupted time series analysis, and difference in differences (DID) offer alternatives for causal inference. These methods are rapidly evolving, making them vital in comprehensive marketing measurement strategies and providing crucial validation for MMM and MTA models.

Choose the Measurement Method Best Suited for Your Need

Consideration	Marketing Mix Modeling (MMM)	Multi-Touch Attribution (MTA)	Incrementality — RCT	Incrementality — Observational
What is it?	Uses regression modeling to analyze historical marketing data against sales, identifying the influence of various factors. Data is typically aggregated.	Assigns fractional credit to touchpoints in the customer journey to assess advertising impact.	Involves testing a marketing strategy by comparing a randomly selected control group with a test group.	Utilizes non-random unexposed groups for comparison, often employing methods like synthetic control, difference-in-differences, etc.
Main Role	Useful for broad planning at monthly, quarterly, or annual basis.	Helpful for real-time campaign adjustments and comparing effectiveness across platforms and tactics.	Ideal for in-depth analysis of a single marketing strategy.	Used when RCT is impractical, offering insights for specific marketing strategies.
Data Granularity	Requires aggregated data, such as impressions and spend over time.	Demands detailed user-level data, including touchpoints and conversion paths.	Requires detailed data for both the control and exposed groups, which may vary by media type.	Utilizes various data types, often requiring granular data at the user or geo level, depending on the method.
Strengths	Broad scope suitable for capturing full marketing mix and macroeconomic factors.	Provides detailed customer journey insights.	Offers ground truth insights on the tested strategy.	Flexible in approach to approximate ground truth insights on the tested strategy.
Weaknesses	Requires a high level of statistical and domain expertise.	Privacy and addressability issues result in lack of complete picture.	Limited in scope to one tactic at a specific point in time.	Less precise than RCT due to the non-random nature of the control group.
Insight Level	Offers long-term strategic insights based on historical data trends.	Provides real-time insights for immediate tactical decisioning.	Specific, time-bound insights into the effectiveness of a marketing treatment.	Specific, time-bound insights into the effectiveness of a marketing treatment.
Difficulty to Execute	Requires a high level of statistical and domain expertise	Requires integration of diverse user-level data sets.	Demands careful planning and execution of randomization.	Need for rigorous method selection and data analysis.



Overview of Marketing Mix Modeling (MMM)

General Guidelines

Marketing Mix Modeling (MMM) has been leveraged for many years by marketers. It is a modeling technique used to quantify the contribution of marketing tactics in driving demand, sales, and market share. The purpose of MMM is to decompose the overall sales by baseline sales, non-media driven sales, and media driven sales. This helps marketers understand the contribution, effectiveness, and efficiency of each marketing tactic in driving sales performance. The key output of MMM is response curves which can be established by marketing and media tactics and by publishers. These response curves are utilized in marketing optimization tools for scenario planning, as well as for marketing budget allocation and optimization to maximize marketing ROI.


MMM uses the principle of regression techniques. Bayesian hierarchical modeling is the most popular for MMM development. A good framework should not solely focus on using data science and machine learning techniques to estimate media contribution, being mindful to consider audience media consumption behaviors and channel interplay to thoughtfully construct models that capture the true nature of the marketing mix.

MMM approaches have different characteristics that need to be considered:

Short- and Long-Term Effects. Media exposure can drive both short-term and long-term effects. Most attribution measurement is meant to measure short-term media effect. In the MMM framework, modelers should not only model media contribution to short-term sales, but also the long-term contribution to build brand equity, which subsequently drives baseline sales.

Decay Effect (Adstock). Decay effect is evaluated by the half-life of an ad that describes the speed of an ad to go to 50% of its initial impact. Better systems will use data-driven approaches based on accepted modeling and machine learning methods to determine the decay factors for different types of advertising. Other methods might hardwire assumptions about these decay factors which are less desirable.

Diminishing Returns (Saturation). It is well-known that media investment and desired outcomes follow a non-linear relationship. For example, if an investment is doubled it will not result in a doubling of the return. Audiences are finite, and as investment increases on a platform there is less audience available for that investment to reach. MMMs seek to find this non-linear relationship between investment and marginal effectiveness by leveraging saturation functions.



Time-Varying Effectiveness. Channel performance does not remain static and will change over time. This can be due to a number of factors such as changes in audience composition or algorithmic decisioning within the platform. Certain modeling techniques like Gaussian Processes (GP) allow for flexible modeling of these temporal dependencies.


Causal Structures. MMMs are causal models and seek to estimate the causal impact of media investment. To prevent models from being influenced by confounding pathways, it is essential for the model to reflect the causal structure of the media-mix interplay. For example, a model might predict TV's impact on search, then search's impact on sales as well as TV's direct impact on sales. You might be most likely to find this capability in models that use Structural Causal Models (SCM), Structural Equation Models (SEM) and Vector Autoregression (VAR).

Rigorous Validation Protocols. Model evaluation is a critical step in the MMM process. Advertisers can work with their MMM vendors to ensure that model estimates are plausible and generally agree with the results of their other Incrementality tests. Additionally, out-of-sample predictive tests check that the model does a good job of predicting sales/outcomes on data the model hasn't seen before. The goal of any MMM is to construct a modeling engine that captures the true underlying process that generates sales/outcomes (for example, how media investment inputs map to a change in the sales outputs). Models that have accurately constructed this process should be able to reasonably predict outcomes on data it was not trained on. Since we are concerned with the true nature of these cause-effect relationships of media investment on sales, traditional evaluation metrics like R2 are not useful because they do not reveal anything about potential over-fitting concerns and non-sensible relationships between media variables.

Model Uncertainty. Advertisers should be aware that MMMs produce estimates of channel effectiveness, which include the point estimate as well as confidence intervals which communicate the amount of uncertainty around that point estimate. At a high level, the uncertainty around point estimates can be thought of as a reflection of the model's ability to tease out signal from noise. A strong signal means the model can estimate the parameter more precisely, leading to less uncertainty. For decision making on future investment strategies, clear communication around the uncertainty of these estimates is critical. Lastly, media investments that result in wide uncertainty are typically good candidates for Incrementality tests.

Marketing Mix Modeling Provider Summary

In 2022 and 2023, NBCUniversal undertook a process to understand leading Marketing Mix Modeling providers, in order to grasp the range of approaches that are implemented in practice. We obtained information via a questionnaire that went to these providers. Provider responses have been reproduced and organized into a comparison grid. These responses are directly sourced from each MMM provider.



The goal of the summary is to educate the marketplace of existing capabilities in the MMM space. We also used these responses to help inform NBCUniversal's position regarding best-in-class analytic plans for measuring TV (Linear and/or CTV) advertising effectiveness.

Key Factors for MMM Solution Evaluation

- ✓ Model input data collection approach
- ✓ Business outcome data type
- ✓ Model data time granularity
- ✓ Category coverage
- ✓ Availability of benchmark data
- ✓ Capability to model at local market level
- ✓ Look-back window
- ✓ Independent variables
- ✓ Modeling approach
- ✓ Model validation approach
- ✓ Approach to estimate Adstock Effect
- ✓ Capability for optimization using MMM result
- ✓ MMM, MTA and Lift Test convergence and unification
- ✓ The principal to model linear, addressable and CTV
- ✓ Approach to model long-term media effect
- ✓ Vision to handle multi-currency media environment in mmm framework

Marketing Mix Modeling Provider Summary

These responses have all been directly sourced and confirmed by the respective providers as provided, based on the Survey Conducted in Oct 2023. Aside from reproducing them into the below chart, NBCUniversal has not edited these responses.

Analytic Partner	Gain Theory	Circana	TransUnion	Nielsen
Main Data Sources including Mass Media and Digital Media Inputs				
Commercial Analytics, powered by GPS-Enterprise, our proprietary technology platform, includes data supplied by both advertiser and directly through publisher partnerships and other sources to ensure comprehensive and holistic measurement of all business drivers.	Receives data via thousands of API calls each day from their data management platform GTD1 (Gain Theory Data One)	<p>Weekly POS data from 600+ retailers with which we have direct relationships covering \$4 trillion in purchase behavior.</p> <p>We also collect promo casuals/variables like in-store display, features through an extensive audit team.</p> <p>Other marketing/non-marketing variables are collected through our partnerships with 3rd party publishers (e.g., Google, Amazon, Meta, Tik Tok, VideoAmp) or from syndicated/ publicly available data sources.</p>	The core data for MMM generally includes information that TransUnion collects from a client and its agencies: historical outcome data, spend data across all relevant marketing channels, and additional data that might influence sales. In terms of media data, this may include: Activity by channel (grp's, impressions, etc.) and by type of messaging (e.g., brand vs. product); Net spend per channel (in the appropriate currency) and/ or type of activity. In addition, all of TransUnion's clients leverage externally sourced data in their marketing measurement programs. For convenience, TransUnion offers direct access to many 3rd party data partners across the industry including the walled gardens.	<p>Nielsen understands how critical it is to ensure a marketing mix captures the full breadth of brand performance drivers. To ensure this occurs, Nielsen leverages a comprehensive network of data sources via:</p> <ol style="list-style-type: none"> 1.) Proprietary data assets (TV ratings data via Ad Intel) 2.) Direct data partnerships with over 100+ engagements including, but not limited to, the world's largest digital platforms with Amazon, Google, Meta, Snap and TikTok. 3.) Direct from advertisers and other 3rd Party data providers for executional data associated with Print, OOH and other digital.
Main Outcomes Variables				
Short- and Long-Term Performance Criteria	Sales (in-store, ecommerce, by category), Leads, Foot Traffic, and up the funnel to metrics such as Consideration, Awareness, and other forms of Brand Health.	Volume contribution, effectiveness, ROI/ROAS	TransUnion's measurement team prioritizes and quantifies how marketing drives growth for a brand across key areas of the consumer life cycle depending on the goals & persona of the brand: short- & long-term sales, new customer acquisition, customer retention & engagement and long-term brand equity. These goals translate into specific KPIs and analyses to measure how marketing and non-marketing drivers deliver impact and how to optimize each. Examples of KPIs include revenue, unit sales, profit, quotes, and subscriptions as well as long term brand health or equity measures.	Nielsen mix models are a KPI agnostic solution, and are able to measure performance across all levels of the conversion funnel (i.e. sales, leads, quotes, tune-in / ratings, awareness, consideration, etc.) based on a brand's business goals. Typical high priority KPIs analyzed include effectiveness, efficiency, investment sufficiency, and return on investment (ROI) / return on ad spend (ROAS) against a given conversion KPI.
Time Granularity				
Aligned to business KPIs, which can be daily, weekly or monthly	Our time granularity is weekly by default. We also leverage short-term economic time-series analyses where we leverage daily data and even dayparted data.	Weekly	Market level insights can be as granular as weekly.	Nielsen marketing mix is capable of modeling daily, weekly or monthly data, depending on data granularity and business profile.

Analytic Partner	Gain Theory	Circana	TransUnion	Nielsen
Categories				
Extensive expertise in all major categories (e.g., Auto, Retail, Financial Services, Consumer Goods, Travel, QSR, Apparel, Tech).	Today, we work with top 5 businesses in all major industry sectors. Our core clients come from Retail / E-Tail, CPG, Automotive, Financial Services, and Travel and Entertainment.	Circana's focus is on consumer-packaged goods (CPG) space, including over-the-counter health (OTC). Recent integration with The NPD Group provides additional focus on General Merchandise categories.	TruAudience® marketing solutions serve a variety of industries including Banking, Insurance, Automotive, Retail & eCommerce, Consumer Packaged Goods, Telecommunications, Media, Technology, Electronics, Internet, Travel & Hospitality, Quick Service Restaurants, and Healthcare & Pharmaceuticals. TransUnion maintains a Benchmark Database to evaluate and check client performance against industry-level norms, as appropriate for comparisons.	Nielsen has experience in 30+ industries spanning Apparel, Automotive, Consumer Electronics, Consumer Goods, Entertainment, Financial Services / FinTech, Gaming, Media, Quick Serve Restaurants (QSR), Retail, Travel and more with operations and client engagements in over 40 countries.
Benchmark Data				
One of the outputs of ROI Genome is intelligent benchmarks	Yes, we maintain a Gain Theory anonymized database of benchmarks that go beyond ROI – spend norms, % impacts, consumer response parameters & long-term impact – covering a range of business sectors & brand types.” Our benchmark database contains 40+ yrs. of data with 37K+ models benchmarked), providing insights for our clients, within & across industries.	We maintain a benchmark database containing key model KPIs across 300+ projects run over the past 3-4 years.	The TruAudience® knowledge library is comprised of empirically measured consumer marketing responses spanning nearly 20 years of experience across 1,000s of models, more than 50 countries, and all major B2C verticals	As the global leader in Marketing Mix, Nielsen has an extensive proprietary database of historical Marketing Mix results, Nielsen Compass, that provide a comparative lens on performance relative to industry benchmarks covering over 5,000 models and 25,000 response curves across 50 countries. Included in this are results from over 3,000 brands spanning more than 100 categories.
Local Level				
GPS-Enterprise supports all levels of geographic granularity from store, zip (in the US) to region clusters	Yes. We estimate regional (DMA or zip) media response via our geo-based measurement solution- SensorTM. We initially developed SensorTM in 2017 and have continued to expand it's capability via automation and enhanced analytical techniques. Today, we apply the solution across many categories. A key requirement for the solution is access to sales and media / marketing activity at a granular geo-level.	Store/Week/Sub-brand	The TruAudience® MMM models optimize investments at any level of interest within the model structure, though practical limitations may apply. These are managed with our hierarchical constraint manager.	Geographic granularity reporting is determined in collaboration with our clients and based on a combination of business questions, statistical validity and data granularity. In the U.S. for instance, some clients opt to model and report at the DMA (or more granular) level for regional or localized strategies while others evaluate performance at national levels aligned with their buying strategy.
Time Period for Lookback				
Varies depending on client, industry and history available	Data available for 3 years at a weekly level is ideal, but in cases when data availability is more limited we can run measurement with as little as 18 months' worth of data.	Models typically built over 104 weeks. However, because models are built at store level, we have run models using 4-5 years historical inputs up to only 6-8 months.	Marketing Mix Modeling requires 2-3 years of historical sales and marketing data.	As standard, Nielsen typically includes at least 2 years of historical data in our models and in some cases, depending on data granularity and business objective (i.e. understanding the long term impact of advertising) can include as much as 3-5 years of data. If data granularity allows, it is possible to build models with shorter time periods and in some cases as little as 6-9 months worth of data for new launches.

Analytic Partner	Gain Theory	Circana	TransUnion	Nielsen
Causal Variables				
Aligned to all business drivers including marketing, product, price and promotion	There is no limit or restriction to the number of dependent variables or intermediary KPIs that we can include. The only limit is the statistical validity of the KPIs (for example, if variables are highly correlated and indistinguishable from one another). For TV, Print & Radio we typically use GRPs (and if necessary, we can calculate these from Impression's data and knowing the target audience). For Outdoor, sometimes data is available in an equivalent format to GRPs, and if not, we would use size weight number of panels. GRPs are transformed through a non-linear function to enable us to measure the impact of diminishing returns and the spread of impact over time.	Our models are typically structured to capture impacts across controllable and non-controllable effects. Controllable variables typically capture above the line media (e.g., tv, radio, print, social, digital, retail media) and below the line marketing (e.g., shopper marketing, trade, consumer promotions). Non controllable variables typically capture macro-economic impact, competitive effects (e.g., media spend, distribution), seasonality impact, COVID etc. The intent is to ensure enough of the non-controllable effects have been measured to ensure an accurate base business (e.g., business that sustains in short-term in absence of marketing). For marketing inputs, the priority is some type of impression measurement that captures marketing pressure associated with that marketing activity (e.g., impression, GRPs, clicks, circulation).	Paid media (Impressions, GRPs, spend, etc. - as appropriate for the channel).	Ensuring all performance drivers are accurately reflected can mean the difference between success and failure. For that reason, Nielsen accounts for all drivers in our models. The focus areas generally are Media (traditional and non-traditional), Pricing, Consumer Promotions/Incentives, CRM, Sponsorships, Operational Considerations and External Drivers. The commonality across studies is that we include all major drivers of a given business to produce much more than a traditional marketing mix analysis. Many of our advertiser clients have elevated our MMM engagements to be comprehensive "Business Drivers" analyses looking to understand all factors impacting their growth, not just marketing (e.g. COVID, Economy, etc.).
Macro Variables				
Essential to analysis to capture all non-marketing and non-controllable factors (e.g. weather, macro-economic indicators, category trends)	Macro factors split broadly into two groups – client/industry-specific and general factors For factors specific to NBCU, we would work with you to understand the likely key drivers of each KPI we are modeling and agree on the best data source to account for this. For general factors such as Public Holidays, COVID cases and restrictions, Economic Factors such as Unemployment and Inflation, Climate (Seasonal patterns, daily weather and extreme weather events) and News/Political Events (e.g. large scale protests), Gain Theory have a database of information which is used to create a range of variables for testing in the models.	See above	TruAudience® marketing solutions utilize economic, seasonality, industry specific, competitive spend, and other control variables. TransUnion tests numerous non-marketing and exogenous variables available through more extensive data partnerships. This includes but is not limited to: Macro Economic trends (CCI, CCP, Gas Price, etc. via Moody's), weather (AccuWeather), competitive (Vivix, Pathmatics), Google query volume, including 'privileged' data that is proprietary to our partnership and would include any trends that may impact the client's business, and social listening trends (BrandWatch). TransUnion also maintains its own proprietary and licensed data sets (example: "recent movers") and identity resolution capabilities.	As with many other aspects of our models, this is highly customized based on vertical and business questions. Generally, though, we account for factors such as weather, economy, seasonality, competitive media, COVID and additional known industry trends.

Analytic Partner	Gain Theory	Circana	TransUnion	Nielsen
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Modeling Approach				
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<p>Proprietary methodology blending statistical models with ML to provide the most robust predictive and explanatory power.</p>	<p>We leverage several econometric timeseries techniques, Bayesian Regression among them, to maximize insight granularity & computational efficiency. This allows us to account for new channels, with no historical data, but where priors exist from our benchmarks. Our unique approach, provides insight into base sales changes over time (unobserved components), marketing impacts across the sales funnel (long & short-term, direct & indirect) & granular audience impacts.</p> <p>Additionally, our Integrated Marketing Response (IMR) offering goes beyond traditional MMM. IMR analyzes contributing factors, both direct and indirect, that leads to final sale or KPI. IMR ties marketing investments to 'upper funnel' and mid-term metrics (e.g. Brand Affinity/Perception, Search, Web Traffic, App installs), links each KPI to one another, and ultimately through to sales/conversions.</p>	<p>Circana's MMM approach combines the best from Machine Learning advancements with causal modeling, driven by Circana's experience in running MMM analysis for millions of products every year, across hundreds of categories in multiple countries across the world. To this end we build models that produce explainable results and achieve a good in-sample fit being mindful of the overfitting cases that reduces the ability to project the results to the future investment allocation decisions.</p> <p>Circana's modeling engine is a data agnostic platform that reads data from Circana's data management platform (or any other data input process) and provides evaluation of the impact of each marketing activity controlling for other potential drivers like macroeconomic, weather, competition, in-store activities etc.</p>	<p>TransUnion builds its regression models using a number of analytical techniques to solve for real-world marketing realities. These include log-log multi-regression models, Bayesian approaches, diffusion models and the like—based on the challenge at hand. The econometric method identifies the causal relationships between outcome (e.g., consumer purchase funnel and charitable donations/sales) and marketing and other business drivers based on observed behaviors.</p>	<p>Nielsen utilizes advanced (time-series and cross-sectional) multivariate regression along with Pooling and Bayesian methods to develop multiplicative marketing mix models. Regression lines up the key performance indicator (e.g., brand equity or sales) with media and other drivers (e.g., weather, economy, seasonality, etc.) and mathematically ascribes a lift factor to each of these drivers. These lift factors define how much sales change as a result of fluctuation in each individual driver. This basic model structure is consistent across our engagements regardless of the data input source.</p>
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Validation Process				
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<p>Multiple validation steps are incorporated into the engagement to ensure accuracy of insights blending technology and human intervention including transparency with client on model inputs/fits and intelligence from ROI Genome.</p>	<p>All our models pass a series of statistical tests such as: Durbin Watson and Breusch-Godfrey for Autocorrelation, VIF for Multicollinearity, Breusch-Pagan for Heteroscedasticity, Jarque-Bera test for Normality, Dicky-Fuller for Unit root, Ramsey RESET for Misspecification. Data entered in models must pass t-value requirements. We also ensure that our models satisfy adjusted R-square and MAPE requirements. We apply 'hold-out' and stress tests to ensure that the model can predict 'future' outcomes (data outside the modeled period).</p> <p>All tests are backed by our long history and experience in delivering MMM. Our outputs are not only statistically robust, but make business sense Where requested, we leverage testing to validate model results. We offer both 'matched market' and 'exposed vs. non-exposed lift studies.</p>	<p>Out of sample tests are used for the marketing mix model validation. Each model is validated against a set of statistical tests:</p> <ul style="list-style-type: none"> • The correlogram or Autocorrelation Function (ACF) is used to check autocorrelation in the residuals. • The normality charts are used to test whether the model residuals are normally distributed. • The Durbin–Watson statistic (d) is a test statistic used to detect the presence of autocorrelation • The out of sample MAPE chart is created by applying the estimated model betas to ten weeks of data that were not included in the modelling period. • The fit-actual chart provides a graphical representation of how close the fitted values are to the actual sales 	<p>TransUnion's MMM models are subject to a variety of common statistical tests including exploratory data analysis to identify common data issues such as collinearity, non-stationarity, autocorrelation, serial correlation, etc. After the models are constructed, we look at a variety of goodness of fit metrics including credible intervals and standard errors. Finally, TransUnion computes the mean absolute percent error or MAPE for each modeled cross section and compares a variety of in-sample and out-of-sample holdouts to ensure model fit and predictive capacity. In many instances, we also consult with our clients to build robust experiments in order to further validate the model results in real world environments.</p>	<p>Advertisers need to feel confident in the results a model produces. Nielsen ensures that models are robust and predictive via a rigorous model fit protocol. Our model selection is primarily based on holdout testing. We believe model performance against data the model has not seen is the best indicator of the ability of the models to predict future impact to help clients make better decisions. Beyond the hard statistical rigor applied to model evaluation, we always do this with an overlay of practical reasonableness.</p>
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Analytic Partner	Gain Theory	Circana	TransUnion	Nielsen
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Approach for Ad Stock and Diminishing Effects				
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<p>Expressly modeled as a part of each individual customer's analysis, aligned by planning and optimization levers, and incorporated into future decisioning scenarios</p>	<p>We deal with media decays using the Gain Theory AdModel™, our proprietary approach to media measurement that helps our clients to forward plan media by showing how customers respond to campaign activity. The AdModel™ analyzes how many times consumers need to see an advertisement, with what recency, how quickly they forget the advertising, and whether exposure to the campaign makes for a lasting impact onto their behavior.</p>	<p>Circana uses a geometric formulation for Ad-Stock which is applied to each of the media drivers to capture the carryover effect of media drivers. S Curve Transformation is applied over the Ad-Stock transformation to account for the diminishing rate of returns. Transformed Media Variables are created by iterating through multiple values of ρ (Ad-Stock parameter), b (Diminishing returns curve parameter) and c (Saturation parameter).</p>	<p>Ad stocks and lags are incorporated into TransUnion's MMM models for each marketing touchpoint for each modeled outcome. In addition to using a client's historical data to determine the ad stocks, we also leverage our proprietary benchmark database to ensure that ad stocks fall within the norms based on vertical and maturity of business.</p> <p>More specifically, TransUnion uses Cobb-Douglas functional form to capture diminishing returns/saturation, as well as the synergistic nature of media consumption and marketing effects. TransUnion estimates log-log models to linearize the equation and run regressions, while preserving diminishing returns. Raw data goes through various transformations (adstocks, lags, normalizations, interaction terms, etc.), and response curves are NxN based on the interaction of all variables in the models.</p>	<p>Using Nielsen's patent pending methodology, we identify response curves for each marketing tactic using effective frequency, marketing vehicle penetration rate and half-life parameters for each vehicle and campaign in scope. We empirically test both C and S-shaped curves and select appropriate curves using a combination of model fit and plausibility based on known penetration of the media employed. We directly estimate the response curves within the modeling process, rather than predefining their shape in advance. This results in better fit and better forecasting. Response curves generated as part of the engagement directly contribute to the calculation of ROI and MROI. Similarly, ad-stock is estimated through a modeling evaluation process rather than defined in advance.</p>
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Optimization Approach				
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<p>Our GPS-Enterprise platform includes robust scenario planning and optimization capabilities. Users are provided with the ability to simulate future outcomes in real-time as well as provide optimizations and budget recommendations, across multiple KPIs, dimensions and long-term and short-term goals.</p>	<p>Our client-facing optimization and activation engine- Gain Theory Interactive (GTi)- employs a hill-climbing optimizer with a number of features to avoid common pitfalls of typical hill-climbers. These include: Adaptive increments; "flooding" (otherwise known as setting initial conditions); min, max, and equals constraints that can be programmed at every level of the hierarchy; and the ability to optimize over all common media transformations (S-curves, Power curves, Negative exponentials), as well as custom Gain Theory transformations.</p>	<p>Circana offers a simulation/optimization solution called Marketing Foresight (MFS). This is loaded with results from the marketing mix analysis and is a self-serve tool for future simulation/optimization needs. MFS does support the ability to simulate/optimize for multiple KPI's and objectives, including maximizing ROI as well as maximizing sales.</p>	<p>Clients leverage our always-on SaaS-based scenario planning and optimization UI to identify optimal budgets based on their current media plan and to plan against the many different scenarios specific to their business needs. The model that the TransUnion team constructs is the same model that is deployed in our simulation and optimization software with no post-modeling transformations or alterations. This means that clients have access to the model and can interact with every variable and cross-section at the most granular level.</p>	<p>Nielsen understands that a key success driver of a marketing mix engagement is uncovering actionable optimization opportunities. To do so, we leverage a leading math programming solver within our optimization platform. Our tool enables advertisers to optimize based on their custom defined goals. Once the objective is defined, the platform then optimizes the budget plan by selecting the best vehicles to achieve the specified goal.</p>
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Budget Granularity				
AP has the capability to create budget allocation based on specific client needs, including brand, region, campaign, channel, tactic, etc.	We employ a two-stage budget allocation optimizer. Stage 1 optimizes across channels. Then once channels level budgets are optimized, Stage 2 optimizes across publisher (i.e. TV Networks, Digital Partners, etc.) and campaign combinations. We have seen that providing a 2 Stage optimizer rather than a single end-to-end optimizer is much more user-friendly to our clients as it gives them the power to make adjustments in a more straightforward user flow.	Most often Circana models at the executional level (e.g., Site/Partners/Networks, Targeting Type, Campaigns). To model budget/spend, any allocation we would do would be outside of the model in order to determine an ROI/ROAS.	Budget allocation recommendations can be as granular as the source level input data.	Budget planning/allocation can be performed at any level a given engagement has been performed.

Unified Modeling, e.g. MMM + MTA				
Commercial Analytics provides both strategic and tactical analysis in one holistic measurement framework.	Our "Unified" approach is unique in that it is a system of integrated models that goes beyond simply MMM and Attribution, and can incorporate predictive analytics, market simulation (e.g., ABM - Agent Based Modeling,) and other analytic approaches (gravity models, customer segmentations, etc.).	<p>Circana offers a single, end-to-end marketing platform for data management, modelling, optimization & visualization to deliver fact-based decisions at speed & scale i.e., Circana's Unified Marketing Measurement Platform – an end-to-end solution that ensures information and recommendations, are always aligned across time periods, portfolio, and campaigns.</p> <p>Multi-Touch Attribution (MTA) is a core component of our Unified Marketing Measurement approach.</p>	TransUnion defines Unified Measurement as the combination of strategic and tactical marketing measurement in an analytically integrated system of models that enables the optimization of marketing investments across all levels of granularity: channel, campaign, placement, and audiences. More specifically, we build better Marketing Mix Models (MMM) and Marketing Attribution models that share data and measurements to ensure that we are applying the more appropriate analytical techniques to the available datasets that allow us to extract the greatest insight possible for client decisioning.	<p>Within Nielsen marketing mix, we always provide analysis breaks at the finest level of granularity possible based, at least in part, by executional sufficiency and granularity of the input data. We also offer publisher-level deep-dives through our secondary modeling solutions, leveraging ML/AI to further isolate performance by campaign objective, frequency, duration, ad format, and more.</p> <p>Nielsen can also integrate campaign level A/B testing results as well as MTA results into our models through the use of Intelligent Priors™, a patented method to import and meld person-level results into aggregate models.</p>

Linear TV vs. CTV				
Linear TV and CTV are measured, reported and optimized differently in our methodology given large differences in execution, responsiveness and costs.	We have begun to transition our approach from "TV as a Media Channel" to "Video as a Media Channel". In this construct, Video has key subcategories; Linear TV, Addressable TV (i.e., Comcast, DISH, Xandr, etc.), Connected Devices (i.e., Roku, Sling), and Streaming (i.e., Hulu, YouTube). This approach matches where the market is going from a media strategy and channel planning standpoint.	We measure both Linear TV and Advanced TV (e.g., CTV, OTT, OLV). Linear TV is measured through partnership with VideoAmp providing national and local impressions. Advanced TV support is provided by the advertiser.	Regardless of video tactic, the goal of the TruAudience® measurement solution is to measure all forms of media in a single measurement framework in an effort to reduce bias and improve accuracy of measurement. TransUnion does not make any assumptions about the effects of media on the desired outcome based on its type and instead relies on data to evaluate its effectiveness. In the context of MMM this would include sourcing of media spend, impressions, GRPs, or other available measures in aggregate for inclusion in the models along with similar data for all other media tactics and control variables. TransUnion also has direct integrations with leading television data providers to capture both linear and CTV data in our Marketing Attribution solution to help clients manage their tactical executions more effectively.	Nielsen will isolate performance to whatever granularity the data allows. If executional weight is sufficient, CTV can be modeled as its own media tactic, allowing for the evaluation of effectiveness independent of Linear TV and/or Digital.

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Long Term Contribution of Media				
<p>Brand Impact, as part of our Commercial Analytics solution, provides long-term contribution of media. Customers can understand how their marketing activities influence brand equity, which in turn impacts their sales in the longer term. It helps them balance both short-term and long-term impact of their budgeting decisions and assess marketing's impact through the purchase decision funnel.</p>	<p>We estimate longer-term impacts using an approach called "Unobserved Component Modeling" or UCM. UCM pulls 'signals' from the residuals of a main MMM model. The approach looks for hidden (unobserved) trends in the data that move over quarters / years rather than from week to week.</p>	<p>Circana will execute a supplemental model to our standard marketing mix models to build a more complete view of how marketing not only drives short-term sales but also influences upper funnel effects. This will be executed through a multi-staged approach:</p> <p>Stage 1: Run an MMM model using Circana's time varying approach for base sales.</p> <p>Stage 2: Use the time varying base sales as dependent variable and regress it over media and other marketing activities.</p> <p>Stage 3: Calculate long term media contribution to base sales and determine the long-term volume contribution multiplier</p>	<p>TransUnion captures the long-term impact of marketing on sales and other financial outcomes, as well as the relationship between the impact of marketing on brand health and then of brand health to sales, as a part of the agreed upon solution scope when desired by the client.</p>	<p>Nielsen is on the forefront of assessing long-term media impacts having developed a revolutionary process working with Dr. Carl Mela. This process simultaneously assesses not only the impact that media is having in the short and long-term, but also the role brand attitudes play in driving conversion outcomes.</p>
How to Handle TV Moving to Multi-Currency				
<p>GPS Enterprise is built to be flexible and granular to allow for multiple variable inputs enabling adaptive planning</p>	<p>At Gain Theory, we are constantly assessing the media data available in the market and ensuring we have the most up-to-date information, and using the best available sources.</p>	<p>Our approach in determining what support metrics we put into our models is to strike a balance between consistency of measurement across clients vs. utilizing those metrics that provide the greatest value in terms of business outcomes.</p>	<p>TransUnion's model form is dynamic in nature, where the metrics collected from different sources could be used in the models for measurement. There are always multiple metrics associated with certain media channels and it is our strength to test them through multiplicative model form for their lift impact.</p>	<p>Given Nielsen's approach is data agnostic, we are able to use the currency data of preference in our models.</p>
Results Shareable with Publishers				
<p>Dependent on contract terms</p>	<p>Because sharing raw model results for Advertisers directly with Publishers can present a conflict of interest, we only share raw model results with Publishers based on written authorization from the client. However, what we do quite often (based on client permission) is share indexed model results back with Publishers</p>	<p>The decision on whether results are shareable with publishers is owned by the advertiser client.</p>	<p>TransUnion shares modeling insights and reporting with clients through a more robust online reporting platform and quarterly QBRs. Clients can share these licensed insights with publishers and other third parties at their discretion.</p>	<p>Sharing results with a publisher is under the control of the advertiser running the marketing mix. For studies commissioned by a publisher, we will provide visibility of their results, and our benchmark database can provide a perspective to publishers on the effectiveness of media across tactics.</p>
Modelling at Network Level and Shareable with Network				
<p>Dependent on contract terms</p>	<p>Within our analyses, it would be possible to see performance specifically for any Network/Publisher. And if an Advertiser permitted it to be shared back with the Network/Publisher, we would share it.</p>	<p>Yes, assuming we have models at the Network/Publisher level we would be able to report out contributions at this level.</p>	<p>TransUnion can provide licensed insights to clients at the most granular level of the input data received (including publisher-level, campaign level, keyword level, channel level, etc.). Networks and publishers can see their contributions if the brand chooses to share those with them.</p>	<p>Nielsen mix models provide insights at the lowest level possible given collinearity, variance and sufficiency, and we attempt to break out as many dimensions of TV execution as the model allows. To drive additional insights, we also offer secondary modeling options to drill-down with further granularity, whether for TV or Digital execution.</p>

Analytic Partner	Gain Theory	Circana	TransUnion	Nielsen
<p>Do you have a Dashboard?</p> <p>Yes, part of our GPS Enterprise platform</p>	<p>Yes, we have a client-facing dashboard for which a client can be granted full access. We typically set up individual login credentials for a roster of users at the client and their media agencies. The users can be granted different layers of access depending on client requirements.</p>	<p>MMM results are available on our Unify reporting platform. The results are also loaded onto our Marketing Foresight (MFS) platform. This enables both ongoing performance reporting across all the modeled dimensions (e.g., contribution, ROI) and also the ability to interact with those models for ongoing simulation (e.g., what is \$ impact of increasing spend by 10% on linear TV) and optimization (e.g., what is the optimal distribution of \$1 million of marketing investment across current marketing mix to drive maximum profit).</p>	<p>The TruAudience® marketing solutions platform and UI were designed for empowering clients to address their key needs in mind. The dashboard and reporting are configured for each engagement and fully shared with clients.</p>	<p>Nielsen's MMM toolkit includes dashboards that allow advertisers to drill into the key drivers of their business, forecast changes in budget allocations, and develop optimizations.</p> <ul style="list-style-type: none"> • The Nielsen Outcomes Dashboard (NOD) delivers granular, detailed outcomes reporting across marketing performance drivers. • Marketing Planner Optimizer is our platform that leverages response curves, allowing users to determine the optimal level of investment by tactic.



APPENDIX: Marketing Mix Modeling Provider Questionnaire

1. Company Overview


- a. What is the company size and ownership status?
- b. How big is the client base for MMM?
- c. What other media buying/selling solutions do you provide? Please describe.

2. Data Collection Methodology

- a. Mass Media and digital media collection approach?
- b. What platforms do you cover, and how deep do you go in the platforms?
- c. What is the source of your 1st party data?
- d. What KPI you are using and how do you collect it?
- e. What is the time-dimension granularity of your data?
- f. Which categories (e.g. CPG, Auto etc.) do you cover?
- g. Have you established any benchmark data per category for MMM development?
- h. Are you able to go to local level?

3. Modeling Methodology

- a. How far is the historical lookback of your data?
- b. What variables go into the model? What kind of units do you use for the variables? Do you use impressions or GRPs for other media data (radio, print, outdoor, etc.)?
- c. What macro variables go into the model?
- d. How do you capture special events in the model?
- e. What statistical model do you use? Can you explain your modeling framework?
- f. What is your model evaluation & validation approach and criteria?
- g. What's your approach to model media diminishing effect and ad-stock effect?
- h. What kind of optimization techniques do you implement?
- i. What is the granularity of your budget allocation?
- j. Is this a unified measurement model (unified with MMM and MTA)? If so, please describe the methodology in detail.

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- k. If you offer MTA model, please list the identity providers you work with to stitch different media exposure data across publishers.
 - l. Please specify your approach to measure Linear TV vs. CTV in your MMM framework. Do you treat CTV as TV media or digital media?
 - m. Do you have the approach to factor in media long-term contribution in MMM?
 - n. Please share your thoughts around MMM approach if TV industry moves to multi-currency environment.

4. Reporting Details

- a. How do you share your results with publishers?
- b. If you go to NBC level, can we see NBC contributions?
- c. Can we see TV contributions as a whole?
- d. Do you share your results with clients?
- e. Do you have a dashboard, and how much of the dashboard do you share with clients?
- f. How often do you engage with clients? (Monthly, Quarterly, etc.)
- g. How deep can we dive into the results? (Break-Out for Linear, Device Break-Outs for digital?)