Enterra®
SOLUTIONS

ENTERRA® TRADE PROMOTION OPTIMIZATION AND ASSORTMENT SOLUTION

An Enterra Solutions White Paper

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Trade Promotion

Promotions at consumer packaged goods (CPG) retailers are historically paid for by CPG product manufacturers using trade funds. A promotion's costs compensate the retailer for the consumer's discount (the retailer's reduced per-unit revenue), feature (advertisements), loyalty rewards, and special displays. Of the $1.3 trillion spent on CPGs per year in America, over $200 billion is spent in trade funds to promote those sales. Because trade promotion is a massive expense, second only to product production, CPG manufacturers want to maximize their net benefit. However, in many categories, maximizing the effect of trade promotions has become increasingly challenging because promotions are overly frequent and expected by consumers. These factors often make promotions look comparatively more effective only because non-promotions periods experience reduced sales.

When promoting products, choosing the right product assortment and determining the optimum level of attractive discounts are important. Most promotions attempt to maximize return on investment (ROI); however, new product promotions are often more concerned with increasing brand recognition. As a result, new product promotions often target broad consumer bases by aligning targeted trials with retailers known for their product diversity and trend setting. Retailers seek to maximize store sales, not category sales, which means they want to rotate promotions between different product brands and subcategories of a given category so they appeal broadly to as many consumers as possible. Promotions help attract consumers into stores to take advantage of "great deals" and, hopefully, get them to leave with a full shopping basket also containing regularly priced items.

If a CPG manufacturer fails to promote its products often or fails to discount deeply enough, it may lose market share and shelf space. Manufacturers also know there is value in being named a "category captain." Category captains are able to partner more intimately with retailers to help plan promotions for the entire category, including competitor brands. This obvious advantage is only awarded to dominant manufacturers in a specific category. Certain feature and display priorities may require a manufacturer to offer deep discounts. This can be risky. To counterbalance the risk and maximize the opportunity, manufacturers must carefully weigh all pertinent factors. Get it wrong and a manufacturer can suffer brand devaluation (i.e., be perceived as a discount brand), or they can unintentionally train the consumer to only purchase the brand on promotion.

The retailer controls the promotion schedule and manufacturers must compete against each other to secure a spot. As a result, manufacturers must propose and negotiate promotions that show value for the retailer in order to earn the retailer's approval. Enterra seeks to find more optimal promotion schedules, attributes, and assortments resulting in a win for both the retailer and the manufacturer.

Enterra's Trade Promotion Optimization Solution

Enterra's trade promotion optimization (TPO) system is designed to operate as a complementary partner to a client's existing Trade Promotion Management system's accounting modules. Enterra's TPO adds analysis, optimization, and recommendations

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to determine the best trade promotion schedules as well as the expected performance they will yield. The four most important concerns when specifying optimization are:

1) Having a realistic operating model to predict the expected sales impact of a promotion schedule.
2) Having a balanced objective function that scores the utility of schedules (e.g., balancing ROI, volume, and brand perception concerns).
3) Specifying realistic constraints so any solution found is implementable by the business.
4) Having an optimizer sophisticated enough to process the above requirements with acceptable speed.

The Enterra TPO system performs the following major business functions:

- Compares and contrasts future promotion schedules.
- Adds/edits the constraints used by the optimizer.
- Runs a constraint-based, non-linear optimization/simulation to auto-generate a recommended optimized schedule.
- Provides results via a Microsoft Power Business Intelligence (BI) application.

Why Enterra's TPO Solution is Better than the Competition

The following features make Enterra's TPO better than other TPO solutions:

- Advanced machine learning. The system leverages advanced machine learning and optimization provided by Massive Dynamics™.
- More constraint possibilities. The solution provides optimization allowing for significantly more types of constraints than is available in other TPO solutions.
- Business intelligence customization. The solution provides Microsoft BI integration, which allows for extreme user customization.
- Computing Architecture. The system's technical architecture uses distributed message queuing to notify the user interface (UI) when a long-running simulation is complete and allows the number of calculation modules to be dynamically scaled.
- Cloud-hosted Solution-as-a-Service. The solution is delivered as a cloud-hosted application with Solution-as-a-Service (SaaS) subscriptions.

The solution is supported by professional services to ensure a smooth implementation and necessary customizations.

Technical Description of the TPO Solution

As with most processes, the devil is in the detail. Below are some of the technical details that drive Enterra's TPO solution implementation. Currently, the solution utilizes Nielsen data, which is updated only biweekly and reports Sunday to Saturday weekly

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sales. The Nielsen baselines (i.e., the sales that occurred or would have occurred if no promotion existed that week) are estimated before the promotion event and are not adjusted afterward to actual sales. We have found this methodological flaw usually causes Nielsen to significantly understate its baselines, which, in turn, overstates lift due to promotional effectiveness. Enterra TPO's baseline-prediction model remediates this flaw. In addition to Nielsen data, the manufacturer provides:

- The cost components for determining future promotion expenses.
- Wholesale cost and product master information.
- The currently proposed, and recent years promotion schedules.
- Customer (Retailer) master information.

This data is used to run trade promotion optimization simulations looking for insights. The time to perform a simulation will usually take longer than the time of a REST call's timeout. Most products solve this by using a "polling" solution to determine when a computation is completed. Enterra uses a real-time queue so notifications to the UI are instantaneous. Clients also require analytics data to be available in Microsoft Power BI so it can be used and intermixed within other BI dashboards and reporting.

Data processing is a challenge since data is not presented in the fully parameterized form needed for analysis. Many data fields are provided as text that needs to be interpreted and expanded into multiple parameterized fields, such as the promotional offer's details. Most promotions do not align with Nielsen's Sunday to Saturday reporting. For example, a weekend promotion would be included in Nielsen's bi-weekly reports, but since the promotion only lasted 2 days, the sales allocated to those promotions must be estimated. The data is processed from Azure files and the results are sent to Azure files using python or pySpark (based on file size) without requiring a database.

Enterra applies complex rules to input files to convert them to an analytical format and estimates sales of promotions not aligning with Nielsen's reporting. The TPO solution also leverages Massive Dynamics' Representational Learning Machine™ (RLM), which is retrained every two weeks with updated promotional data and is used to produce component functions for each input variable, which are then used to estimate future expected sales. Other models used by the solution are:

- Massive Dynamics' baseline-sales estimation model.
- Massive Dynamics' Constrained Optimizer, which uses the input from RLM's trained model and baseline estimates to produce optimized promotional schedules subject to selected constraints and the objective function.

As mentioned above, having a realistic model to predict the expected sales impact of a future schedule. Massive Dynamic's RLM achieves this goal. Utilizing a balanced objective function our models score the utility of proposed schedules. And the system utilizes realistic constraints so any solution found is implementable by the business. Achieving the best results requires many, extremely flexible constraints that can be specified at different levels of scope, such as at synchronized, promoted product groupings within a retailer. To achieve this, Enterra supports:

- The overall minimum/maximum budget.

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- Promotion price points rules, e.g., only at $_.09, $_.49 or $_.95
- Promotion frequency: Minimum/maximum number of promoted weeks per year and the duration of each promotion, minimum time gaps between promotions.
- Minimum/maximum retailer margins, discounts, and minimum promoted price, which may vary when promoted in conjunction with a feature/display.
- The anticipated maximum availability of features and displays.
- Specifying promotions that must run at a fixed time (e.g. to align with an overall marketing event) and/or with a fixed discount percentage.

Having an optimizer sophisticated enough to process the above acceptably fast is extremely important. We use Massive Dynamic's proprietary non-linear optimizer which runs within adequate time. Other technical details:

- All code is containerized and orchestrated via Kubernetes.
- The UI to manage, configure, and initiate simulations/optimizations and is written using React/Redux JavaScript making calls through a GraphQL server to Microsoft Azure Data Services, and can also send messages via the RabbitMQ service to initiate communication with the python microservices of the middleware.
- Uses Microsoft Azure for file shares, tables, and blob storage.
- RabbitMQ is used as the messaging queue between the middleware and also Massive Dynamics' calculation engines, which allows us to scales the calculation resources as needed.
- Authentication and authorization are provided by Azure Active Directory and Microsoft Single Sign-on.
- Microsoft's Power BI is used to explore and compare the results of the simulations.

Concluding Thoughts

The late department store magnate John Wanamaker once stated, "Half the money I spend on advertising is wasted. The trouble is I don't know which half." Manufacturers could state the same lament about trade promotion optimization. Enterra's TPO solution helps manufacturers and retailers better understand how trade funds can be deployed and accurately determine a promotion's ROI.

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About Enterra Solutions

Enterra Solutions is a leading cognitive computing company providing data-enabled prescriptive analytics and insights for companies across a broad range of industries. The Enterra Cognitive Core™ enables organizations to capture, curate and analyze vast amounts of complex and disparate data. This powerful capability allows clients to uncover and understand inter-relationships that lead to innovative new product development and innovation, heightened consumer understanding, enhanced supply-chain execution, and more efficient and targeted consumer marketing. Enterra's analytics and insights help the world's leading brands and organizations operate smarter by finding higher meaning in their data.

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