EXECUTIVE OVERVIEW

With the increase in new product introductions, the ability to effectively manage product lifecycles and design profitable promotional strategies is becoming more important across many industries. Product lifecycles continue to get shorter as technology drives planned obsolescence, customers demand greater variety, and manufacturers strive to stay ahead of competition. This onslaught of new products has put pressure on product development, manufacturing, marketing and sales to synchronize their efforts to ensure profitability in a time when price increases and big marketing budgets are a relic of the past. Failure to synchronize these efforts has led to more new product failures than successes.

In categories such as high technology, consumer electronics, consumer-packaged goods, and media and entertainment—categories characterized by dynamic product assortments—there are frequent new product introductions, short product lifecycles, and high degrees of seasonality. Such categories are particularly challenging from a demand planning point of view because there is limited or no demand history, and consumer demand changes rapidly over time. And the costs of misjudging demand can lead to unrecoverable lost sales, unprofitable markdowns, or products that must be written off as complete failures.

Oracle’s Demantra Demand Management uses a powerful technique called “shape modeling” as an integral part of an analytic and computational methodology to forecast demand while taking into account the effects of product lifecycles and promotional strategies. These forecasts are achieved through a combination of pattern matching and analytic algorithms, database search methods, and insights into the science of marketing.

INTRODUCTION

A recent article in the MIT Sloan Management Review discusses the rapid changes occurring in the world of supply chain management, and how new questions are replacing old ones. One could extend this line of thought to the key concepts

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discussed in this article: forecasting demand throughout product lifecycles and forecasting demand while accounting for promotional effects.

New technologies let you use many advanced techniques and multiple sources of data to find the answers to difficult questions about both types of demand forecasting. In the case of product profiles, the following questions are important:

- Can I use existing product and market attributes as well as existing sales patterns to automatically generate baseline forecasts for new or short lifecycle products?
- Can I use a combination of seeded and computed decay curves to forecast the decay rates of obsolete products?
- Can I do all of this in a scalable manner, while allowing for the possibility, once products and ideas are taken to market, of incorporating automated and manual updates when incremental information becomes available?

Promotional forecasting brings up its own set of questions:

- Can I use historical sales curves and information on past promotions to predict a baseline demand as well as the impact of future promotions on sales volumes?
- Can I compute the interactions between sales of related products and sales outlets, as well as the impacts on and by the competition?
- Can I understand the customer and consumer impacts of a promotion over time, specifically with regard to preeffects and posteffects like pantry loading, forward buying and delayed purchasing, and the net impact of these?

Shape modeling functionality provides an analytic and computational methodology that answers all these questions.

SHAPE FITTING METHODS FOR PRODUCT PROFILES

Products with short lifecycles such as certain fashion or seasonal items, in addition to newly introduced products, might not have enough historical information (for example, past orders, shipments, or POS data) to generate meaningful statistical forecasts through the data alone. Or there might be a lack of information regarding causal variables such as price, promotions, weather, and demographics to generate a forecast. Modeling or predicting the growth, decay, or maturity of demand profiles in these situations—especially in light of the variability that natural conditions such as seasonality or corporate decisions and policies add—can be a challenging task.

Standard Statistical Methodologies Poorly Forecast Product Profiles

Management scientists and statisticians have long realized that product profiles can be difficult to forecast using standard statistical methodologies, because the information content in the historical data is low. However, a few analytic software vendors do claim that “proprietary” statistical methods, which are minor variations
of existing techniques, can provide solutions in this context. Methods that rely on pure statistical approaches and result in “improvements” in the historical (fit) data could be misleading, as these might model patterns that cannot be generalized, resulting in extremely poor forecasts. In view of these known pitfalls, a few software vendors take the extreme view that neither mathematical nor scientific methods are applicable for these problems, even to provide initial recommendations to planners or executives. But approaches that solely rely on GUI-based user interactions are not effective or scalable. This remains true even if these approaches are combined with database search methodologies based on attributes or pattern matching.

Shape Modeling Technology Greatly Improves Forecasts

The patterns inherent in demand profiles are difficult to isolate from short historical data alone. Therefore, Demantra Demand Management attempts to improve forecasts through a selective blend of business knowledge, established processes, and analytical models. In lieu of historical information, growth and decay curves resulting from introduction or obsolescence, promotional lift profiles, and lead and lag effects can be modeled through the use of flexible “shapes.” The growth and decay curves of short lifecycle products that might be additionally influenced by promotions and seasonal patterns can also be modeled using this method.

The form of these nonparametric shapes are determined in either of two ways: from data gained through an intelligent combination of similar products and promotional effects that already exist in a corporate repository, or from data that are known in advance from a knowledge of the business. For example, one way to model the time variation of demand for short lifecycle products could be through special types of growth and decay curves or shape models. These shapes capture essential characteristics of the business process. These could include a gradual reduction of demand in time, superimposed with seasonal effects and appropriate price discounts. The knowledge of the business is thus analytically parameterized through these flexible shapes, and in turn, these shapes can be adjusted for volume and scaled for time to accommodate individual products. In the context of lifts from promotions, these shapes can be used to handle lead and lag effects, and adjusted to handle the volume and time duration of the lift.

From an analytic perspective, shape modeling is achieved by regressing the magnitude of the shape or profile—the time periods can be selected by the user—with various linear and nonlinear functions of the time from the start. Once the shape is captured through these regression equations, time is treated as an index rather than as an absolute value. Scaling this index scales the shape. This provides an end user with the ability to define product launch profiles that resemble existing product launches or obsolescence curves, but allows for scaling to account for the expected time to maturity, or to reflect new sales or POS information once the product goes to market.
Demantra Demand Management integrates shape modeling technology with existing capabilities to provide solutions for the business user. In the area of product profiles for example, shape modeling is complementary to Bayesian forecast analytics, the mechanisms for allocation and consolidation, defining sales profiles for newly introduced products, and other planning capabilities. These individual technologies are utilized to provide integrated, easy-to-use, effective solutions for a business user or planner.

The shape model shown in Figure 1 can handle complex profiles such as introductory growth, followed by a sharp decay in demand, in turn followed by an increase caused by price discount, and then a steady mature demand phase.

![Figure 1: Shape model showing product introduction with follow-up promotional activity.](image1)

A shape model such as that seen in Figure 1 might describe the demand curve for a product in the home entertainment and media industry.

The shape model shown in Figure 2 below can model and forecast complex growth and decay profiles corresponding to product introductions and obsolescence, and help in product lifecycle management.

![Figure 2: Shape model showing entire product lifecycle.](image2)
A shape model such as that seen in Figure 2 might describe the demand curve for a product in the high technology or consumer packaged goods industries.

**INSIGHTS WITH ANALYTICS FORECAST PROMOTIONAL EFFECTS**

**Measure and Analyze Impact**
Extending the capabilities of Demantra Demand Management, Demantra Advanced Forecasting and Demand Modeling helps you understand to incremental lift from marketing programs and promotions. Advanced Forecasting and Demand Modeling helps planners recommend promotional strategies based on post-promotional analysis and predictive modeling. The solutions combine insights from marketing science with cutting-edge analytics, to provide quick and effective answers to business problems. One of the basic premises of the solution is that marketing activities cause sales distortions from a presumed baseline, resulting in “lifts,” or incremental gains or losses, caused by promotions. These could be uplifts; that is, increased demand due to a promotion on a specific product and location at a given time. Or they could be depressions, reduced sales caused by ripple effects in product, location, or time, resulting in switching effects such as account cannibalization or impacts over time such as forward buying.

**Decompose into Baseline and Lifts**
The form of these “lifts” over time could result in a variety of shapes, based on the intensity of effects such as forward buying, pantry loading, and delayed purchasing. There could be reduced buying in anticipation of a direct promotion, a gradual build-up toward the promotion, followed by a peak demand, and then a gradual decline when the initial demand is met. Finally, there could be reduced sales after a direct promotional activity is over, as demand is lower than the usual baseline. A traditional system that uses constant promotional attributes for the duration of the promotion misses these important variations of demand patterns. These could result in a variety of undesirable effects, from stock-outs to unused inventory or surplus production.

**Isolate Pre-promotional and Post-promotional Effects to Calculate Profitability**
The modeling process used in Demantra Advanced Forecasting and Demand Modeling is enriched by shape-fitting functionality, described earlier. Shape fitting is a nonparametric method proprietary to these solutions. It enables them to analytically capture the time distribution of promotional uplift and the marketing profile of product introductions. Note that promotions can be superimposed over and above natural variability, such as seasons or weather, and over demand profiles like introductory growth. This is illustrated in Figures 3 and 4 below.

Figure 3 illustrates that lift factors caused by promotions have a pattern, which is not necessarily rectangular. If one were to assume rectangular lift factors (or uniform lifts), this might measure the uplift volume correctly, while missing...
important details about the time evolution of a promotion. Among the important
effects that cannot be handled are prepromotional and postpromotional effects. An
example of a pre-effect is delayed consumer purchasing in anticipation of a
promotion, resulting in reduced sales before the promotion. Post-effects, including
consumer pantry-loading advance purchases, reap the benefits of a promotion—
resulting in lower demand when the promotional period is over.

Figure 3: Shape model showing an introductory growth phase with subsequent
promotions.

Figure 3 shows that shape models can handle promotional patterns through time,
including the evolution of demand before, during, and after the promotions are
applied. The promotions can be superimposed over and above other profiles such
as an introductory growth phase (shown in Figure 3) or seasonal effects. A shape
model such as that seen in Figure 3 might describe the demand curve for a product
in the retail, consumer packaged goods, home entertainment media, fashion, fast
food, and high technology industries.

Figure 4: Shape model showing ripple and product cannibalization effects.

Figure 4 shows that promotions on one product or category, at a given location
over a certain time duration, can have a ripple effect among related products and
locations and over long time periods before and after promotions. The light blue
curve at the bottom of the chart shows a possible cannibalistic effect (or reduction of sales) on another product or account. These could also have patterns that evolve through time, which could be captured through shape models. Shape models such as those seen in Figure 4 might describe the demand curve for a product in the retail, consumer packaged goods, home entertainment media, fashion, fast food, and high technology industries.

For product introductions or lifecycle management, shapes might need to capture introductory growth, maturity (which can be short for certain industry verticals), and decay phases. Promotions can be superimposed over these basic profiles. The flexibility of shape modeling, besides providing the ability to capture a variety of patterns, allows time scaling so that estimated profiles can be fitted to different promotion durations or introduction and decay patterns. These approaches complement Demantra Demand Management’s strengths in predictive modeling.

CONCLUSION

The approaches used by Demantra Demand Management to model short product lifecycles and promotional evolutions effectively blend business knowledge, cutting-edge analytical models, and the information contained in corporate repositories in a scalable and accurate manner.

Demantra Demand Management designed to address the challenges faced by business planners. Demantra Demand Management takes into account innovative, cutting-edge research from practitioners and academicians in areas like promotional analysis and new product introductions. The

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proprietary shape modeling functionality represents an additional step in ongoing efforts to utilize innovative strategies to solve emerging business problems. This new analytic technology integrates with and complements analytics and predictive modeling capabilities.

With the ability to accurately forecast demand for new products, short lifecycle products, and seasonal products, you can maximize on-shelf availability while minimizing inventory levels. Oracle’s Demantra Demand Management lead the way in the utilization of superior analytics for real-world business problems, helping you to significantly improvement your profitability, market share, and revenue growth.

