Now in its sixth year, this remains the most comprehensive study of demand planning performance, encompassing $250 billion in annual sales from the global businesses of 14 multinational consumer products companies, with 9 billion cases and more than a million item-warehouse combinations. This public version of the report captures the state of demand planning performance in North America, allowing readers to compare their forecast performance against the industry average and top performing companies.

Key Findings

It is not a pretty picture. Item proliferation is rampant and getting worse, with growth through innovation strategies driving complexity but not sales. The days of relying on historical performance and applying rules of thumb are over, replaced by the use of daily data reflecting current market conditions, automation and advanced pattern recognition algorithms.

Key takeaways from this year’s Forecasting Benchmarking Study include:

- **Network complexity continues to outpace sales.** Since 2010, the number of items grew by 32% compared to a 4% increase in sales. As a result, average sales per item dropped 22%.

- **The rate of new product introductions is considerably higher,** with the number of distinct items for sale nearly tripling in the last 5 years, up 187%; 82% of these have since been discontinued.

- **The long tail continues to grow longer and now accounts for 81% of items.** A different view of the data shows that the top 10% of items generate 75% of sales; whereas the bottom 50% only contribute 1%.

- **Existing demand planning technology and processes have reached their limits,** with forecast value-added and accuracy remaining essentially flat, varying by no more than +/- 2% since 2010. This is a tribute to planners who have managed to maintain the status quo despite rapid proliferation, but is not sustainable.

- **Demand Sensing provides a step-change in performance that management seeks by automating the use of market data,** more than doubling forecast value-added and cutting average forecast error by 37%.

This whitepaper identifies trends in network complexity, demand planning error and bias, forecast value-added and extreme error. It also summarizes the reduction in error manufacturers are seeing through the use of demand sensing. To learn more, request a full copy of the Forecasting Benchmark Study report at terratechnology.com.
Network Complexity

Growth through innovation strategies are driving supply chain complexity but not sales. Since 2010, the number of active items grew by 32% compared to a 4% increase in sales. As a result, average sales per item dropped 22%. This additional complexity creates a challenging planning environment and increases workload at a time when planner headcount is down roughly 20% since last year.

CHANGE IN NETWORK COMPLEXITY

More concerning than the 32% rise in active items is the rapid rate of actual new product introductions. Marketing seems to have run amok with the number of distinct products offered for sale over the 5-year period nearly tripling, up by 187%; 82% of these items have since been discontinued.

Each introduction and discontinuation is associated with a wide number of supply costs including setup changes to manufacturing, inventory of raw materials, packaging and finished goods, as well as write-downs for obsolescence. The sheer scale of the introduction/churn cycle raises questions about the financial advantages of current innovation strategies.

The Long Tail Continues to Get Longer

To understand the characteristics of fast- and slow-moving items, the dataset was divided into five velocity quintiles, each comprising 20% of sales. The top 1% of items, referred to as Velocity 1, generate 20% of the sales. These are the fastest-moving products often referred to as your “A” and “super-A” items. The number of Velocity 1 items shrunk somewhat last year, while the long tail continued to get longer. The tail now encompasses 81% of items, up 1% point from last year.

The Fate of New Products

Products that start off in the tail, stay in the tail; whereas those that fall into any of the faster-moving quintiles within the first year have the potential to grow into top sellers. Of new items introduced in 2010 that start off in the tail, only 4% managed to break out to a higher velocity quintile and none of them became top sellers. The other 96% remained trapped in the tail. The data shows there is an opportunity to cut deeper faster, reduce ongoing complexity and improve financial outcomes.

Items that start off in the tail, stay in the tail.
Demand Planning Error and Bias

Weekly forecast error measured at the item-location level dropped by 1% point last year, to 49%. Since 2010, weekly error has remained essentially flat, averaging 50%, plus or minus 1% point. The spread between companies in the quintile with the lowest and highest error narrowed slightly to 9% points.

WEEKLY DEMAND PLANNING FORECAST ERROR BY YEAR
![Graph showing forecast error by year]

Industry Remains Overly-optimistic

While error is a measure of how well companies forecast, bias provides an indication of sales and operations planning performance and how well departments work together to create a consensus forecast. Bias continued its downward trend, shedding 1% point to reach its lowest level in 5 years. However, the consistently positive bias across all years of the study reflects the overly-optimistic outlook of the consumer goods industry.

Forecasting has become harder since 2009; extra effort by planners has kept accuracy stable.

Forecasting Items in the Tail

Over-optimism for low-volume items in the tail remains a key driver of overall bias. Bias for these items is 13%, 6 times higher than for top sellers. Given the size of the tail and resource limitations, it would be natural to focus efforts on the more important and politically-sensitive fast-moving products. This underscores the opportunity for technology to automate manual and time-consuming tasks in the forecasting process, free human resources for more strategic activities and improve outcomes for items in the tail.

WEEKLY DEMAND PLANNING PERFORMANCE BY VELOCITY
![Graph showing performance by velocity]
New Products

With the number of distinct products offered for sale nearly tripling in the last 5 years, accurate forecasting of new items is more important than ever. Unfortunately, uncertain consumer response makes new introductions hard to predict and the absence of historical data renders conventional statistical analysis tools ineffective. The pervasive over-optimism that each new item is a winner compounds the problem by introducing a positive bias. As a result, weekly error in the first year of production was 70%, 1.5 times greater than for existing items. Bias for new items was 15%, almost 4 times greater than bias for existing products.

DEMAND PLANNING PERFORMANCE FOR NEW AND EXISTING ITEMS

Products become easier to forecast as they age, with both error and bias decreasing over time. The first big improvement occurs after the first year with error dropping from 99% to 62% and bias from 23% to 12%. The second improvement comes in the second year, when error and bias start to stabilize.

Just as some companies are better at controlling bias in the tail than others, some are better at controlling bias of new items. Companies with the lowest new product bias had a dramatic advantage, with bias of only 1% compared to 25% for those with the most over-optimism.

WEEKLY BIAS FOR NEW ITEMS

Bias was almost 4 times higher for new items, confirming over-optimism associated with new product launches.
Forecast Value-added

Forecast value-added provides a measure of the value created by planning activities, systems, and processes compared to using a simple, seasonally-adjusted moving average.

Overall, value-added remained relatively stable over the 5-year period, at 10% plus or minus 2% points. This is a tribute to planners who have managed to deliver consistent benefit despite a 30% or more increase in workload from rapid SKU proliferation. It also exposes the limits of current demand planning technology and processes. The incremental gains from continuous improvement programs narrowly maintained the status quo, but are unable to deliver the step-change in performance that management seeks.

FORECAST VALUE-ADDED BY YEAR

More than half the items in the study had a positive forecast value-added, but there are still far too many that are negative. Further investigation reveals that the long tail is a key driver of negative forecast value-added.

FORECAST VALUE-ADDED BY ITEM-LOCATION

Many planning activities are highly manual and with 81% of all items in the tail, it is hardly surprising that planners would focus their limited time on the more important faster-moving items. Forecast value-added in the tail was 4 times lower than for the rest of the business and 6 times smaller than top sellers.

FORECAST VALUE-ADDED BY VELOCITY

Traditional demand planning methods have reached their limits, with forecast value-added remaining essentially flat in the past 5 years, at an average of 10%.
Extreme Error

Supply chains are designed to operate in an uncertain environment, with the flexibility to tolerate normal daily error with little impact. Cases of extreme error — when forecasts exceed shipments by two times or more (extreme undersell) or shipments exceed forecasts by two times or more (extreme oversell) — are disruptive and costly to supply chains. Extreme oversell error imposes hardships on human resources, erodes margins through transshipments, expediting and/or unplanned production changes and risks service levels. Extreme undersell error has significant financial consequences stemming from high levels of excess inventory, poor use of working capital and ongoing finance and carrying costs.

It turns out that one-third of all forecasted volume is affected by extreme error. This has remained largely unchanged throughout the life of the study. Weekly extreme oversell and undersell error ranged between 13-14% and 19-20%, respectively. The volume of monthly extreme error was roughly half these values. While weekly extreme error of 33% is high for any business, the fact that it remained constant is another tribute to planners and a reminder that current methods and processes have reached their limit.

Extreme error affected one-third of all forecasted volume, creating costly disruptions, risking service and impacting return on capital.

The degree of extreme undersell error was consistently higher than extreme oversell error, in line with the observed positive bias for the industry. Just as bias was several times greater in the tail than for top sellers, extreme undersell error was also several times higher in the tail. Both weekly extreme undersell and oversell error were 3 times more for the slowest-moving items, resulting in excessively high stock levels, putting service at risk and requiring expedited shipping that erodes margins.
Demand Sensing

Demand Sensing is how you would imagine demand planning worked if it were invented today instead of 50 years ago. Feed the system all of your current demand signals including orders, shipments and even point of sale data, let it automatically crunch the data to determine what is important and create the most accurate demand prediction for every item in the portfolio at every location in the supply chain.

The result is a step-change in performance compared to conventional planning systems and processes. The dataset confirms that across all items, Demand Sensing more than doubled the current forecast value-added from 10% to 24%. Forecast accuracy increased significantly too, with weekly error being cut by 37% across all years in the study.

**Clear Advantage for Product Introductions and Items in the Tail**

Demand Sensing uses daily demand signals to understand actual consumer acceptance and current market demand for new items at each location. With very few new items becoming top sellers, properly supporting popular introductions is essential for meeting growth objectives. Likewise, with 95% of new products ending up in the tail, avoiding excessive inventory investments is key to achieving return on capital goals.

Within a few weeks, forecast accuracy for Demand Sensing reached the same level as demand planning achieved only after a year or more. Weekly error in the first year was cut by 32%. Demand Sensing generates more than 4 times the forecast value-added for both new products and items in the tail.
About Terra Technology

Terra Technology helps companies outperform in volatile markets through automated and mathematically-sophisticated supply chain software solutions that drive profitable growth, raise shareholder value and improve operational efficiency.

Terra senses demand, optimizes inventory and predicts transportation and warehousing requirements in more than 160 countries for some of the world's largest companies including Shell, Procter & Gamble, Unilever, Mondelēz International, Kimberly-Clark, Kraft Heinz, General Mills, ConAgra Foods, AkzoNobel, Kellogg, Reckitt Benckiser and Campbell Soup. Terra invented demand sensing in 2002, which was the first solution to systematically use customer data to enhance service, cut inventory and reduce waste. Information on how Terra enables a truly integrated supply chain can be found at terratechnology.com.

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