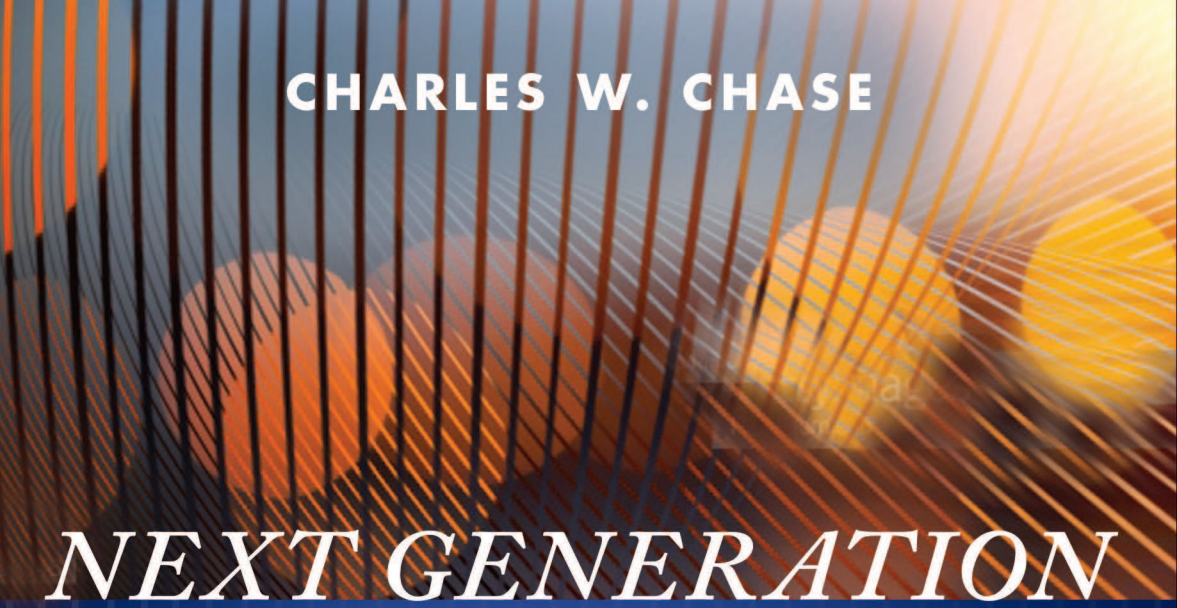


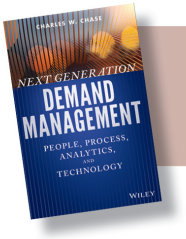
CHARLES W. CHASE

NEXT GENERATION

DEMAND MANAGEMENT

PEOPLE, PROCESS, ANALYTICS, AND TECHNOLOGY

WILEY



Contents

Foreword xiii

Preface xv

Acknowledgments xxi

About the Author xxiii

Chapter 1 The Current State 1
- Why Demand Management Matters More Than Ever 4
- Current Challenges and Opportunities 14
- Primary Obstacles to Achieving Demand Management Planning Goals 21
- Why Do Companies Continue to Dismiss the Value of Demand Management? 23
- Summary 28
- Key Learnings 29
- Notes 30
- Further Reading 30

Chapter 2 The Journey 31
- Starting the Supply Chain Journey 32
- Introducing Sales & Operations Planning (S&OP) into the Supply Chain Journey 34
- Sales & Operations Planning Connection 34
- Transitioning to a Demand-Driven Supply Chain 40
- The Digitalization of the Supply Chain 46
- Leveraging New Scalable Technology 51
- Benefits 52
- Summary 53
- Key Learnings 54
- Notes 57

Chapter 3 The Data 59
- What Is Big Data? 60
- Why Is Downstream Data Important? 68
- Demand Management Data Challenges 71
- CPG Company Case Study 75

Does Demand History Really Need to Be Cleansed? 78
How Much Data Should Be Used? 81
Demand-Signal Repositories 82
What Is Demand Signal Analytics? 86
Demand Signal Analytics Key Benefits 87
Summary 89
Key Learnings 91
Notes 92
Further Reading 93

Chapter 4 The Process 95
Centers of Forecasting Excellence 97
Demand Management Champion 99
Demand-Driven Planning 100
What Is Demand Sensing and Shaping? 100
A New Paradigm Shift 113
Large-Scale Automatic Hierarchical Forecasting 115
Transactional Data 116
Time Series Data 117
Forecasting Models 117
Skill Requirements 120
Summary 121
Key Learnings 123
Further Reading 125

Chapter 5 Performance Metrics 127
Why MAPE Is Not Always the Best Metric 128
Why In-Sample/Out-of-Sample Measurement Is So Important 131
Forecastability 135
Forecast Value Added 137
H_o: Your Forecasting Process Has No Effect 138
Summary 144
Key Learnings 145
Notes 146
Further Reading 146

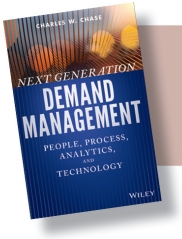
Chapter 6 The Analytics 147
Underlying Fundaments of Statistical Models 148
How Predictable Is the Future? 153
Importance of Segmentation of Your Products 157
Consumption-Based Modeling 167
Consumption-Based Modeling Using Multi-Tiered Causal Analysis 168

Consumption-Based Modeling Case Study 170
Summary 179
Key Learnings 180
Notes 181
Further Reading 181

Chapter 7 The Demand Planning Brief 183
Demand Planning Brief 186
Overview 187
Background 188
Recommended Forecast Methodology 188
Model Hierarchy 190
Model Selection Criteria 190
Supporting Information 192
Analytic Snapshot 194
Model Selection and Interpretation 199
Scenario Analysis 205
Summary 212
Key Learnings 213

Chapter 8 The Strategic Roadmap 215
Current State versus Future State 216
Current State 223
Future State 226
Gaps and Interdependencies 237
Strategic Roadmap 245
Summary 252

Index 253



CHAPTER 1

The Current State

Today's business challenges are numerous due to globalization pressures, supply chain complexity, rising customer demands, and the need to increase revenues across global markets while continuing to cut costs. Adding to these challenges is the current economy in which the last several years supply has outstripped demand. Intense *market volatility and fragmentation* are compelling companies to develop and deploy more integrated, focused, demand-driven processes and technologies to achieve best-in-class performance. As a result, there have been major shifts in demand management.

Unfortunately, there has been more discussion than actual adoption, and where adoption has occurred, there has been little if any sustainability. Demand-driven processes are challenging and more difficult to get right than supply, and they tend to be *politically charged*. Furthermore, implementing a demand-driven process in support of a new-generation demand management process requires investment in people, process, analytics, and technology. Adoption requires an executive *champion* who has the influence to change corporate behavior, encourage new analytics skills (descriptive and predictive), and integrate processes horizontally utilizing new scalable technology. Strategic intent and interdependencies play a key role in maintaining long-term sustainability. Without sustainability, the adoption of new conceptual designs like *demand-driven* tends to fail over the long-term. In most cases manufacturers lack the necessary analytical skills, horizontal processes, and scalable technologies needed to capitalize on *big data* and digitally collected information. After all, it's not just about process anymore.

As shown in Figure 1.1 investment in *people, process, analytics,* and *technology* requires a champion not only to facilitate adoption but also for sustainability purposes. Sustainability can only occur if the strategic intent and business interdependencies are horizontally aligned and supported by scalable technology.

Companies are realizing that moving to the next generation demand management will require a laser focus on four key areas:

1. Investing in their people's skills, which requires change in behavior
2. Reorganization around horizontal processes

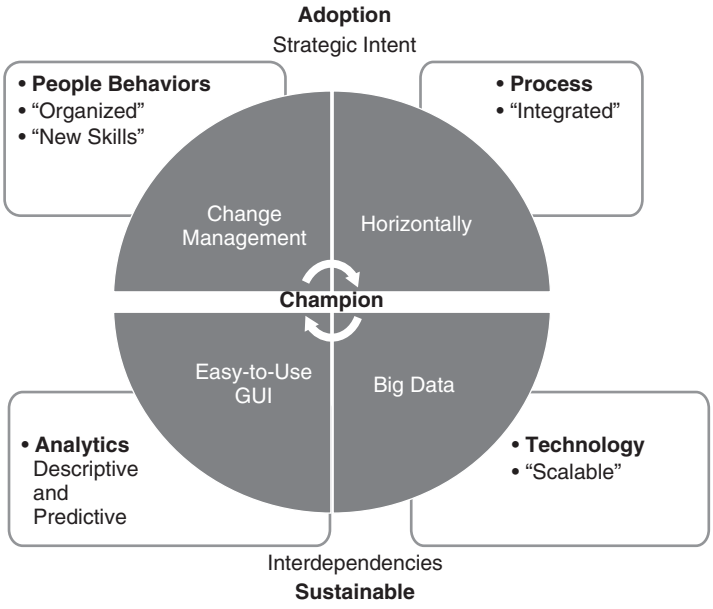


Figure 1.1 People, process, analytics, and technology required for adoption and sustainability.

3. Integrating predictive as well as descriptive analytics into the process
4. Investing in large-scale automatic forecasting technology

These four areas are the key catalysts to move from the current state to the future state, along with good metrics to measure progress. Although adoption requires changes in people behaviors that include new skills and horizontal processes, it will also require more focus on predictive analytics supported by large-scale technology that can adapt and scale to big data. It requires changes in corporate culture led by a champion who has the authority and leadership to not only drive adoption, but also create a new corporate culture that stresses accountability with a focus on customer excellence. Finally, sustainability can only occur if the strategic "intent and business interdependencies" are horizontally aligned and supported by scalable technology.

In many cases, companies get adoption, but once the champion moves on to a new project, the process participants tend to go back to the old process, stop investing in new skills, bypass the analytics,

and create Excel workaround programs to avoid using the technology. This suboptimizes the process and technology, not to mention creates poor results. In other words, the intent becomes self-serving to all people and all things—except for the *right* thing, generating revenue and profit. We have become so immersed in achieving low MAPEs (mean absolute percentage error) that we have lost the original intent of the process.

Before a company invests in people, process, analytics, and technology, they need to define their true intent. We all know through experience that the one number forecast does not work. It might work in theory, but not in practice. Plus, only a handful of companies are forecasting true demand (e.g., POS and/or syndicated scanner data). Most companies are forecasting the supply replenishment signal (sales orders), and/or the supply response (shipments). Finally, most demand planners really don't do forecasting. They manage data and information. This is another reason why more and more companies are looking to hire demand analytics and data scientists who have strong statistical skills. The key word is *intent.* Is your demand management process intended to create accurate forecasts (lower MAPEs) to reduce inventory costs or to provide business decision support to grow revenue and profitability?

WHY DEMAND MANAGEMENT MATTERS MORE THAN EVER

Demand management concepts are now 20 to 25 years old. The first use of the term *demand management* surfaced in the commercial sector in the late 1980s or early 1990s. Previously, the focus was on a more siloed approach to demand forecasting and planning that was manual, using very simple statistical techniques like moving averaging and simple exponential smoothing, and then, Excel, and a whole lot of gut-feeling judgment. Sound familiar? In the mid-1990s, demand planning and supply planning were lumped together, which gave birth to supply chain management concepts of demand planning and integrated supply chain planning.

Most supply chain professionals are quickly realizing that their supply chain planning solutions have not driven down costs, and have not

reduced inventories or speed to market. Companies globally across all industry verticals have actually moved backward over the course of the last 10 years when it comes to growth, operating margin, and inventory turns. In some cases, they have improved days payable, but this has pushed costs and working capital responsibility backward in the supply chain, moving the costs to the suppliers. To make matters worse, Excel is still the most widely used demand forecasting and planning technology in the face of significant improvements in data collection, storage, processing, analytics, and scalability.

According to a 2014 *Industry Week* report (see Figure 1.2), moving averaging has now become the preferred statistical model of choice for forecasting demand, digressing from Holt-Winters Three Parameter Exponential Smoothing based on studies conducted by the Institute of Business Forecasting in the late 1990s. Furthermore, with all the advancements in analytics and technology, there has been minimal investment in the analytic skills of demand planners.

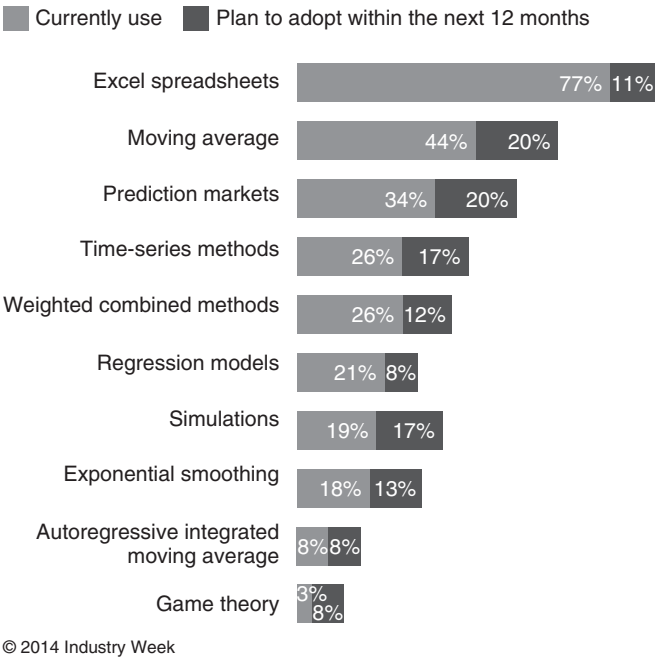


Figure 1.2 Current use of forecasting methodologies and tools.

To make matters worse, downstream data—with all the improvements with data collection, minimal latency in delivery, and increased coverage across channels—is still being used in pockets across sales and marketing, rather than the entire supply chain, for demand forecasting and planning.

Companies are quickly learning that in order to move forward, they need to admit their bad practices of the past. They must be willing to risk failure in order to move forward. Leaders must confront a number of mistakes made in the design of their demand management processes over the course of the last decade. The mistakes are many, but all can be corrected with changes to the process, use of downstream data, and most all, the inclusion of analytics. Here are a number of good intentions with poor execution that have caused companies to make key mistakes in demand management.

The One-Number Forecast

Well-intentioned academics and consultants tout the concept of one-number forecasting. Enthusiastic supply chain executives have drunk the Kool-Aid, as they say. But, the reality is, it does not reduce latency and it is too simplistic. In other words, it is conceptually appealing, but not practical in execution.

The sole concept of a one-number demand forecast is that *if everyone is focused on one number, the probability of achieving the number is great.* As a result, the concept adds unintentional, and in many cases, intentional bias, adding error to the demand plan. It is too simplistic; all the participants have different purposes, or intentions.

I ask supply chain managers, "What is the purpose of your forecasting process?" They say, "To create an accurate demand forecast." I respond, "What is the true purpose of their demand forecasting and planning process? Is it to create a financial plan, set sales targets, or create a shipment forecast?" They pause, and say, "All the above." I say, "*All the above* are plans, not an unconstrained consumer demand forecast."

There is only one true forecast—the unconstrained demand forecast, or as close as possible to "unconstrained," given the inherent constraints, whether self-inflicted or customer specific. There is no

such thing as a shipment forecast, financial forecast, or sales forecast. They are all plans created from the unconstrained consumer demand forecast. Furthermore, most consensus forecasts are a blend of different plans and financial targets. The people who push the one-number concept really do not understand demand forecasting and planning. An unconstrained consumer demand forecast is used to build a demand plan, financial plan, sales plan, marketing plan, and operations plan. Each plan has a different intent, or purpose, and as such, will be different. There are many separate activities including workflow that require different skills (people), process, analytics, and technology capabilities.

A demand forecast is hierarchical around products, time, geographies, channels, and attributes. It is a complex set of role-based time-phased data. As a result, a one-number thought process is naïve. An effective demand forecast has *many* numbers that are tied together in an effective data model for role-based planning and what-if analysis. Even the eventual demand plan is sometimes not reflective of the original unconstrained demand forecast due to capacity constraints, which results in demand shifting to accommodate supply lead times and materials availability. In fact, most companies who describe demand shaping during interviews with supply chain executives actually describe demand shifting, not true demand shaping. A one-number plan is too constraining for the organization. A demand plan is a series of time-phased plans carefully architected in a data model of products, calendars, channels, and regions. The numbers within the plans have different purposes (intents) to different individuals within the organization.

So, instead of a one-number demand plan, the focus needs to be a common set of plans for marketing, sales, finance, and operations planning (supply plan) with different plan views based on an agreement of market assumptions and one unconstrained consumer demand response. This requires the use of an advanced enterprise demand forecasting and planning solution with the design of the system to create a true demand response and visualize role-based planning views. The legacy systems implemented over the past decade were not designed to accommodate different plan views based on an unconstrained consumer demand response.

Unfortunately, the concept of the one-number forecast often does more damage than it does good, especially when taken literally. What is important is that an entire organization (sales, marketing, finance, and operations planning) is working together to achieve aligned goals based on a set of aligned and integrated plans. This can only be achieved via a well setup and functioning set of cross-functional horizontal planning processes, with plans generated from the S&OP/IBP (sales & operations planning and/or integrated business planning) process driven based on a one-number unconstrained consumer demand forecast. In reality this results in multiple sets of numbers, and ideally, multiple plans are generated and used as inputs into these processes. It is the processes themselves that convert multiple inputs into an aligned set of plans. The notion of a single number to represent the forecast for all departments is a frequent, but incorrect, interpretation of the phrase "a single agreed-to plan."

If you can imagine that marketing, sales, finance, operations planning, and manufacturing all came to a consensus plan discussion with the same numbers, what would they discuss? The idea of all teams meeting to discuss how they arrived at the same number (forecast) is impractical and impossible. Conversely, to arrive at consensus, you want several views with multiple assumptions to discuss. Multiple perspectives of the market and business will enable discussion and debate on how the company can meet and agree to a set of integrated plans. In other words, how much of that unconstrained consumer demand forecast are we willing to fill to meet the most profitable sales revenue goal?

To clarify this process, the demand signal, and corresponding demand response created by sales and marketing, will most likely "not" match the financial plan and senior management's strategic goals. This is where the one-number forecast falls apart. Generally, they hold to the financial plan, particularly when the demand response is below the financial plan. In a demand-driven forecasting and planning process this is where data, analytics, and domain knowledge kicks in. Using data, analytics, and domain knowledge, the sales/marketing teams collaborate using what-if scenario analytics to determine how to close the gap. In other words, what KPIs can be increased/decreased to close the gap between the demand response and the financial plan? Then, the finance team determines what the

costs will be to add, say, another sales promotion or marketing event. These gap scenarios are discussed in the S&OP/IBP meeting, where a decision is made to either lower the financial plan or provide sales and marketing with incremental spending to close the gap.

The process just described is the only way a one-number forecast can be achieved. You cannot use gut-feeling judgment, nor wish the financial plan to happen. However, this is pretty much how most demand management processes work (e.g., simple baseline forecast using a moving average with a whole lot of gut feeling judgment).

Collaborative (Consensus) Planning

Collaborative planning is a conceptually sound principle with good intentions, but poor execution. The entire basis for the concept of collaborative planning is based on the belief that each department within the company can add insight (value) to improve the accuracy of the demand plan. In concept, if designed properly, this is correct. In reality, the implementation has been flawed. The challenge is that most companies do not hold the groups within the departments accountable for their bias and error. Each group within the company has a natural bias (purpose or intent), and corresponding error based on incentives. The old adage holds true: "Be careful what you ask for because you may get it." Unless the process has structure regarding error reporting and accountability, the process of collaborative planning will distort the demand plan, adding error despite well-intended efforts to improve the planning process.

Many companies that have redesigned their collaborative planning processes only resulted in improvements in their user interface with the intentions of making data collection and manipulation easier for demand management. I call this, "Automate what I do, but don't change what I do." In each redesign, companies do not question the value and appropriate uses of the demand inputs, nor do they apply structure around the input that drives a 40 to 60 percent forecast over/under bias.

We struggle with why more companies do not apply the principles of *lean forecasting* to the consensus forecasting and planning process through forecast-value added (FVA) analysis. This is best described

by Mike Gilliland in his book, *The Business Forecasting Deal: Exposing Myths, Eliminating Bad Practices, Providing Practical Solutions.*[1] In its simplest form, FVA measures the impact of each touch point in the collaborative planning process before and after the statistical baseline forecast is adjusted by one of the participating departments (i.e., sales, marketing, finance, and operations planning). If that particular touch point isn't adding value, then you need to either eliminate it or weight the bias up/down. This requires that all the forecasts be captured each cycle and compared to determine any bias.

Forecast by Exception

Given all the acquisitions and consolidation that have taken place over the past 20 years, SKU proliferation, as well as companies selling their products across geographic regions, markets, channels, and key accounts (customers), has made it difficult to touch every product every cycle. It is not uncommon for a company to have anywhere from 1,000 to 18,000 products (SKUs) that span across multiple channels (e.g., grocery, mass merchandisers, drug, gas and convenience, and others), across multiple regions and countries, not to mention customers and demand points. This could lead to millions of forecasts each cycle. We recently worked with a very large CPG company that had over 4.5 million data series across multiple geographies, channels, and customers. This size data set requires a highly scalable enabling enterprise solution, not Excel, to help manage and forecast all those data series.

It is virtually impossible to touch every product every cycle. Companies forecast at some aggregate level in their product hierarchy with little attention to the lower levels (product mix). Then, disaggregate it down to the SKU/demand point using static historical percentage ratios (SKU splits). Imagine managing that disaggregation for 1,800 SKUs by region, channel, brand, product group, product, SKU, and location using Excel. Well, that is reality. The biggest contributor to forecast error is the lower-level product mix due to the sheer number of products and locations (SKU/ship to location). Thus, a large-scale automatic forecasting system is required that can do all the heavy lifting using analytics, and can filter on an exception basis those

products and locations that need the most attention based on a set of business rules, and error statistics (e.g., MAPE, weighted absolute percentage error and others). Excel is simply not scalable, nor does it have the depth and breadth of analytics.

Fitting Demand to Supply versus Fitting Supply to Demand

Traditionally, companies focus on forecasting what manufacturing should make, rather than what the market and channel were demanding. It is a supply-centric approach to demand forecasting and planning that compensates for the lack of a strong demand management process. The process needs to focus on identifying market opportunities and leveraging internal sales and marketing programs to influence consumers (customers) to purchase the company's products and services, also known as sensing demand signals and shaping future demand. This radical change with a focus on customer excellence versus cutting costs changes the process focusing on modeling (using predictive analytics) what is being sold in the channel based on market conditions and consumer preferences to determine the best demand response. This difference might sound insignificant, but it is a major change.

An additional step is required after demand sensing and shaping to translate demand into a more accurate demand response (demand plan). Forecasting channel demand reduces demand latency and gives the organization a more current demand signal. It allows the augmentation of the forecast with demand insights (signals) to improve the quality of the forecast. For most companies, this requires a reimplementation of demand management methodologies, analytical skills, and new enabling technologies.

Lack of Statistical Skills (People)

Recently, while meeting with the supply chain management team of a large appliances manufacturer, we were asked to provide them with a detailed description of the skills required to hire demand planners. This is not uncommon as most demand planners have minimal statistical skills. The demand planner's primary role in the demand

management process is focused on taking aggregate level forecasts and disaggregating them into ship to location by SKU forecasts. This requires minimal statistical skills. This is done using Excel spreadsheets, and then manually entered into a legacy ERP system. Those companies who invested in demand analysts with advanced analytical skills combined with new demand forecasting and planning enabling technology based on demand sensing and shaping have significantly improved their demand management processes.

Most traditional demand management organizations are positioned in the operations planning departments too far upstream to understand how to apply analytics to downstream channel data. When meeting with supply chain managers, I ask, "Who is responsible for demand generation?" They always respond, "Sales and marketing." Then I ask, "Why then are the demand planners positioned in the operations planning organization?" When in fact, they should be positioned in the marketing organization where the domain knowledge exists. In other words, demand forecasting and planning requires analytics and domain knowledge.

The demand management organization of the future needs to be positioned in marketing for two key reasons: (1) to provide statistical support, and (2) to gain domain knowledge. As marketing product managers move every two to three years, the demand planners (analysts) will remain as the product domain experts, as well as the analytics experts. As a result, companies begin to sell through versus sell into channels of distribution, as demand analysts begin to analyze and measure the effects of those factors that influence consumers and/or customers to buy their products. Subsequently, inventories will be managed more efficiently in those channels, avoiding discounting, sales promotions, and other vehicles required to push products through the channels of distribution. This will have a positive impact on profit margins, resulting in higher revenues, as well as higher market share.

How Do We Know? Several large consumer packaged goods (CPG) companies in the apparel, food, and beverage segments have recently moved their demand analysts and data scientists into the consumer insights departments, and/or aligned their demand management departments with marketing, significantly improving their

demand forecast accuracy—not to mention gaining valuable consumer insights, becoming valued analytic advisers, and transferring accountability and ownership to marketing.

Accountability for the Unconstrained Demand Forecast

Sales and marketing are responsible for demand generation, and ultimately for creating the most accurate demand response. Their primary role is to identify market opportunities, translate those opportunities into demand signals, measure the key performance indicators (KPIs) that influence demand signals, and use them to shape (influence) future demand. The collaboration (consensus) should be between sales and marketing, with finance assessing the programs to determine if they are profitable. If not, then it is finance's role to push back on sales and marketing. This is a truly demand-driven planning process. Operations planning should not provide another input into the consensus forecasting process other than to assess the implications from a supply perspective. If there is a capacity challenge, it should be raised at the S&OP/IBP (sales & operations planning/integrated business planning) meeting to determine a strategy to resolve the constraints (i.e., add another manufacturing shift, OEM the capacity to a third-party manufacturer, or shift demand by moving a marketing program to accommodate the capacity constraint).

Nestle Chocolate Company direct store delivery (DSD) does this best by following a structured demand-driven planning process that is supported by new demand-driven forecasting and planning technology that allows it to measure sales promotions and marketing events by mathematically calculating the lift, and then assessing the lift to determine if it generates profit. If not, the sales promotion is not implemented. This combination of data, analytics, domain knowledge, and financial assessment has significantly improved forecast accuracy as well as sales performance, resulting in higher profit margins and lower finished goods inventory safety stock.

While companies want to move forward, and the desire is reemployment of demand management, in my opinion, they cannot be successful unless they admit to their poor practices of the past! Good intentions but bad execution results in poor results.

For the last three decades, inventory has been the primary method for managing demand volatility. Inventory is expensive, and having the wrong inventory only increases working capital. Nevertheless, companies' efforts have been focused on tightening up their supply chains by becoming more responsive to market signals and trends, and reducing inventory while maintaining high customer service levels. Today, only a handfull of companies, 14 percent according to a 2014 *Industry Week* survey, have begun to adopt demand-driven principles to be more than just reactive to supply chain fluctuations. They are monitoring and responding to early demand signals, and they're figuring out how to reduce demand variability itself. Emerging data collection, storage, processing, analytics, and technology capabilities, coupled with real supply-chain collaboration, are making this possible.

CURRENT CHALLENGES AND OPPORTUNITIES

Globalization and changes in customer expectations continue to increase market volatility, adding complexity that makes it difficult to balance supply and demand across multiple product lines, business units, and geographic regions on a daily and weekly basis. The sheer size of the corporate footprint due to the diversity of many multinational corporations, compounded by the multiple channels they sell through, are driving much of this complexity. At the same time, market pressures are increasing the range of product offerings. This is evident by the growing number of SKUs that most manufacturers have to manage. Add shorter product life cycles, longer lead times, declining customer loyalty, and rising expectations for immediate product availability, and it quickly becomes clear that any improvements in demand visibility and responsiveness would pay huge dividends.

According to recent industry surveys conducted by several analyst firms, there are five key trends occurring that impact the supply chain, and particularly demand management:

1. *Continued demand volatility* and expanding product portfolios challenge supply chain leaders across all industries to elevate demand management performance.

2. *Persistent cost pressures* require supply chain leaders to better align supply with demand for improved performance.
3. *New product launch importance* drives supply chain leaders to seek stronger alignment between new product development and supply chain planning and execution capabilities for increased launch success.
4. *End-to-end partner communication and collaborative execution* by all partners in the supply chain from retailers through raw material providers must constantly collaborate on what events are occurring, the data behind those events, and how they can execute as a unified group to respond to the challenges as they unfold. Trading partners are now acting in a concerted manner based on transparent information to resolve issues as they happen. Solving a problem by pushing costs to another supply chain partner is an antiquated proposition as companies realize that cost shifting is not a sustainable, nor a competitive solution.
5. *Big data is becoming mandatory*. Big data has been the big IT story in recent years. Combining the data of multiple supply chain partners, turning that data into information, and being able to react and execute accordingly requires a lot of information. Big data solutions combined with complex event processing (CEP) solutions are being used more than ever to digest the enormous magnitude of available data and turn it into executable actions. Leveraging these tools with supply chain visibility solutions will quickly become a "must have" rather than a "nice to have" as companies utilizing these tools set the bar for the new normal in supply chain performance.

Companies continue to face an uncertain economy, with volatile demand, expanding product portfolios, and increasing cost pressures. At the same time, they need to aggressively focus on growth and revenue acceleration, increased customer responsiveness, and reduced inventory for improved cash flow. Together, these challenges cause leading organizations to invest in demand-driven transformation to improve demand orchestration, and supply and product capability. Supply chain technology is helping to transform the way companies

do business with consumers/customers and each other. If there is one thing these five trends have in common, it is that having constant feedback and control over supply chain functions is key to doing business in today's ever-changing environment. For this reason, these trends are likely to continue for the next several years and beyond.

The primary obstacles responsible for impeding companies from achieving their supply chain goals has not changed much over the past decade. If anything, they have intensified, making it more challenging for those companies that continue to allow their corporate culture (bad habits) to guide their judgment. Most executives continue to focus on three core business priorities: (1) leveraging the supply chain organization to drive business growth, (2) driving business process improvements, and (3) improving customer service. These three primary goals and objectives have not changed very much over the last decade.

It is not surprising that these supply centric strategies still focus primarily on cost reduction to support corporate supply chain initiatives. When asked, "What are the top three obstacles to achieving your organization's supply chain goals and objectives?" the number-one response from supply chain executives is forecast accuracy and demand volatility, followed by the inability to synchronize the supply chain end-to-end, and lack of cross-functional collaboration (planning), consecutively.

Twenty years ago, it made sense to use inventory buffers up and down the business hierarchy when comparatively short supply chains existed, and forecasts based on the previous month adjusted for seasonality were sufficient. Now, with longer supply chains stretching around the world, along with ever-increasing demand variability, companies are realizing that they can no longer use inventory buffers to protect against demand variability. In fact, according to companies we have worked with around the world, demand volatility has not decreased. If anything, demand has gotten more volatile over the past one to two years globally, according to executives in the United States, Latin America, Europe, and China.

Subsequently, among the primary influences causing demand volatility are new product launches, the state of the economy, increased globalization, and SKU (Stock Keeping Units) proliferation

on shelf at retailers. As companies have become more global and the size of their product portfolios has increased through acquisitions and industry consolidations there has been an enormous increase in SKU proliferation on shelf. In addition, due to ever-changing consumer demands, new product launches have increased significantly.

As data collection, storage, processing, and analytical power have steadily evolved, systems costs have declined. It is hard to determine if supply and inventory management adoption has kept pace with the growing market complexity. Or, if companies in fact created that complexity by enabling massive global supply chains, and endless product configurations and customer choices to appease the never-ending demands of consumers. Why didn't product life cycle management evolve to maintain continuity across the product portfolio to reduce the increasing complexity of their product offerings?

Across most companies, there is a similar ongoing tension between process, people, analytics, data requirements, and technology needs. The ability to collect, cleanse, and share data across the organization originally required a significant investment and justification within already strained IT budgets, often without an immediate ROI (return on investment). Such investments created the foundation for companies that were the early adopters of advanced data management capabilities. As data collection and analytic tools, applications, and solutions have become more affordable and powerful, they've become easier for companies to justify. For many companies, data management capabilities have advanced so quickly that the challenge now is how to report and make practical use of it all. Furthermore, data storage costs have declined significantly over the past decade. Sales transactional data is being collected at increasingly granular levels across markets, channels, key accounts, brands, and product configurations. Faster in-memory processing is making it possible to run what-if simulations in minutes that previously had to be left to run overnight.

Of course, the output and recommendations of any planning and decision-support system like demand management are only as good as the integrity of the underlying data. The road to achieving the benefits from improved forecast accuracy starts where most business process improvement projects start, with the data. It begins by addressing data quality, and then by breaking down the functional siloes and making

the data readily accessible to everyone in the demand management process that feeds into the sales & operations planning (S&OP) and integrated business planning (IBP) processes. According to a 2014 report by *Industry Week,* both data quality and data availability have improved for companies reporting wider adoption of demand-driven forecasting and planning methods. That implies that better and more widely accessible data are a prerequisite, or that poor quality data and a lack of sharing are most likely the barriers to adoption.[2]

However, according to the same 2014 *Industry Week* report, companies have not progressed much in the way of using true demand data to drive their demand-driven forecasting and planning processes. In Figure 1.3, the majority of those companies that participated in the study are still using customer orders and/or customer shipments as their primary data to forecast and plan their demand response. What is even more disturbing is that with all the enhancements in data collection, cleansing, and technology improvements, POS and syndicated scanner data (e.g., Nielsen and Information Resources Inc.—IRI) are the least used data for demand forecasting and planning. According to a book written in 2003 by Oliver Wight, *Demand Management Best Practices: Process, Principles and Collaboration*, POS data is closest to true demand. So, after over two decades companies are still using customer orders and shipments to sense demand signals and shape

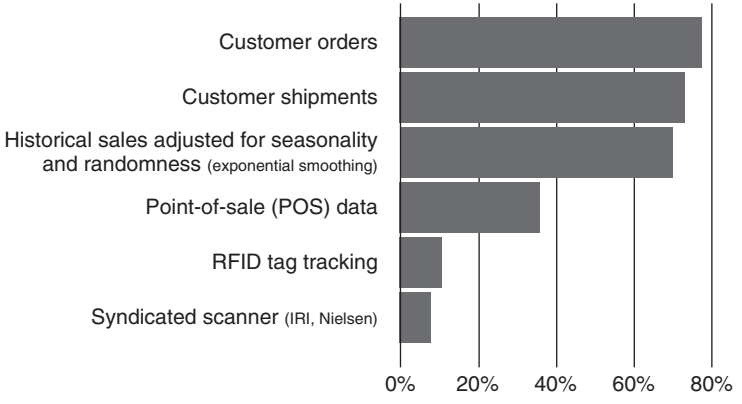


Figure 1.3 Demand data used for forecasting and planning.

future demand to create the most accurate demand response, when in fact they are really sensing supply replenishment signals and shaping the future supply plan, or supply response. Consequently, it has been proven that customer shipments are the most volatile data stream due to inventory replenishment policies and other related trade incentives, creating what is referred to as the *bullwhip effect*.

When it comes to preferred technology, it is no surprise that Microsoft Excel remains the most widely used forecasting tool in 2014 (see Figure 1.2), with over 77 percent of the participating companies, according to the 2014 *Industry Week* report. As limited as its capabilities are, spreadsheet applications are ubiquitous on every desktop and laptop computer, as well as most mobile devices. The challenge with spreadsheet analysis, given the SKU-proliferation and data deluge, is that it is simply not powerful or scalable enough to get the job done. Over the last decade, a wide variety of other, non–spreadsheet-based forecasting and planning tools, applications, and enterprise solutions have become available that can scale to the ever-increasing sources of information referred to as *big data*. Consequently, spreadsheets do not have the depth and breadth of analytical methods available for demand-driven forecasting and planning. The good news is that those companies that participated in the study said that they plan to adopt in the next 12 months a number of these more advanced analytical methods, ranging in complexity from simple moving averaging to time series, regression, and other related analytic methods. The really puzzling fact is that simple moving averaging was the number-one analytical method in this study, which indicates that companies have actually regressed, since only a decade ago almost every survey indicated that Holt-Winters Three Parameter Exponential Smoothing was the number-one mathematical method.

The goal for demand planners shouldn't be to use the latest or most complex tools for their own sake, but to identify the analytical method that best fits for a given product line by providing the necessary intelligence on a timely basis. Of course, when it comes to building consensus plans, analytical outputs are only the beginning. Domain knowledge is also necessary to incorporate the correct business inputs that influence demand outside the precursor that fuels the demand forecasting

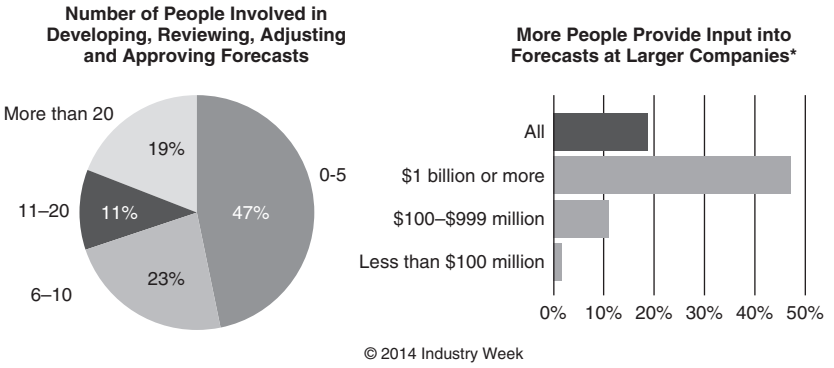


Figure 1.4 Number of people reviewing, adjusting, and approving demand forecasts.

engines with the understanding that such inputs do not take the form of wishful thinking. No matter how sophisticated the underlying statistical algorithms, people often feel that they haven't participated in the forecast process unless they've tinkered with the numbers. Almost half (47 percent) of manufacturers report that five or fewer people are involved in forecast development, review, and approval (Figure 1.4). There tends to be a wider network of perceived responsibility for more people to participate in the demand forecasting and planning process at larger companies, especially those with $1 billion or more in annual revenues.[3]

In addition, translating unconstrained demand forecasts into the appropriate demand response requires not only sensing demand signals, but measuring those KPIs (Key Performance Indicators) that influence the demand signal, and shaping future demand to drive revenue and profit, not just to reduce costs to create the most efficient supply response. Just as collaboration with external value chain partners is necessary to optimize the demand response on the supply side, demand shaping practices using key business drivers, or influence factors such as price, in-store merchandising, sales promotions, and more, require internal collaboration to optimize and coordinate activity on the demand side. More than three out of four manufacturers indicate their demand planning and other planning activities are at least somewhat integrated with fulfillment, manufacturing, procurement, and supply chain functions.[4]

PRIMARY OBSTACLES TO ACHIEVING DEMAND MANAGEMENT PLANNING GOALS

With all the enhancements in demand management over the past decade companies are still faced with challenges impeding the advancement of demand-driven planning. Many organizations are struggling with how to analyze and make practical use of the mass of data being collected and stored. Others are perplexed as to how to synchronize and share external information with internal data across their technology architectures. Nevertheless, they are all looking for enterprise-wide solutions (technology) that provide actionable insights to make better decisions that improve corporate performance through improved intelligence.

Before we can address all the demand management challenges of people, process, analytics, and technology we need to address the many bad practices that must be overcome before companies can truly embrace the benefits of demand-driven planning. The reality is that the obstacles to impeding companies from achieving their goals translate into mistakes and perceptions that hinder the progress of demand management. Those mistakes are still being made today after two decades of data collection, storage, processing, analytics, and technology improvements. In many cases, as we mentioned earlier, the conceptual design is sound, but in practice those designs are flawed due to corporate culture and other related political bias.

In fact, the size of the company or its location doesn't matter. I have sat across the table from several supply chain management teams over the past 10 years at companies that span from less than $1 billion in annual sales to over $109 billion in annual sales. Talk about stirring emotions with the words *demand forecasting*, or *demand-driven planning,* not to mention *being digital-driven*. Although the atmosphere in those rooms could be defined by despair, disillusionment, and most of all skepticism, it was far from hopeless. It seemed like déjà vu when I worked for a large CPG company back the early 1990s—no analytics, no technology other than Excel, and 100 percent gut-feeling judgment injected into the process by multiple departments, including sales, marketing, finance, and operations planning—all in an attempt to create a one-number consensus forecast (technically a supply plan).

The story goes on with no real attention to accountability and little or no attention to the product mix, as the focus was always a top-down forecast (plan). The supply chain leaders didn't just say they wanted to improve their demand management process, but said that they had no choice due to the fact they were sitting on anywhere from $100 million to over $600 million in finished goods inventory, WHIP, and raw materials. Over $75 million to $400 million was in finished goods inventory alone. Talk about being supply centric in their approach to demand management. I guess using buffer inventory to protect against demand volatility doesn't work after all.

Subsequently, demand forecasting and planning is still the key focus area for most companies. For most, it is the biggest challenge that they will face in their supply chain journey. Companies want to improve demand forecasting and planning, but have focused mainly on the process with little or no attention to improving data quality, people, analytics, and technology. As a result, their skepticism has become prevalent among their supply chain leaders, as many have conceded that they can never be successful in improving demand forecast accuracy. As indicated in survey after survey demand forecasting and planning is important to supply chain leaders, but also an area with the largest gap in user satisfaction.

Based on my personal experiences visiting companies, I have found that demand management is the most misunderstood supply chain planning process with little if any knowledge of how to apply analytics to downstream data (POS/syndicated scanner data). Also, well-intentioned consultants have given bad advice, particularly, that a one number forecast process is the key to success. As discussed earlier the one number forecast only encourages well-intended personal bias, and is used to set sales targets, financial plans, and other factors that are not directly related to an accurate demand response. What drives excellence in demand management is the ability to incorporate sophisticated data-driven analytics into the process using large-scale enabling technology solutions to create the most accurate unconstrained consumer demand response. Once that unconstrained demand response is adjusted for sales, marketing, finance, and/or operational constraints, it becomes a sales plan, marketing plan, financial plan, and/or a supply plan.

WHY DO COMPANIES CONTINUE TO DISMISS THE VALUE OF DEMAND MANAGEMENT?

Today, we live in a polarized world that divides family members, friends, and business colleagues. It affects everything we do, from the way we communicate with one another to how we handle business challenges. I have seen long-time business colleagues have passionate discussions defending their supply chain position regarding what adds more value—demand or supply. As a result, we now work in what I refer to as the *polarized supply chain*, where you are either a believer in supply or demand. Sound familiar? We get caught up in what we are comfortable with, or what we believe is the "holy grail" to fixing the inefficiencies in the supply chain. The pendulum seems to swing back and forth from decade to decade, focusing on supply or demand "processes and technologies" with little emphasis on people (skills and changing behaviors), and virtually no attention to predictive analytics.

We are at a pivotal point in the three-decades-old supply chain journey. Are we going to continue to address the symptoms, or finally take action to fix the root cause of our supply chain challenges?

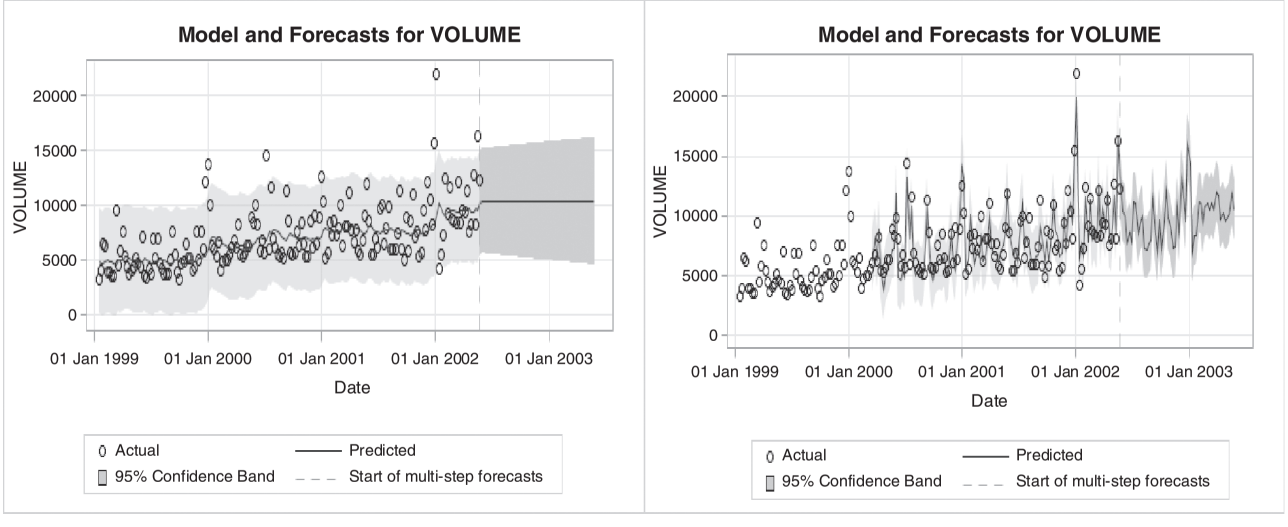
Everyone seems to be high on supply these days as they continue to smoke inventory crack. They justify their addiction on the fact that forecasts will always be wrong. Well, I have news for our supply-driven friends. Why is it that when we underforecast, companies experience significant backorders, and when we overforecast, companies sit on millions of dollars of finished goods inventories? What's more, why are our supply-centric colleagues suddenly abandoning their traditional use of buffer inventory (safety stock) to protect against demand volatility?

By the way, I agree completely that a 1 to 3 percent increase in forecast accuracy may have very little impact if any on safety stock or possibly finished goods inventories, particularly if your forecast accuracy is already above 85 percent on average across the entire product hierarchy. At that point, each additional 1 percent of accuracy (or reduction in error) requires exponential investment in time and resources with minimal effect on buffer inventories. Of course, that is if your forecast accuracy at the lower mix levels (i.e., product/SKU or SKU/demand point) is above 70 percent. We have found that over 90 percent of companies still focus on measuring forecast accuracy at

the highest aggregate level of the product hierarchy with little if any attention to the lower level mix accuracy. In fact, the average forecast accuracy across all industries is between 50 and 65 percent on average at the aggregate level, and between 25 and 35 percent or lower at the lower mix levels. How do we know? These numbers have been validated not through analyst surveys but by working directly with over 100 companies during the past 10 years. So, there is a lot of room for improvement regarding demand forecast accuracy—--much more than 1 to 3 percent.

A classic case of poor demand forecasting is when a company ships into a channel, or retailer more products than the retailer can sell, while simultaneously incurring backorders. So, you would think, how could that happen? Well it's all about the product mix. Not only did the manufacturer ship in more products than the retailer sold, they shipped in the wrong mix of products. So, now the retailer is sitting on excess inventory that is not selling. So, what does the manufacturer do? The manufacturer discounts the products in inventory at the retailer by running sales promotions and other related consumer incentives in an attempt to reduce the inventory by pulling it through the channel and retailers' stores. This has a negative impact on profit margins and market share.

In addition, the forecasting methods being deployed, mainly moving averaging and nonseasonal exponential smoothing models, are only accurate one to three periods into the future. As a result, the upper/lower forecast ranges (confidence limits) that are a key input to safety stock calculations tend to be cone shaped (exponentially get larger as you forecast beyond one to three periods). This is why the impact in many cases actually increases safety stock volumes, rather than lowering them. This is not the case when using more advanced statistical methods like ARIMA, ARIMAX, and dynamic regression (predictive analytics) as they are more accurate further into the future, so the upper/lower forecast ranges tend to be tighter (more consistent to the forecast, not cone shaped) as you go further out into the future. These models actually help lower safety stocks not only through more accurate forecasts, but by reducing the upper/lower ranges of the forecast, which is a key input to safety stock calculations. Which demand forecast in Figure 1.5 would you choose to drive your safety stock calculations?



Non-Seasonal ESM **ARIMX Model**

Figure 1.5 Comparing upper/lower forecast ranges for different forecasting methods.

The increase in the use of Excel by demand planners over the past decade and the broader use of moving averaging are the result of companies' investment in ERP solutions, which have restricted model selection. They only support simple statistical forecasting methods (mainly exponential smoothing). In fact, the one area of the supply chain that has received the least attention and investment in people, analytics, and technology over the past decade is demand forecasting and planning. If you noticed, I left out process. Process alone cannot improve your forecast accuracy. It requires investment in people skills and behavior, horizontal processes, predictive analytics, and scalable technology putting equal emphasis on all four areas.

Using proof-of-values (POVs use a subset of the customer's data in the software vendor's technology to prove the value—whether it improved forecast accuracy) conducted with multiple companies over the last 10 years, SAS Institute Inc. has shown improvements in forecast accuracy of anywhere between 10 and 30 percent (and in some cases up to 50 percent) on average up/down company's product hierarchies by just deploying "holistic" modeling driven by predictive analytics, not by sales targets, financial plans, and/or judgmental overrides. In fact, it has also been proven using historical demand data (uncleansed—not segmenting demand history into baseline and promoted volumes) combined with predictive analytics that there is no reason to cleanse demand history (shipments/sales orders). Cleansing demand history by segmenting it into baseline and promoted volumes, and for any other reason other than historical realignment or true entry errors, is actually a bad practice. In fact, this type of cleansing makes the forecast less accurate. This cleansing process creates two separate data streams: (1) baseline, which tends to be a moving average, and (2) promoted, which is supposed to reflect promotional spikes and outlier corrections, but is actually a combination of seasonality and promotional volume. Furthermore, the promoted volumes are given to sales and marketing to adjust manually. Finally, the demand planner manually tries to piece these two data sets back together. The result, 1 + 1 now equals 5. In 95 percent of the POVs conducted, there were improvements in demand forecast accuracy in the range of 10 to 25 percent, significantly lowering buffer inventories (safety stock) and finished goods inventory. Furthermore, they found that

applying multi-echelon inventory optimization, auto leveling, and other advanced analytics for supply planning along with improved forecast accuracy creates a synergy effect of another 15 to 30 percent reduction in finished goods inventories, thus reducing costs and freeing up working capital.

Another reason why improved forecast accuracy doesn't have a strong impact on inventory safety stock is because no one is actually forecasting demand, but rather supply. Those companies that are moving toward becoming demand-driven and ultimately digital-driven are engaging sales and marketing, and linking downstream data to upstream data using a process called multi-tiered causal analysis (MTCA), or what can be referred to as *consumption-based modeling*. Many have seen as much as a 25 basis point (or 50 percent) improvement in forecast accuracy for shipments on average across their product portfolios. They have also statistically proven that there is a direct correlation between downstream data and upstream data. So, why do we continue to say that improved demand forecast accuracy has no direct impact on supply?

We need to stop relying solely on either demand or supply as a quick fix to our supply chain challenges. Companies need to take a holistic approach to solving the root cause, which focuses on people skills and behavior, horizontal processes, predictive analysts, and scalable technology that is driven by structured and unstructured data addressing both supply and demand. I call it the *holistic supply chain.* Successfully implementing an agile demand-driven supply chain will require a holistic view of demand and supply. *We can no longer make it and hope consumers will buy it.* Companies need to focus across the entire supply chain starting with downstream demand to create a more accurate demand response to fulfilling that demand with the most efficient supply response. It includes a new definition of supply chain management (SCM), which includes the commercial side (sales/marketing) of the business, which is responsible for demand generation. Finally, in order to achieve this new approach to supply and demand, companies need to invest in training people in predictive analytics, implementing horizontal processes with performance metrics, applying and relying on predictive analytics to make better decisions, and implementing scalable technology to allow them to gain the most insights

from big data. You cannot get it right by just focusing on demand or supply alone. However, we need to start with demand working with sales and marketing to support demand generation with the intentions of creating the most accurate demand response. Then, work horizontally across the supply chain to meet that demand response with the most efficient supply response.

SUMMARY

As many corporate leaders recognize, investments in people and capabilities are essential for a business to thrive and keep growing. While companies are planning to increase investments in demand management capabilities over the next several years, many are relying on past or ongoing investments to keep moving forward. The top three investment priorities are general demand forecasting and planning, new data management technology, and tools that will help manage new product introductions. When it comes to demand forecast accuracy and maximizing profitability, anything will be better than continuing to use Excel spreadsheets and falling back on simple statistical methods like moving averaging. Excel is simply not scalable, particularly given that SKU proliferation has been on the rise for the past decade. Also, Excel doesn't have the depth and breadth of predicative analytics to support a demand-driven planning process on a large scale.

In order to support an enterprise demand management process, it is critical to have predicative models and a user-friendly, point-and-click user interface. The solution must be highly scalable, allowing the user to sense demand signals and shape future demand up and down the business hierarchy. The rise of demand management capabilities continues to be a broad trend toward improving performance by working smarter without increasing operating costs. Manufacturing leaders readily recognize that the ability to develop more accurate demand forecasts by sensing and shaping consumer demand could have a multimillion-dollar impact on their revenues and cost structures. So, what is impeding them from adopting demand-driven forecasting and planning?

The purpose of this book is to provide a framework and guide for practitioners with a proven structured approach that takes into account *people*, *process*, *analytics*, and *technology* to transition to the next

generation demand management process. These four areas are the key catalysts to move from the current state to the future state along with strong horizontal performance metrics to measure progress. Although adoption requires changes in people behaviors that include new skills, and an integrated process that includes both descriptive and predictive analytics, scalable technology is required that provides scalability to not only gain adoption but also sustainability. It also requires changes in the corporate culture led by a champion who has the authority and leadership to not only drive adoption but also create a new corporate culture that stresses accountability with a focus on customer excellence in order to maintain sustainability.

The primary goal is to provide readers with a strategic roadmap to transform their current demand management process to the next generation demand management process that is not only adopted but also sustainable, becoming part of the corporate culture.

KEY LEARNINGS

- Number one obstacle to achieving supply chain goals is demand forecast accuracy, followed by:
  - Inability to synchronize end-to-end supply chain
  - Lack of cross-functional collaboration
- Increasing demand volatility is creating a sense of urgency within companies to improve their demand management capabilities.
- Companies can no longer use inventory buffer stock to protect against demand volatility.
- Persistent cost pressures are requiring supply chain leaders to better align supply with demand for improved performance.
- 77 percent of demand planners are still using Excel spreadsheets.
- The most widely used statistical method is moving averaging, followed by exponential smoothing.
- Multiple departments and users (47%) are touching the demand forecast each cycle.
- Too many touch points add political bias, resulting in error.

- Focus is on aggregate level forecasts, rather than the lower product mix.
- The one-number consensus forecast philosophy is ineffective because of the corporate culture and lack of accountability.
- The process is politically charged due to different intentions, purposes, and goals.
- Companies are still struggling to know what to do with big data.

NOTES

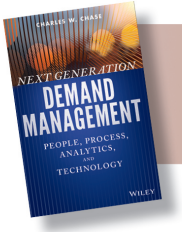
1. Michael, Gilliland, *The Business Forecasting Deal: Exposing Myths, Eliminating Bad Practices, Providing Practical Solutions* (Hoboken, NJ: John Wiley & Son, 2010), pp. 1–266.
2. SAS Institute, "Demand-Driven Forecasting and Planning: Take Responsiveness to the Next Level," *Industry Week* (2014), pp. 1–13.
3. Ibid.
4. Ibid.

FURTHER READING

Chase, Charles W. Jr., "Cleanse Your Historical Shipment Data? Why?" *Journal of Business Forecasting* 34, no. 3 (2015), pp. 29–33.

Chase, Charles W. Jr., "Using Downstream Data to Improve Forecast Accuracy." *Journal of Business Forecasting* 34 (2015), pp. 21–29.

Crum, Colleen, and George E. Palmatier, "Demand Management Best Practices: Process, Principles and Collaboration," *Integrated Business Management Series*, co-authored with APICS (2003), pp. 1–206.



About the Author

As Advisory Industry Consultant and Consumer Packaged Goods (CPG) Team Lead for the Global Retail/CPG Industry Practice at SAS Institute, Charles Chase is a thought leader and trusted adviser for delivering demand-driven solutions to improve SAS customers' supply chain efficiencies. Chase has more than 20 years of experience in the CPG industry and is an expert in demand forecasting and planning, market response modeling, econometrics, and supply chain management.

Prior to working as Advisory Industry Consultant, Chase led the strategic marketing activities in support of the launch of SAS Forecast Server, which won the Trend-Setting Product of the Year Award for 2005 by *KM World* magazine. Chase launched the SAS Demand-Driven Planning and Optimization Solution in 2008, which is being used by more than 100 large corporations globally. He has also been involved in the reengineering, design, and implementation of three forecasting/marketing intelligence process/systems. He has previously worked for the Mennen Company, Johnson & Johnson, Consumer Products, Reckitt & Benckiser, the Polaroid Corporation, Coca Cola, Wyeth-Ayerst Pharmaceuticals, and Heineken USA.

Chase's authority in the area of forecasting/modeling and advanced marketing analytics is further exemplified by his prior posts as president of the International Association of Business Forecasting, associate editor of the *Journal of Business Forecasting*, and chairperson of the Institute of Business Forecasting (IBF) Best Practices Conferences. Chase currently writes a quarterly column in the *Journal of Business Forecasting* titled "Innovations in Business Forecasting." He also served as a member of the Practitioner Advisory Board for *Foresight: The International Journal of Applied Forecasting*.

In 2013, Chase won the Institute of Business Forecasting Lifetime Achievement Award, and the following year he was certified in professional forecasting by the Institute of Business Forecasting. In 2004, he was named Pro to Know by *Supply and Demand Chain Executive*

magazine. He is the author of *Demand-Driven Forecasting: A Structured Approach to Forecasting*, which is now in its second edition (Hoboken, NJ: John Wiley & Sons, 2013), and, with Lora Cecere, *Bricks Matter: The Role of Supply Chains in Building Market-Driven Differentiation* (Hoboken, NJ: John Wiley & Sons, 2013). He served as an adjunct instructor in the Masters of Science in Analytics program at North Carolina State University in 2012–2013.