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Sweet Spot

The relationship between forecasting and optimal stocking levels

At-a-Glance

- Forecasting and setting optimal inventory stocking levels are related processes, and getting the two "in sync" can result in dramatic bottom-line improvement.
- Lack of accurate stocking level information can result in overstocking, understocking, and lower profitability and shareholder value.
- Software that uses statistical optimization techniques can go a long way toward accurately setting stocking levels.

For many vendors and purchasers of forecasting software, the demand forecast is an end in itself. However, the forecast is really a means to an end: a starting point for demand planning. The forecast feeds a variety of systems used for inventory, production, distribution, financial, and sales planning. So ultimately, forecast accuracy is not the only thing that's important. What you actually do with the forecast matters, too.

During the recent economic downturn, it was painfully evident that what really matters to most companies is knowing how much inventory they should have on the shelf to meet their desired customer service levels. The problem is that forecasts—whether statistical or judgmental—rarely translate neatly into the amount of stock that should be put on the shelf. And in some industries where slow-moving items make up a large part of company inventories, the fast movers are often the only ones that get forecasted, leaving the great majority of inventory items rendered unforecastable.

Such is the case in the automotive service (spare) parts market, where stocking levels are often too high. The Automobile Aftermarket Suppliers Association (AASA) estimates that there is $6 billion of inventory—slow-moving items—in the automotive aftermarket channel that hasn't moved in 12 months or more. Needless to say, this imbalance ripples though the supply chain costing the industry between $1.5 and $2 billion dollars a year in excess inventory carrying costs. The AASA recently launched a working group to improve demand forecasting and inventory planning in the industry.

The increasing interest in optimizing stocking levels has given rise to a number of software vendors offering solutions that claim to optimize inventory, sometimes across the entire distribution system. Likewise, pundits and industry analysts are taking notice and are covering this new class of soft-

ware with an eye to determining how well these solutions help companies do a better job of managing their inventories.

Our experience is that many demand planners do not adequately understand the relationship between forecasting and the setting of inventory stocking levels, and many companies are challenged to implement even basic internal systems for improved inventory management. Our focus, therefore, is to explain the relationship between forecasting and stocking levels and show how better methods, including statistical forecasting tools, can often lead to greater degrees of inventory optimization.

The stakes are high. Failure to have critical stocking level information may lead to incorrectly balanced inventories, and can have significant negative effects on the operational health of the organization. These effects manifest themselves as

- Overstocking, which ties up cash in unneeded inventory and increases carrying costs
- Understocking, which leads to stockouts, lost sales, poor customer service, and reduced competitiveness
- Inefficient uses of production and financial assets
- Lower profitability and shareholder value.

Competing goals

INDEED, TO INCREASE shareholder value and remain competitive, corporate management is often given two seemingly competing and contradictory goals: Reduce inventory and increase service levels. The key to achieving these goals is knowing the minimum amount of inventory required over a specified lead time to meet a desired service level. We refer to this amount or point as the "sweet spot." If your inventory exceeds it, your inventory costs are too high. If your inventory is below it, your risk of stocking out is greater that you anticipated.

To reach the sweet spot, inventory managers and planners need to shift their focus. Forecasting expected future demand is not enough. Inventory planners need to learn how to use their forecasts to optimize the inventory stocking levels required to meet future orders. This process combines not only accurate forecasting, but also accurate estimates of required safety stocks.

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Demand volatility

THE DIFFERENCE BETWEEN what you expect to sell and what you need to have on the shelf to meet actual orders is commonly called safety stock. A correctly calculated demand forecast gives you the best estimate of what you can expect to sell over a future lead time. Statistically, this number is often best represented by the median or midpoint on the distribution of all possible demand values. Actual demand has an equal chance of exceeding or falling below this value. While the median estimate of future demand is useful for a variety of planning purposes, this number, by itself, is not very helpful if you're responsible for ensuring that there is enough product on the shelf to fulfill all (or nearly all) orders. That's because when there is demand volatility, the number you need to put on the shelf may be quite different from the number you expect to sell.

Let's look at a simple example. You have a steady, mature product item, an automobile headlamp, of which you sell 5000 units per month, month after month. When you forecast sales for this product, it predictably equals 5000. There is no uncertainty in its demand and thus, you don't need any safety stock to guard against demand volatility.

However, you produce another product, a gear plate assembly that is installed in transmissions, and its demand is very variable, often exhibiting wide swings in value from month to month. For this product, a forecast of expected demand—based on your best estimate of the median of the demand distribution—won't take into account the inherent demand volatility associated with this item. By itself, this forecast won't tell you the safety stock you need to cover the possibility that actual demand might be more than expected demand and by how much.

Ad hoc rules can fail

THE AMOUNT YOU plan to sell plus a safety stock estimate is what has traditionally been used to estimate inventory stocking requirements. The problem is how to calculate safety stock in an optimal manner. In many planning systems, this value is based on ad hoc rules, such as adding an arbitrary fixed amount to the forecast (e.g., an additional two or three months of expected demand).

Most ad hoc approaches assume that every inventory item in a particular class or group has the same relative degree of demand volatility. Thus,

estimates of safety stock based on these approaches may have little relation to what should really be on the shelf. The result is that inventories are often out of balance.

Here's why. The fixed amount used in an ad hoc approach could depend on various characteristics of the product item. For example, if the item is an important "A" product, with a four-month replenishment lead time, you might decide to add another four months of expected demand to the lead time forecast as safety stock for this item. On the other hand, if the item is a less significant "C" product, with a two-month lead time, you might add just one month of expected demand to the forecast. Unfortunately, this type of procedure does not take into account the degree of demand volatility associated with the item. In fact, the A item could be very stable and, for a given service level, require a smaller amount of safety stock, while the C item could be very volatile and require a much larger safety stock.

The data is there

MOST COMPANIES HAVE the data they need to do a much better job of setting stocking levels. The problem has typically been software systems that require ad hoc inputs to work, when statistically derived inputs could be generated and should be used.

The correct approach would be to look at the demand pattern for each inventory item and calculate an accurate forecast of expected future demand over the specified lead time. The safety stock requirement could then be computed based on two factors: the degree of uncertainty associated with the item forecast—as estimated by its forecast error—and the desired service level. The sum of the forecast and the safety stock values would represent the optimal inventory stocking level for that item. (The preferred approach for intermittently demanded, slow-moving, items differs from this but is in the same spirit.)

Even when there are a small number of inventory items, to do this manually could become very cumbersome. With thousands of items, it's impossible to accomplish this task in a reasonable amount of time during a normal planning cycle. That's why a number of inventory optimization software solutions have been coming to market.

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By applying statistical optimization techniques to forecast estimates, as well as safety stock estimates, new software has solved much of the problem. The use of statistical methods instead of ad hoc rules has several obvious advantages. Rather than making arbitrary judgments, statistical methodologies can enable users to look at empirical demand data for each inventory item. Users can then easily identify trends and seasonal patterns, determine demand volatility, calculate the demand forecast, and automatically project safety stock and inventory stocking level requirements over the item's lead time. If the forecasting process is accurate—producing reliable estimates of forecast error and thus measuring demand volatility—this method provides inventory planners with a solution that's more useful, by orders of magnitude, than the forecast alone.

These techniques are helping companies approach the sweet spot and have resulted in millions of dollars in savings. Finding optimal stocking levels, however, doesn't necessarily lead to inventory reductions. Sometimes it points out grossly understocked inventory. In some of those cases, increased inventory investments have resulted in improvements in service levels of as much as 20 percentage points.

Finally, companies often discover that their inventory mix is out of balance. Solving this problem enables them to cull obsolete inventory, improve availability of highly demanded items, and redeploy production and sales assets to higher margin activities.

Finding your sweet spot

BEING ARMED WITH a better way of attaining optimal stocking levels and approaching the sweet spot, however, does not automatically translate into such glowing results. The process is less than perfect and there are a number of obstacles that can stand in the way. Following are recommendations that can help increase your chances for success.

Use the right tools. Not every forecasting or inventory optimization software system will meet your specific needs. For example, there are some that handle intermittent, slow-moving, demand very well, and others that are optimized for certain types of industries. Choose software that will accomplish your goals, is easy to implement within your organization, and promises a solid payoff leading to a high return on investment (ROI). And make your vendor prove its claims before you buy.

Get corporate commitment. To maximize the value of their software tools, companies need to invest in the training of their demand planners and others involved in the forecasting and planning process. Software vendors and organizations like APICS are key in this area. Demand planners also need to be given the time to explore the features in

forecasting and optimization software—especially those that promise big payoffs in results.

Track performance. Companies need to track performance. The better the performance of the forecasting software and the more accurate the inventory stocking recommendations as measured against actual results, the more confidence the organization will have in its planning capabilities. In this type of situation, experience shows that production lines run smoother and communication with suppliers is enhanced. Demonstrated tangible results and ROI are also strong justifications for continuing investments in better inventory management solutions.

Improve data inputs. The importance of having clean historical data as inputs into your planning systems can't be overstated. Good historical data is necessary for a reliable baseline forecast, but there are other factors that should be considered. Demand planners, inventory managers and others inside their respective organizations, as well as vendors and customers, should engage in an active collaboration process. Inputs resulting from collaboration can be used to adjust the baseline forecast, add value, flag unforeseen changes in demand not reflected in the demand history, and often increase forecast accuracy.

Share results. While this may seem obvious, your information systems should enable the easy communication and sharing of forecast results and stocking level recommendations. These results are the inputs for planning systems such as advanced planning and scheduling, enterprise resources planning, material requirements planning, financial systems, and others, throughout the organization. The more compatible your forecasting system is with your other planning systems, the easier this will be to do, and the smoother your operations will run.

The payoff for approaching or reaching the sweet spot can be huge. This fact hasn't been lost on corporate management, nor on software vendors offering solutions that help companies not only produce accurate demand forecasts but also optimize their inventory stocking levels. It's only by moving beyond the forecast and optimizing inventories, by finding the sweet spot, that the seemingly contradictory goals of reducing inventories and increasing customer service levels can be realized. ◆

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