

Demand Forecasting 2.0: Introducing the Unified Forecasting Method™



Executive Summary

Managing volumes of complex and continuously evolving demand patterns presents a common problem for suppliers, manufacturers and retailers. For most companies, it's guesswork at best.

Lost sales, increased costs and poor customer service due to inaccurate forecasts, out-of-stocks, overstocks, unsuccessful promotions, markdowns and out-of-season items play havoc with a company's bottom line. Not too many companies can remain profitable by writing off hundreds of thousands of dollars worth of merchandise on an annual basis or sitting idly by as their customer bases erode due to inadequate service.

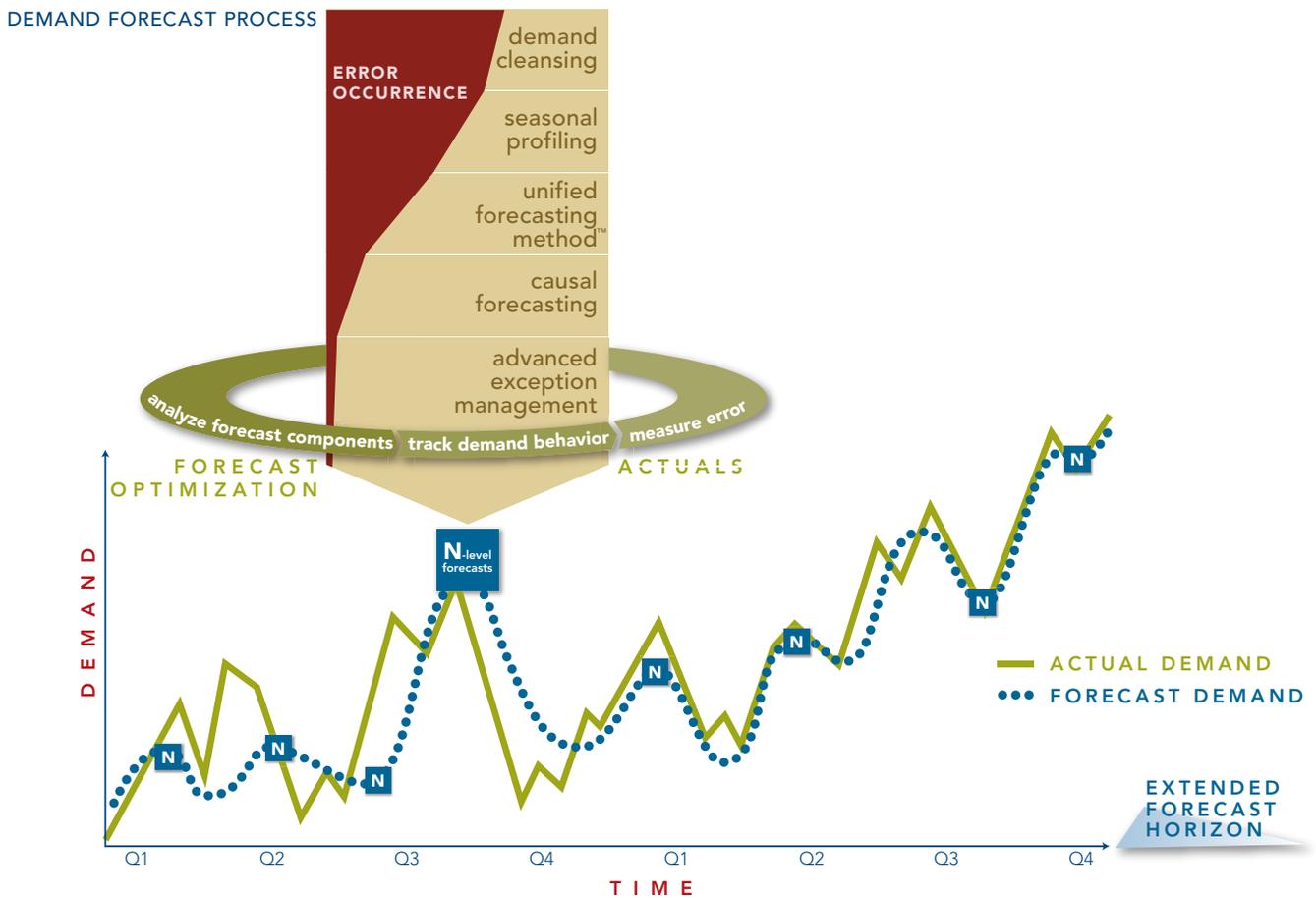
A variety of demand forecasting solutions and tools exists in the marketplace today—none of which addresses the full range of fluctuating demand patterns without requiring the use of multiple methods and large amounts of expert intervention. However, Manhattan Associates has developed the next generation of forecasting that addresses the broad, dynamic nature of demand while eliminating the need for multiple methods and greatly reducing the level of intervention and expertise.

This whitepaper provides a detailed explanation of the applications and benefits of Manhattan Associates' optimized Demand Forecasting solution. Additionally, this document provides a high-level proof of concept and explanation of methodology for Manhattans' Unified Forecasting Method™ (UFM™), a built-in intelligence that automatically manages the mixture of demand pattern, from intermittent and seasonal impacts to the changing demand pattern over the lifecycle of a SKU.

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Demand Forecasting: Proactively Extending the Forecast Accuracy Horizon



Manhattan’s Demand Forecasting solution was designed to do the ‘heavy statistical lifting’ in order to provide a better demand forecast to Manhattan’s Replenishment and Planning solutions. Demand Forecasting users are buyers and planners—not certified forecast analysts—so our solution is designed with their needs in mind. Products offered by the ‘tool’ vendors require significantly more interaction from an expert user. Demand Forecasting enables our wholesale and retail customers to focus on their key goal—to buy and plan profitability rather than spending their time analyzing forecasting components.

Reliance on a forecasting method which handles just one component (for example, seasonal) will not be effective in handling other components or changing lifestyle characteristics of a SKU.



Forecasting Complexity Forces Many to Look the Other Way

Given the costly and detrimental effects of poorly forecasted demand, why aren't companies giving this aspect of their supply chains more attention? Simply put: it's not that simple. A number of challenges come into play:

- Demand frequency can be erratic, intermittent, lumpy, or seasonal—and could be a mixture of all of these. It can also be continuously shifting or evolving in rate and pattern due to trends, product lifecycle stages, or simply just having a previously less complete picture of expected demand occurrences.
- Demand levels can be erratic and/or seasonal. They can also, of course, be influenced by trends, product lifecycle stages, and/or demand frequency continuity and patterns.
- Other external factors such as planned demand, promotions, and holidays (especially those that move from year to year) have significant effects.
- Technical support often involves periodic updates that normally have to finish in a very short time window of nightly processing and are in the critical path to inventory optimization and merchandise planning. This requires innovative processing and architecture to be useful to the business.
- Operational issues often come into play for retailers and wholesale distributors. They both can deal with very large SKU (forecast entity) volume on which the forecast update, seasonal profile, trend, and demand frequency analysis have to be performed.

Single-Method Forecasting Produces More Risks Than Results

Reliance on a forecasting method which handles just one component (for example, seasonal) will not be effective in handling other components or changing lifecycle characteristics of a SKU.

This approach can be very risky because demand patterns vary significantly based on both the type of SKU and where the SKU is in its lifecycle. Consider SKUs with short lifecycles of two to six weeks, such as video games or DVDs. By the time a standard forecasting algorithm catches up with the demand pattern of a short lifecycle SKU, that SKU's life may be over—and sales opportunities evaporated.

Take fashion apparel SKUs as another example. They can be notoriously slow sellers; therefore, they require alternative forecasting techniques. For new products without historical demand data, businesses cannot afford to rely on the same forecasting algorithm used for regular-turn SKUs. Different approaches are needed when forecasting demand for different product types, such as "functional" and "innovative." New products fall into the innovative group and require very responsive forecasting and replenishment approaches.

Even in a business with some of the most durable products, SKU types are highly diverse. The toy industry provides an excellent example. Standard techniques will suffice for steady sellers such as traditional board games, but new, fad-sensitive, short lifecycle toys call for new forecasting approaches.

Additionally, SKUs that are part of promotions or other special events require causal techniques to predict the expected demand lifts as well as the cannibalization or halo effects on non-promoted SKUs that have affinities to the target SKU.

A “Best-Pick” Approach Is Nice, but Comes with Many Shortcomings

Using methods focused on single demand forecasting components has become antiquated as supply chains have grown in both size and complexity. Most demand forecasting, demand planning, or inventory management vendors now provide multiple methods—standard textbook methodologies that are available to everybody—as part of their solutions. However, these solutions require a lot of time, attention and engagement from experts.



These solutions are typically built around assumptions and user-defined classifications, forcing companies to use a “best pick” approach, which, in reality, is often a “best guess.” A best-pick approach offers analysts the flexibility to choose the method they feel best forecasts a given entity. This is a nice capability, but has some inherent shortcomings. For example, the best-pick approach usually requires companies to staff forecasting experts who then must diligently monitor the health of their selected methods across a predefined set of entities.

Additionally, companies must vigilantly monitor demand signals in order to swap and tune methods. So, customers with large SKU populations are forced to segment how they forecast demand. This approach causes major problems: lost operational efficiency and, most notably, a continually oscillating loss of forecast accuracy—which negatively affects planning and inventory optimization.

Other problems surfacing with current solutions that incorporate the use of multiple forecasting methods include:

- Lack of scalability;
- A chance of suboptimal performance if the analyst is not vigilant. Thus, the analysis can be too subjective and error prone;
- Although this approach leads to crisp and discrete mapping of a demand signal to a single given method, if the dynamics of the signal change enough, then forecast analysts must begin looking to adjust parameters or switch to a different method. This starts the configuration/initialization process all over again; and
- Finally, the best-pick method also leads analysts to prioritize and focus on the entities they deem as “most” important, forgoing the benefit of having global and complete coverage of demand forecasts— and sacrificing the 80 percent for the 20 percent.

Manhattan Associates has addressed these problems head-on by developing more comprehensive solutions that continuously handle transitions and mixtures of demand pattern classifications in a self-adjusting and optimal manner.

Using methods focused on single demand forecasting components has become antiquated as supply chains have grown in both size and complexity.

The UFM addresses the entire demand spectrum, from that extreme intermittency over to high-volume movement, but mixed in with seasonality, trends and everything in between.

Introducing the Unified Forecasting Method™

Up until now, best-pick demand forecasting methodology was the most advantageous for buyers and planners. Manhattan Associates took this approach one step forward and, in essence, built these multiple well-proven but specialized forecasting methodologies into one unified method. This Unified Forecasting Method™—or UFM™—combines the principal components of these multiple methods in a unified construct that can comprehensively handle the complete spectrum of demand patterns and distributions in a continuous manner—regardless of transient or permanent shifts in demand behavior. This type of “built-in” intelligence reduces or almost eliminates any need for users to intervene based on what they intrinsically know about the product or how it is selling at a given time.

The Unified Forecasting Method accomplishes this by separating demand signals into multiple subcomponents and handles each subcomponent within two domains or spectrums: the demand level and the demand frequency. It tracks and evolves the components within these two spectrums and then combines them to ultimately provide the projected forecast components. It looks at all dimensions, all the time—holistically—across any mixture of demand signals.

The ability to handle the “heavy statistical lifting” is one of the overriding design concepts that went into this new product. Designed to provide a better demand forecast to replenishment and merchandise planning, the UFM was built more for buyers and planners, and less for professionals trained in forecasting and statistical sciences. To that end, these unique capabilities distinguish this next-generation demand forecasting solution from other “tools” that perform some of the same functions, but require significantly more interaction from expert users. One of the biggest differentiators is the UFM’s ability to forecast demand for millions of products or product location combinations—in a hurry, for the next ordering horizon.

Another notable design concept is the ability for UFM to incorporate components from multiple methods and technologies to dynamically handle the broad spectrum of demand signals. Companies typically have items that sell pretty predictably while other products have a lot of seasonality during different times of the year. Some items trend, and some have what is called intermittency—they have a sale and then several consecutive periods of no sales. The UFM addresses the entire demand spectrum, from that extreme intermittency over to high-volume movement, but mixed in with seasonality, trends and everything in between.

The Unified Forecasting Method Applies Science and Math Behind the Scenes

Manhattan Associates’ Unified Forecasting Method addresses the demand forecasting pitfalls in a new and sophisticated way. This is a more optimal approach to traditionally advanced forecast tools that use a “pick best” type of forecast methodology.

The UFM has the ability to improve forecasts for intermittent items by using more traditional methods—smoothing type methods of forecast updates that predict when those items will sell.



The scope of the UFM goes beyond the actual runtime algorithm used to generate the forecasted output. The logic for the UFM is embedded within four modules and operates on demand signals in a pipeline manner—and exactly in the sequence stated below:

1. Demand Cleansing and Seasonal Profiling (DCSP)

The processing and preparation for forecasting first begins with the Demand Cleansing and Seasonal Profiling step. Aside from general DCSP activities such as removing outliers, smoothing spiked values, processing anomalous event effects, and conducting seasonal profiling, it is here that the first step of the UFM is executed. While analyzing and characterizing a given demand signal, the solution also generates and associates metadata to the demand stream that is unique to the downstream processing requirements of the UFM.

2. UFM Initialization

Next, the process moves to incorporate the UFM Initialization logic. Forecasting initialization always occurs when new demand history is first received or processed. It can also be executed at any given time by system users if they deem it necessary to reset forecasting parameters and metadata. During this step, the UFM parameters are optimally initialized. The solution also conducts special processing for zero-demand periods, leveraging previously generated UFM metadata. As part of the system's collective, objective functions, these sub-processes enhance inventory control optimization for safety stock.

3. UFM Update

The next course of action involves the actual generation of the forecasted values within the UFM Update process. This process is designed to run continuously, and the UFM engineers the methodology to self adjust parameters in order to maintain their optimality and update metadata associated with demand entities. Advanced demand cleansing and seasonal profiling logic is applied here as well. Additional logic specific to the UFM's management of intermittent signals is also conducted here. The process proactively handles periods of zero demand in a manner optimal for inventory control optimization of both safety and cycle stocks.

The final step in the UFM process takes into consideration demand frequency, or the generation of a demand forecast for items that have intermittent or sporadic ends. Intermittency occurs, for example, when a store has an item that sells one week, goes seven consecutive weeks with no sales, has another round of sales occurrences, and then the sales pattern repeats. The UFM has the ability to improve forecasts for intermittent items by using more traditional methods—smoothing type methods of forecast updates that predict when those items will sell.

The UFM keeps track of the interval between sales—called the inter-arrival time. The solution calculates the median and mean inter-arrival times across the entire year and translates that to the factor of demand frequency. The UFM keeps track of the starting prediction of when a sales occurrence is going to happen and updates the demand frequency being used. In turn, the demand frequency value modulates the overall forecast.

UFM Results in Greater Revenue, Fewer Lost Sales, Better Service

Because UFM takes a holistic approach and dynamically adapts the forecast method components to demand signals, retailers and wholesalers have improved inventory accuracy as well as enhanced inventory optimization. This, in turn, has resulted in greater revenue and fewer lost sales—not to mention better service.



The following are two actual examples of UFM at work:

Retail:

For auto parts dealers, staying in business means having those hard-to-find items in stock for customers when they need them. However, the business problem in the automotive parts industry, as well as retail in general, is a large volume of the SKU population has extreme intermittent demand signals. The traditional approach is to throw inventory at the problem, but more inventory is the wrong answer. Traditional forecasting simply can't handle intermittency—revenue will suffer every time. UFM enabled this retailer to avoid out-of-stocks while mitigating the risk of having more inventory than required. The resulting success in this instance included:

- 9 percent decrease in inventory for non-intermittent SKUs;
- 1 percent increase in service attained for nonintermittent SKUs;
- 21 percent increase in revenue for intermittent demand SKUs;
- 17 percent increase in service for intermittent demand SKUs; and
- 14 percent increase in inventory for intermittent demand SKUs.

Wholesale Distribution:

A very large distribution wholesale enterprise needed to further reduce its inventory investment while maintaining current levels of service. In this case, the wholesaler was already running an extremely fine-tuned version of inventory optimization and had left no stone unturned from a traditional forecasting point of view.

The addition of UFM enabled the wholesaler to lower its overall inventory investment while maintaining service. The resulting success in this instance included:

- 4 percent overall average decrease in inventory;
- 7 percent safety stock reduction across its network; and
- Service for intermittent SKUs increased slightly while inventory actually decreased slightly.

In Conclusion: Profitable Buying Demands the Next Generation of Demand Forecasting

A company's ability to holistically address a broad range of demand signals has a tremendous impact on today's forecasting environments. New approaches to demand forecasting and seasonal profiling, such as those offered through UFM, provide inventory analysts, buyers and planners with that extra-added "lift" not afforded by traditional forecasting tools. Couple that with the ability to provide more accurate forecast input to existing inventory optimization and merchandise planning solutions, and companies will be well on their way to more profitable buying.

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About Manhattan Associates, Inc.

Manhattan Associates continues to deliver on its 21-year heritage of providing global supply chain excellence to more than 1,200 customers worldwide that consider supply chain optimization core to their strategic market leadership. The company's supply chain innovations include: Manhattan SCOPE® a portfolio of software solutions and technology that leverages a Supply Chain Process Platform to help organizations optimize their supply chains from planning through execution; Manhattan SCALE™, a portfolio of distribution management and transportation management solutions built on Microsoft. NET technology; and Manhattan Carrier™, a suite of supply chain solutions specifically addressing the needs of the motor carrier industry. For more information, please visit www.manh.com.



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