The Power of Machine Learning-Based Forecasting

New Technologies for a New Reality

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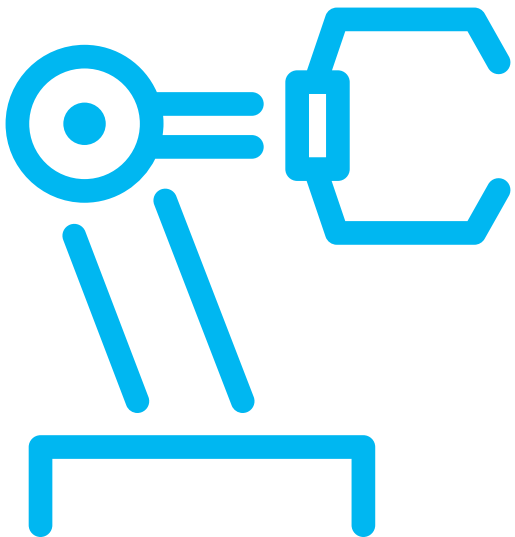
The point is that for manufacturers, distributors and retailers, it's anything but business as usual. It also means that the old way of doing things, and the supporting technologies, are obsolete and will lead to lost sales, higher costs and reduced margins in the emerging environment. New processes and new technologies are needed to succeed in this new reality.

Limitations of rapid response

As consumers gained control over supply chains, and as e-commerce and the "Amazon effect" compressed order lead times, many manufacturers were forced to shift from a strategy of mass production at least-per-item-cost to restructuring production for mass customization, reacting to changes in demand or supply disruption as quickly as possible. For retailers, the impact of COVID-19 and the acceleration of omnichannel approaches have similarly left react/response type of approaches wanting. Traditional forecasting approaches based on historical trends and sales projections cannot always accurately account for today's speed of market changes or the larger number of demand influencing factors. The resulting practices of carrying excess inventory and safety stock are not profitable or sustainable long-term solutions. Rather, they drive capital costs higher and increases the risk of inventory waste and obsolescence, especially in industries with perishables or fast-moving consumer goods. But the real challenge is that trying to respond after the fact is not as effective as predicting and proactively positioning for change. With the rapid-fire nature of today's changing marketplace, simply reacting quickly isn't enough to be successful.



Intelligent forecasting

The new reality of increased demand fluctuations, expanding consumer expectations for personalization, responsiveness, sustainability, and greater uncertainty over trade and economic conditions is making improved forecast accuracy a top priority for manufacturers, distributors and retailers. In addition to traditional sales histories and demographic data, the availability of real-time digital signals from social media, news, events and weather data (SNEW), as well as from edge technologies such as Internet of Things (IoT) devices, can provide demand planners with more insightful and timely information about demand drivers and customer behavior. Traditional demand planning systems have not had the capabilities or processing power to analyze these hundreds of

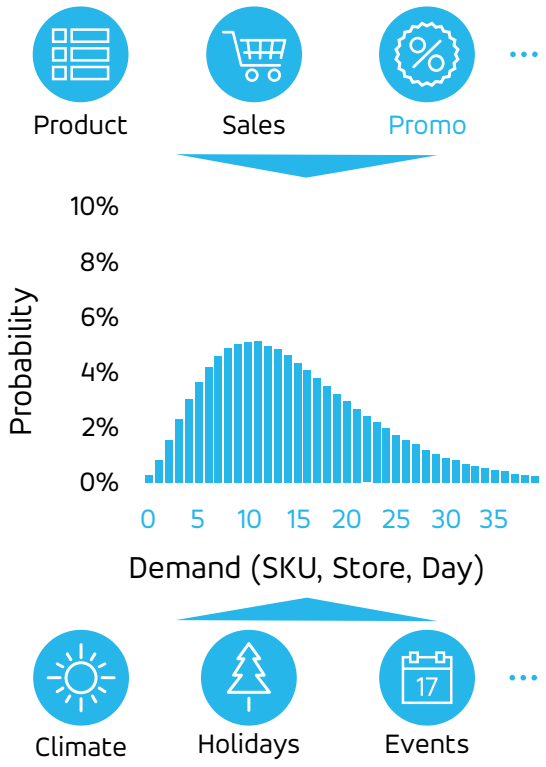
real-time data signals and derive forward-looking insights from them. A new type of intelligent forecasting is needed to leverage the wealth of data now available for greater insights into the impact of changing conditions.

Advances in artificial intelligence (AI), machine learning (ML) and cloud computing power have made intelligent forecasting a reality. By gathering and analyzing a wide array of internal and external demand signals over time, as well as corporate strategies for pricing, promotions, markdowns and service levels, and situational factors such as seasonality, day of the week and day of the month, intelligent forecasting can "learn" how the signals interact, and critically, what combination of signals best foretells change, to produce a more accurate forecast down to the item/location/time level.

Probability density curve

What really sets intelligent forecasting apart from traditional demand planning is that it doesn't just forecast an expected demand number (you'll sell 20 widgets next Wednesday, for example). Instead, intelligent forecasting uses machine learning to create a demand probability density curve for the whole range of likely outcomes. See figure 1.

Figure 1: Forecast probabilities



A probability density curve provides much greater insight into what is likely to occur and identifies the risk factors for outcomes such as stockouts and waste so planners can proactively plan for not only the most probable outcome, but also consider the most likely variances. This is especially important when complex demand shifts occur and the certainty of traditional forecasting methods is minimized.

To show why identifying demand probabilities and risk factors is important, consider the simple example in figure 2. The two probability distributions indicate the same mean prediction of seven units, but different risk values. The example on the left-hand side shows there is a higher probability for high demand (e.g. above 18) than on the right-hand side example, and thus the risk of a stockout is greater. This enables planners to proactively pre-position inventory for the range of probable outcomes. See figure 2.

Intelligent forecasting also evaluates the many constraints and their complex relationships, often hidden, that can lead to mismatches between demand and supply. For example, when a shelf IoT device says a shelf has reached minimum stock quantities, the forecasting algorithm must consider what orders for that product are being processed or are in transit, when they are scheduled to be delivered, what min/max order quantities are allowed, what is the shelf capacity and desired display quantity, and what the many demand signals say will be the likely demand at any point in time.

The interplay of these hundreds of demand signals and constraints is what makes the intelligent forecasting probability density curve so useful in helping planners design optimal procurement, manufacturing, distribution and replenishment schedules and contingencies. It enables realistic plans to reduce inventories, lost sales, waste and cost to serve while improving customer service.

Intelligent automation

The value of intelligent forecasting goes beyond assisting planners in creating more accurate probabilistic demand plans. The deeper understanding of demand factors and the learning abilities of AI/ML-driven forecasting enable automation of many demand plans. The intelligent forecasting solution can create manufacturing and inventory plans that reflect the current and expected future market, as well as corporate strategies and constraints, to free up planners to address exceptions and unpredictable disruptions. This can lead to planner productivity gains of up to 60%. A key point to note is that the automated intelligent forecasts don't just increase productivity, they produce plans optimized to a degree not possible either manually or with traditional solutions.

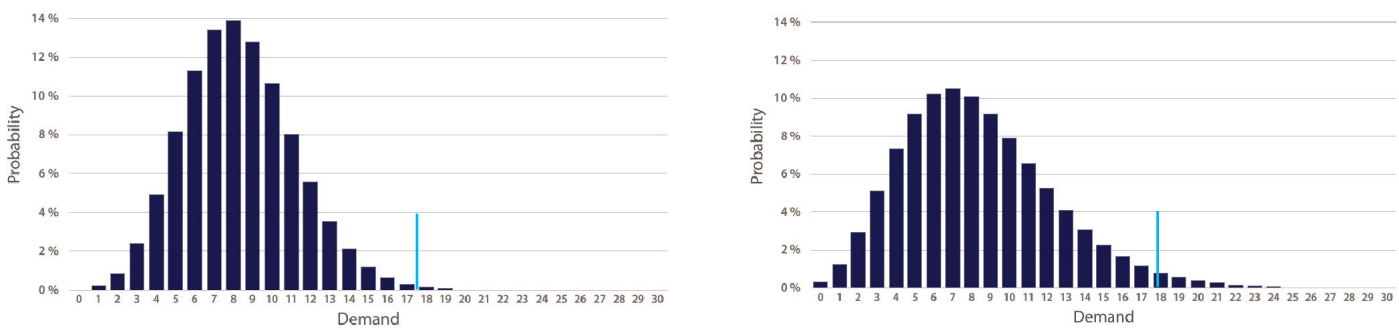
Driving results

Driving greater forecast accuracy has long been a goal of all industries. This is especially important in today's more volatile and complex business environment. For example, McKinsey & Co. has found that increasing forecast accuracy by just 5-10% can result in revenue gains of 2-3%.[1]

It's not just theory. Intelligent forecasting is driving real world results across multiple industries and geographies.

- A global CPG company found in initial tests, even without considering all possible demand factors, automated intelligent forecasting improved accuracy by 5.1% over and above traditional forecasting methods.
- A large North American food distributor found intelligent forecasting improved accuracy by 10%, reduced inventory by 1.3 days, improved margins by 19 basis points and enabled expense reductions of $21 million.

Figure 2



- A global appliance manufacturer was able to improve end-to-end visibility and collaboration and implement autonomous resolutions to prescriptive disruptions.
- A global Indian manufacturer and distributor across multiple industry segments, including aerospace, automotive, agriculture and construction, found they will be able to improve forecast accuracy by up to 10% and reduce inventory levels by up to 20% while increasing customer satisfaction by up to 10%.

Other use cases have shown that intelligent forecasting can raise forecast accuracy up to 95% or more, reduce warehouse out-of-stocks by up to 30% and enable one-time reductions in inventory levels of up to 10%.

Real-world results show that intelligent forecasting capabilities and the probability density curve offer significant operational improvements in forecasting accuracy and planner productivity when compared to traditional forecasting methods. These operational improvements, and the ability to proactively pre-position inventory for predicted changes, drive enhancements in business value, increasing revenue due to fewer lost sales while also reducing inventory investment and waste, resulting in higher gross margins.

By leveraging the combined power of AI/ML and cloud computing to analyze hundreds of demand-influencing data points in real-time, companies across all industries no longer need to boost their inventory levels to counter demand volatility. Instead, they can use intelligent forecasting to develop more risk-aware, probability-driven forecasts, leading to improved forecast accuracy, autonomous responses, improved business decisions, and ultimately, increased business value and superior customer experiences.

Want to learn more about how supply chain autonomy can impact your quality, service and financial results? With over 4,000 successful customers, Blue Yonder has the experience and capabilities to support you in leveraging the full power of automation.

There's a reason

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of Gartner's Top

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1 https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/most-of-ais-business-uses-will-be-in-two-areas

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