Increasing Forecast Accuracy:

Does it Really Reduce Inventory?

SPINNAKER

DELIVERING SUPPLY CHAIN EXCELLENCE

The accepted wisdom of our time portrays forecast accuracy as the "Holy Grail" in conquering the chronic issues of too much inventory or the wrong inventory. If you drink from this cup of philosophy, then increasing forecast accuracy will surely reduce overall inventory levels and provide cost savings into perpetuity; thus creating a lean mean supply chain machine. As evidence, the general industry rule of thumb claims 1% of forecast accuracy improvement should reduce inventory by 1% up to about an 80% accuracy level before hitting a point of diminishing return. While we have experienced the positive impact of forecast accuracy on inventory levels, it is important to be aware of the caution signs when building the business case for forecast accuracy initiatives.

Today, the top initiative besides increasing revenues is freeing up working capital or cutting unnecessary costs. Many initiatives are planned or implemented so as to impact inventory levels through the increase of forecast accuracy. Our response to that one is: **"Caveat emptor".** While these claims are not unrealistic, "there is many a slip betwixt the cup and the lip." Achieving better forecast accuracy is only the start of the race. It is like having live bullets in the gun. You still have to aim and fire it – the much overused word "execute" is very apt for this circumstance. It takes more than a shotgun approach to ensure that improvements in forecast accuracy positively impact inventory levels. Following are some key insights and fundamental logic that should help identify realistically when, where, and how forecast improvements will drive proper inventory levels.

INSIGHT 1

Improved forecast accuracy has a direct impact on the safety stock component of inventory. Therefore, adjusting safety stock policy is a critical step in ensuring forecast accuracy initiatives will have a lasting effect. Even better, using statistical safety stock methods will improve performance.

Is All Inventory Created Equal?

It is rare to find an organization that can point to a pile (for illustrative purposes, say a "pile" is 2000 units) of inventory and say, "1600 of that pile is cycle stock and 400 is safety stock". Yet the distinction is of crucial importance when bridging the link between forecast accuracy and inventory.

As Figure 1 illustrates below, the average inventory is determined by

a) Cycle stock and
b) Safety stock

Why do we carry safety stock? Because forecasts are not accurate, hence the name "safety" stock. Ideally, if everything went according to plan (i.e. our forecast turns out to be accurate), then the safety stock *would not be used*. Since forecasts are not 100% accurate, safety stock becomes a necessity, but one that should be tied directly to inventory accuracy.

Now ask yourself – is your safety stock policy tied to the forecast accuracy via forecast error reduction? The problem is that most companies have a blanket safety stock policy that is dictated by a "comfort level" or gut feel. For instance, the policy may dictate carrying 2 weeks (14 days) of demand as safety stock for *all* products. If this is the case then any gains in forecast accuracy, via forecast error reduction, lead to a dead end unless the safety stock policy is adjusted.

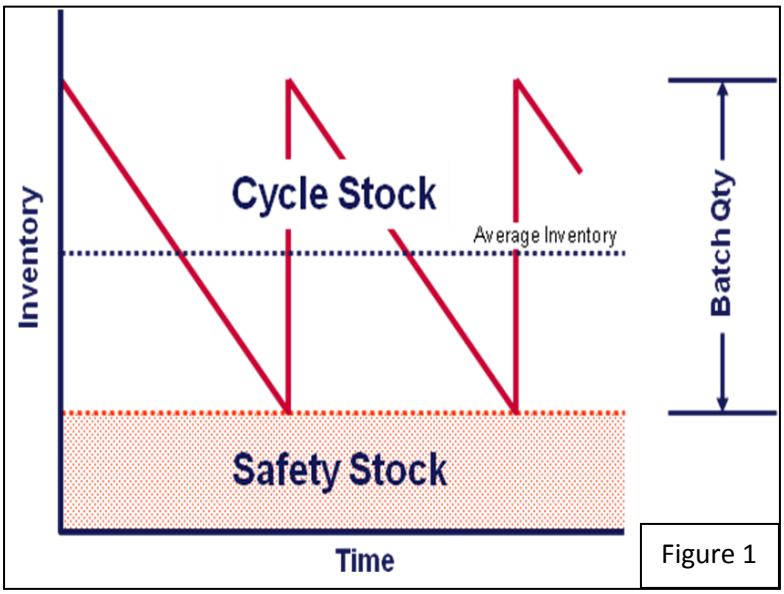

Figure 1

Suggestion:

Safety Stock can be addressed in one of two ways:

1. Simply reduce the number of days of demand that is carried as safety stock. In the above example, reduce the number of days of demand safety stock to 10 days since the expectation is that your forecasts will be more accurate.
2. Use statistical safety stock. This is a more sophisticated way to tie the safety stock to the forecast accuracy and is calculated based on the forecast error for each product. While using statistical safety stock requires a fair amount of investment in understanding, learning and training people on how it works, it drives tremendous results. Most Demand Planning systems offer a statistical safety stock option, although it is seldom explained well, or used properly. Explore this functionality if you have access to it in your software application. If you are using it already, check to ensure it is being used at the optimum levels.

INSIGHT 2

Improving forecast accuracy is meaningful to the plant only if we are talking about the right lag. Syncing up the Demand Planning lag with the production plan lag provides the best results for inventory reduction.

Get the Lag Right

What lag do you use to measure your forecast accuracy? Many companies use a "reasonable" lag like 2 time buckets, such as 2-month or 2-week out based on how forecast is generated. This will be denoted as Lag 2. However, if the plant has to commit its production schedule 3 months out, it does not care about the Lag 2 forecast. For the plant, it is the Lag 3 forecast that is critical. To convince the plant to base their production plan on the demand plan, forecast accuracy has to be improved for the lag that is meaningful to the plant. This means better communication and collaboration between the demand planners and the plant. While this sounds fairly easy, it requires understanding obstacles that would prohibit the collaboration process.

Suggestion:

Measure forecast accuracy at multiple lags. Most Demand Planning systems allow for the measurement of forecast accuracy at multiple lags, but if that is not the case, there is another relatively simple approach. Take a snapshot of the forecasts, save them in a data repository, and use them at a later point to compare with the actual realized demand. If the Demand Planning group truly wants to impact inventory at the plant level, they must not only focus on the lag they use for reporting forecast accuracy, but also on the lag that is meaningful to the plant.

INSIGHT 3

Forecast bias affects the cycle stock. Measuring and then lowering forecast bias can optimize cycle stock levels.

Cycle Stock

Cycle stock is typically one of the larger components of inventory and represents the inventory needed to satisfy demand from one production run (or cycle) to another. The cycle stock hits its peak just after a production run and depletes as demand is fulfilled. In a perfect environment, the next production run replenishes the cycle stock just as it hits zero. This is a lean method that is ideally used.

What determines the cycle stock? Obviously, the spacing of the manufacturing runs has an effect on the cycle stock. A manufacturing run once every 2 months will generate a cycle stock that is twice as much as manufacturing runs once every month. But the cycle stock is also influenced by the demand plan. If the plant follows the demand plan closely, the manufacturing plan will be based on the demand forecast quantity (net of existing inventory, of course). Thus, the demand forecast directly influences the production quantity. If the demand forecast (compared to the actual demand) is too high, the manufactured quantity will be too high and

lead to excess inventory. Conversely, if the demand forecast is too low, the manufactured quantity will be too low and can potentially cause stock-outs.

Few companies talk about forecast bias, let alone formally measure it. Under normal circumstances, if the forecast is unbiased, forecast bias should be high (compared to the actual) as often as it is low. A positive bias in the forecast will cause the forecast to be high more often than it is low. If the production plan is based on such a forecast, the cycle stock will be too high, resulting in excess inventory. A negative bias has the opposite effect and can lead to inventory shortages. Thus, measuring and lowering forecast bias can help lower cycle stocks.

Suggestion:

In practice, the players in the supply chain have a sense of this bias and compensate by implicitly discounting or inflating the demand forecast depending on their take of the bias. Forecast bias thus leads to a decrease in the credibility of the original forecast. Since most people tend to avoid risk each player in the process adds their own padding to the forecast. The end result is an inflated demand plan which ultimately leads to higher inventories.

Forecast bias can be measured by simply adding up the errors in each period. For instance, one could keep a running total of the errors over a rolling window of the last 12 months. If the errors are positive as often as they are negative, then the magnitudes should cancel each other out and result in a sum that is close to zero. If this sum is consistently positive or negative, there is bias in the forecast.

Forecast bias depends on two factors – trust and incentives. If the Sales (or Demand Planning) group is not confident that the plant will deliver on the quantities they need, they will inflate the forecast "just to make sure." Moreover, if Sales is not held responsible for excess inventory after a promotion, they will have a strong tendency to over forecast. These two factors of trust and incentives must be addressed in order to reduce forecast bias.

INSIGHT 4

To benefit from better Demand Planning and Forecasting, the production plan at the plant must be tied closely to the demand plan, so manufacturing aligns with the demand signal. This will ensure the plant makes inventory that is required, not just desired. Institutionalize a process for Demand Planners or Replenishment Planners to talk to the plants using the same numbers.

Inventory is an Outcome

Understand that inventory is an *outcome, not an input*. If one is looking at inventory in the primary warehouse at the end of a period (say, week or month), it is an outcome of the following:

a) how much inventory was there at the beginning
b) how much was shipped out of the warehouse and
c) how much the plant manufactured.

Let's assume that the starting inventory for the period was "just right". If demand "pulls" product through the supply chain, there isn't *direct* control of how much is shipped out of the warehouse. Whether this is influenced by promotional programs or not, the best that can be done is forecast the demand. **That leaves a single lever to influence inventory directly – how much the plant manufactures.**

Tying the production plan to the demand plan is easier said than done. Often plants like to operate on a preferred schedule that lets them rotate through the products in certain weeks of the month. Plants also like to balance their workload and operate at higher, rather than lower capacity. The rationale is that the fixed cost is spread across more units, thus reducing the fixed cost component per unit. Sometimes, plants have their own inventory targets to meet, which often conflict with the goals of the Demand Planning Team.

Suggestion:

To operate in a way that is closely tied to the demand forecast, the plant has to be more flexible in the way they operate without sacrificing too much efficiency. The benefits of better demand planning will not be noticeable unless the plant is capable of delivering on flexibility. The next time you think of reducing inventory by increasing forecast accuracy, ask yourself if your production facilities are on board. Are they willing to change their production plan to synchronize with the demand plan? Aligning these groups with common goals, objectives **and incentives** is a key factor to delivering optimal inventory commitments in time, money and resources. In addition, ensuring these discussions occur in a demand/supply consensus meeting is a critical step. It doesn't "just happen" on its own. **It must be managed and monitored for effective results.**

INSIGHT 5

Pre-building inventory can defeat any initiative to reduce safety stock through improved forecast accuracy. It is important to understand how much the business "pre-builds", and when that occurs, when looking at forecast improvements geared to reduce inventory.

Pre-Built Stock

The effect of pre-built stock can be even more dramatic than cycle stock. Stock is pre-built in anticipation of very high peak or seasonal demand. It would be cost prohibitive to install capacity to produce this quantity in-season and then let the capacity sit idle for the rest of the year when demand is much lower. Seasonal Christmas products are a perfect example. In addition, stock may also be pre-built in anticipation of high demand for a promotional campaigns like school supplies where peak season is generally in July or August.

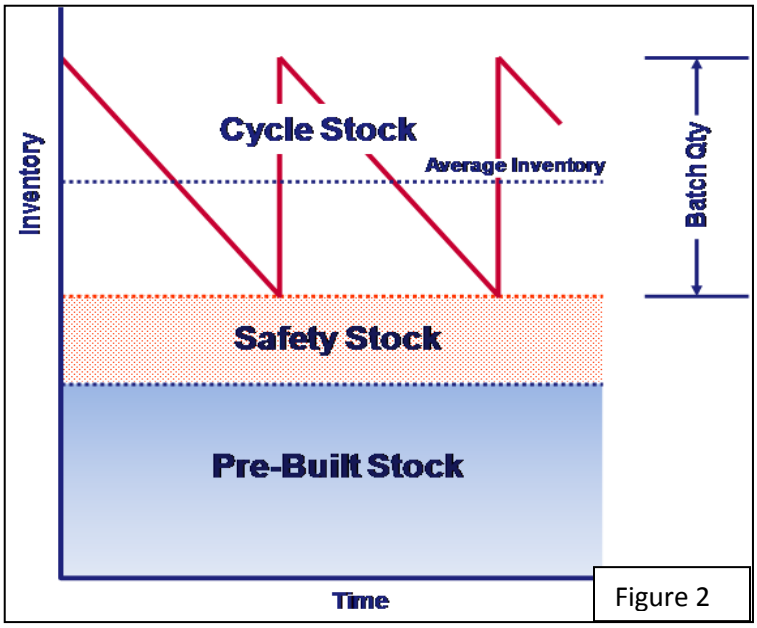

Figure 2

If you pre-build inventory to meet peak demand, the magnitude of the pre-built stock can be significant compared to the normal cycle stock or safety stock (see Figure 2). Improving forecast accuracy will only result in a minor inventory reduction since the safety stock is such a small portion of the overall inventory. Note that this principle is just as applicable for pre-builds that are caused by anticipated demand for promotional programs.

Suggestion:

Avoiding pre-built inventory usually entails finding capacity to handle peak demand. Installing extra capacity just for the peak demand may not be financially viable. Other options that should be considered to avoid carrying pre-built inventory are:

1. Outsourcing production to a local supplier during peak demand periods
2. Finding idle capacity in other plants of the company. Consider assessing how much capacity the plants truly have versus the "perception" of what they have.

INSIGHT 6

Depending on the magnitude of the safety stock in comparison to the overall inventory, improving forecast accuracy may or may not have a large impact on the overall inventory. Understanding the percentage of inventory types is essential in deciding if improving forecast accuracy will impact inventory levels significantly.

Relative Proportions

Suppose a plant manufactures a particular product once every 8 weeks. It must therefore make enough to last 8 weeks, until the next time the product is manufactured. This means the *Cycle Stock* varies between 8 weeks of supply and zero, giving an *Average Cycle Stock* of 4 weeks (see Figure 1).

Suppose 2 weeks of safety stock is carried to protect against forecast error. If the demand is relatively stable, the safety stock will not rise and fall with every cycle. It will be a constant amount of inventory that represents 2 weeks of demand. In this case, the *Average Safety Stock* will be 2 weeks (see Figure 1).

This gives an *Average Inventory* of 6 weeks. However, it is clear that the Cycle Stock is the larger component and makes up 2/3 of this average. The Safety Stock is only 1/3 of the average. If the safety stock is reduced by 50% - from 2 weeks to 1 week, that still leaves the Average Inventory at 5 weeks, which is only a 17% drop in inventory.

Suggestion:

When estimating the impact of improving forecast accuracy, understand that it will only affect the safety stock. If the safety stock is a small proportion of the overall *Average Inventory*, the impact will be comparatively small. Make sure the type and the amount of inventory is clearly analyzed to understand how it can be better managed.

INSIGHT 7

Know the components of your inventory and what techniques affect those components directly. This logic will guide and validate the proper investment on key initiatives that assume forecast accuracy will impact inventory.

The Components of Inventory

Tying it all together leads to the realization that it is critical to understand the components of your inventory:

- Safety stock
- Cycle stock
- Pre-built stock.

Knowing the components helps understand:

- What tactic to use to reduce inventory
- How much we can move the needle in reducing inventory.

It is important to understand the following logic:

- Forecast accuracy (equivalently, forecast error) affects the safety stock.
- Forecast bias affects the cycle stock.
- Manufacturing capacity affects the pre-built stock.

When estimating the impact of improving forecast accuracy, we must understand that we will only affect the safety stock. If the safety stock is a small proportion of the overall *Average Inventory*, the impact will be comparatively small and have little impact financially.

5 Key Takeaways:

Now that we know how and when forecast accuracy can help reduce inventory, how do we use this information to help our supply chain? Here are 5 ways to use the 7 insights presented.

1. Define a safety stock reduction strategy that takes forecast error and supply lead time variability into account.
2. When measuring forecast accuracy, make sure to include a lag that is relevant to the supply side at the plant level of the organization. More precisely, that lines up with the lag at the plant level.
3. When defining a strategy to reduce cycle stock, target forecast bias and investigate more flexible production plans. The more flexible and lean the plant can be the greater impact on cycle stock.
4. Make sure the production plan is aligned with the demand plan[1]. S&OP meetings are an ideal place to ensure this happens; however, at a minimum there should be an "institutionalized" process for demand/supply consensus and collaboration.
5. Understand the components of cycle stock, safety stock, and pre-built stock, and their relative proportions. This will provide a better handle on how to reduce inventory and how much inventory can be affected.

[1] *The statement "… production plan in your organization is aligned with the demand plan" assumes that on hand inventory is netted out of the demand plan to arrive at the production plan*

Case Study

To translate this into a day-in-the-life scenario, the following case study illustrates these concepts and their outcomes.

Black & Decker Hardware and Home Improvement (BDHHI) is one of three divisions of Black & Decker. It is the global manufacturer and marketer of quality power tools and accessories, hardware and home improvement products, as well as technology-based fastening systems.

Due to the large number of new products BDHHI introduces every year across dominant retail partners such as Home Depot and Lowe's, the company was experiencing manufacturing overtime, expedited shipments and excess inventory. This mandated a need for consistent processes, exception-based planning, improved planning cycle times and increased forecast accuracy.

Spinnaker engaged with BDHHI to address their business challenges. First, we used a Consumer Centric approach – fixing the demand planning process, system and leveraging the customer's promotion information and POS data. We developed the ability to provide information – not just data – to retail category managers quickly and at any level in the supply chain. As a result, the manufacturer improved order fill rates to its retail partners while holding less inventory than its competitors.

Next, we developed and implemented the production planning and fulfillment processes and implemented the system to support it. It synchronized the flow of materials and resources for multi-stage and multi-site production needs. It orchestrated all aspects for enhanced productivity, control and prioritization. The approach proactively addressed the numerous factors involved in planning to minimize total inventory, improve flexibility and enhance efficiency, and enabled BDHHI to better predict and respond to changes in consumer demand. We also defined the inventory policy by each product and the overall inventory management process.

The benefits were as follows:

- 10.4% improvement in forecast accuracy
- 60% reduction in forecast development cycle time
- 80% reduction in monthly production cycles

Needless to say, this translated into millions of dollars of savings.

Notes:

"Inventory" refers to finished goods, unless otherwise specified.

About Spinnaker:

Spinnaker is a global supply chain management consulting firm that specializes in balancing demand and supply through effective planning techniques. Using a holistic approach that combines People, Process and ultimately Technology, the firm focuses on providing corporations with solutions that deliver tangible, yet sustainable results.

To learn more, contact the supply chain specialists at Spinnaker. Call **877-476-0576** or visit **www.spinnakermgmt.com**.