Impact of Poor Forecasting Accuracy

Gross Margin and Organizational Effects of Poor Forecasting Accuracy

By Ryan Huff and Max Sultan

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Though it is in many ways the backbone of an entire company, Forecasting is still handled by many organizations without supporting data or automation whatsoever. Additionally, many companies do not monitor their own forecasting accuracy. Even those that do, often do not fully go beyond the aggregate data and break down forecast accuracy by specific regions, platforms, time horizons, products and customers. Furthermore, how many of them understand how gross margin is affected by poor forecasting? This paper gives an overview of the SIOP process, and highlights the importance of forecasting accuracy on both this process as well as the company as a whole. Finally, the paper sheds light on how to calculate both forecast accuracy, as well as its effects downstream, and provides one case study where many of the explained issues arose.

Primary Industry: Relevant for All Industries

Other Industries: Relevant for All Industries

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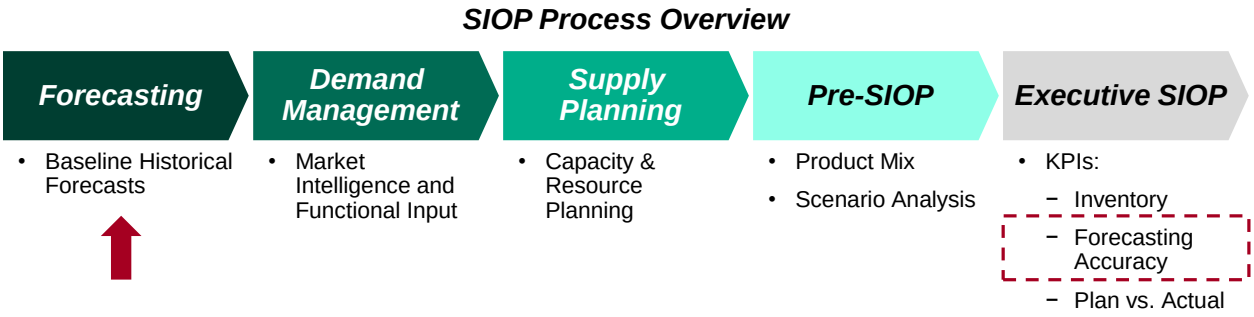
INTRODUCTION

In 1980, Oliver Wight wrote of S&OP: "Sales and Operations Planning (S&OP), is the process of setting the production plan and other activities to best satisfy the current planned levels of sales, while meeting general business objectives of profitability, productivity, competitive customer lead times, etc., as expressed in the overall business plan…"

Today, the definition of S&OP, also called Sales, Inventory and Operations Planning (SIOP), or Integrated Business Planning (IBP), still holds true. In today's globalized economy, if a company wants to have a flexible supply chain, it must adhere to a robust SIOP process that enables its business to meet the challenges of today's business environment.

SIOP is typically a periodic (usually monthly or quarterly) process as illustrated in figure 1:



In an era of drastic change, an effective SIOP process provides a systematic framework and defined processes through which a supply chain can become more flexible and responsive. To do this, the SIOP process itself must be highly disciplined without being rigid. It must be standardized and flexible—agile, in other words.

This paper will focus on Forecasting Accuracy, how it is defined, calculated, and subsequently, on how poor forecasting accuracy can incur different costs and have different impacts on a company's supply chain and entire SIOP process.

2. WHAT IS FORECASTING ACCURACY?

Forecasting is an integrated exercise in which all levels of the supply chain are involved and are willing to share information which helps in increasing demand visibility within organizations as well increase the performance of forecast. Firms that use forecasting successfully had developed not only cross-functional trust, but also cross-organizational trust with distributors and suppliers.

The last point should be especially resonating: Many firms still have an immense disconnect between the different functional areas involved in Forecasting, which creates disruption in the SIOP process, but also, in the end, in the company's ability to deliver products to its customers.

3. WHY COMPANIES SHOULD MONITOR FORECASTING ACCURACY

Because investment in inventory is tied to it, forecast accuracy is critical to the bottom line. If forecast accuracy can be improved on an aggregate level, safety stock levels needed to fulfill specific target fill rates can be lowered, and the bottom-line can benefit.

This is why, in many ways, forecasts are considered the bases for long-range planning. However, many companies still rely on subjective forecasting methods with very little data to back them up, or very little automation to execute plans. In fact, we have found that many practitioners agree that Demand planning KPIs such as Forecast Accuracy and Forecast Bias, as well as safety-stock concepts and tools, should be front and center in a SIOP process. Predictably, better management of *working capital* and an improved ability to *forecast cash flow* are almost always cited among the objectives of a SIOP Process.

More than any other factor, rising consumer expectations have had a trickle-down effect that has increased demand volatility in almost every market. But even as companies have had to become more responsive to customers, longer supply chains that extend overseas to suppliers and contract manufacturers mean that they have less direct control over operational processes. This makes them more vulnerable to delivery problems, quality issues, missed deadlines, inventory liability and *forecasting accuracy*.

As we look at working capital across most industries and companies, we will see inventory fall into five buckets: Safety Stock, Cycle Stock, Decoupling Stock, Anticipation Inventory, and Pipeline Inventory. While the magnitude of that first bucket, Safety Stock, may vary in magnitude relative to the other buckets and company-to-company, it is nearly always significant both in its working capital impact as well as its ability to smooth our operations and deliver customer satisfaction. In most companies safety-stock exists primarily to buffer a specific type of variability, and that is either variability in demand or, more often than not, variability between forecast and actual demand. Therein lies the importance of understanding Forecast Accuracy when working towards a best-in-class S&OP Process.

4. HOW FORECASTING ACCURACY IS CALCULATED

Many organizations might measure forecasting accuracy, but how many of them go beyond the aggregate data and break down forecast accuracy by specific regions, platforms, time horizons, products and customers? Additionally, how many of them understand how gross margin is affected

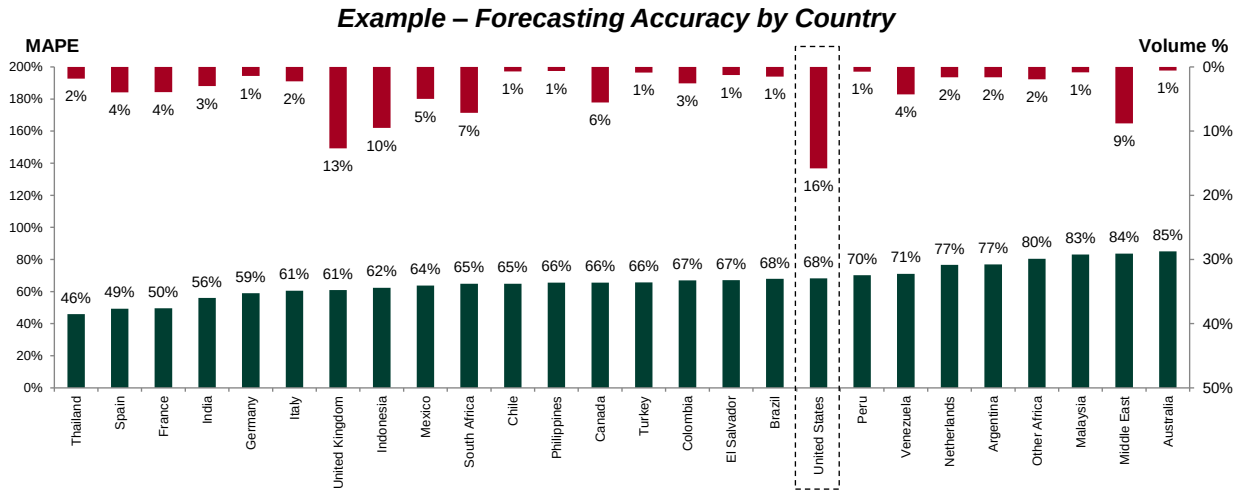
by poor forecasting? Unsurprisingly, very few companies can answer all of these questions. Applied Value has helped companies answer these questions and more.

The main metric used by AV to track forecasting accuracy is a Weighted Average of Mean Absolute Percentage Error (wMAPE), calculated as follows:

wMAPE		MAPE		Weight
$\sum MAPE * Weight$	$=$	$\frac{\lvert Forecast - Shipped\ Order \rvert}{Shipped\ Order}$	$*$	$\frac{Shipped\ Order}{Total\ Shipped\ Order}$

MAPE calculates the absolute value deviation of forecasts from actual orders shipped, thus overages and shortfalls are not washed out. MAPE at an aggregate level does not reflect product and regional differences; therefore MAPE should be adjusted on both product and regional levels. To account for the volume impact from high runners, MAPE should also be adjusted by using weighted average (wMAPE) over total shipped orders.

This methodology allows insight into different forecast horizons, geographies, products and even customers:



The above chart illustrates how one particular company's forecasting accuracy (MAPE) behaves in different countries, and what the respective volume % of sales those countries represent. As it shows, this particular company has a mean absolute percentage error of 68% in the U.S. market, where 16% of its volume comes from. As a quick reference, AV experience shows that a typical MAPE for that industry is closer to 29%, less than half of what this particular client was achieving in its biggest market.

This approach also allows for a more transparent quantification of how forecast accuracy translates into gross margin impact for any given company. The costs associated with poor forecasting could

and should be quantified to provide visibility into gross margin impact. AV will give a brief description of some of the downstream effects of poor forecasting accuracy and why attention should be placed on them.

5. DOWNSTREAM EFFECTS OF POOR FORECASTING

Although inventory is the main cost generally associated with poor forecasting accuracy, there are several other costs that also depend on forecasting: As mentioned above, Applied Value has dealt with quantifying and helping mitigate these costs in several instances. AV divides forecasting costs between hard and soft costs. Typically, if AV is engaged in, for example, a forecasting accuracy project, 'hard costs' would be those to which a concrete, fact-based cost can be tagged with. On the other hand, soft costs, though very real, are harder to quantify with a fact-based approach.

Forecasting Costs	
Hard Costs	***Soft Costs***
a) Inventory / Working Capital: Forecasting might cause the order of excessive inventory which reduces profits by increasing working capital	***d) Supplier Relationship Deterioration:*** − Suppliers and vendors no longer trust forecasts and are less likely to be helpful in times of need − Supplier bake in additional costs to cover potential shortfalls when order volume doesn't come through
b) Expedites & Missed Revenues: Inbound and Outbound Expedites and/or Missed Revenues when components necessary for manufacture are not available	***e) Internal Administrative Costs:*** Putting together demand and supply plans takes a lot of FTEs as well as FTEs to analyze the issues after actual levels hit
c) Excess & Obsolete Material: EOL levels above plan that must be scrapped / Especially relevant in decreasing demand markets	

a) ***Inventory / Working Capital:***
Inventory is the most direct casualty of poor forecasting efforts. Because forecasting is typically a result of the sales team's estimates, and their incentives offer differ from those in supply or demand planning, over-estimating sales can often cause high resulting levels of inventory (working capital), and therefore, reduce the company's profit in the end. In one engagement that AV conducted at a Mobile Device OEM where all of these costs were considered, over-ordered inventory accounted for about 40% of all costs associated with poor forecasting. Therefore, inventory costs due to poor forecasting can have a significant impact on a company's cash and working capital position on the balance sheet.

b) ***Expedites / Missed Revenues:***
On the other hand, if a company is too conservative (or depending on the inventory strategy, too aggressive) and under-orders material or components for use in manufacturing, they might be stuck with exorbitant expediting costs or in extreme circumstances even missed

revenues altogether. Expediting costs can also arise during up-markets where growing demand outpaces the supply chain's ability to deliver parts on time. AV was once engaged with a client that was consistently stuck paying over $3,000 for air-freighting per component from Europe whenever demand outpaced supply. These costs can add up quickly, and being in that situation too often can hinder a company's ability to meet demand and keep customers satisfied.

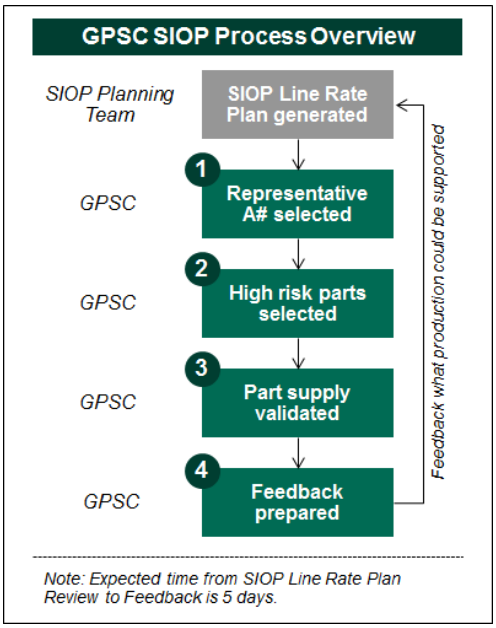
c) ***Excess & Obsolete Material or Finished Goods***:
So far we have covered how poor forecasting can create excess inventory and, on the other hand, how it can force companies to expedite parts or material or even miss revenue. However, what happens to this excess inventory after it arrives and does not go into production? – One would hope that it is held on to, considered for the next SIOP or IBP cycle and then used up during the next month or however many periods. In that scenario, inventory creates a dent in a company's balance sheet and time value of money, but does not create a cash outflow per se. That said, how about when finished goods are near the end of their product lifecycle and are faded out? Or when specs for previously ordered materials change before inventory is used up? – Though the rarity of these events vary by industry, in those cases, companies might be forced to write off inventory altogether.

d) ***Supplier Relationship Deterioration***:
Poor forecasting is not exclusively an internal issue. Our suppliers and customers are also directly affected by our forecasting practices. An issue that will be further discussed below, relationships with suppliers can be significantly deteriorated by poor forecasting. Not only that, but that deterioration can have a further impact on a company's supply chain down the line. For example, should a supplier experience that the forecasts they are basing their own production on rarely come true or are constantly off by a wide margin, they are prone to stop listening to the forecast, creating a typical 'boy who cried wolf' situation – When forecasts *are* correct, suppliers are unlikely to act on them.

e) ***Internal Administrative Costs***:
Depending on the organizational setup of each company, once aggregated, there could be plenty of FTE's on whom the forecasting efforts depend on. When AV sees that forecasting accuracy is exceptionally poor, a common recommendation is to at the very least cut down on the administrative costs on which that accuracy depends on. Because it is unlikely that the accuracy of the process will decrease even further, there should at least not be an overwhelmingly robust organization around it.

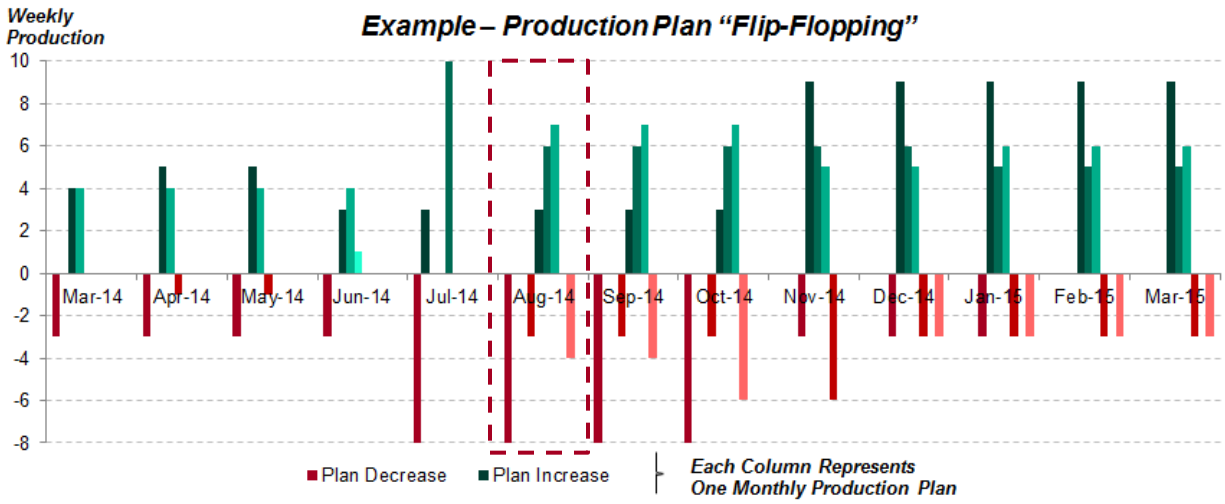
6. SUPPLY VALIDATION CASE STUDY

Recently, Applied Value was engaged by a Fortune 500 company in the construction equipment manufacturing industry. The company was facing challenges in a very specific area of the SIOP Process – for lack of a better term, Applied Value called it the Purchasing SIOP process. The purchasing SIOP process essentially involves everything between when Supply Chain receives the Line Rate or production plan, and when feedback on supply validation is delivered back to the demand planning team. The main challenge faced by the team was the fact that the entire Purchasing SIOP process was scheduled to take no longer than 5 business days – however, this was hardly the case. In fact, upon further investigating, AV realized that the client company's supply chain team could take up to 20 or even 30 business days to return with verification that supply chain could support production changes. This variance in the time it took supply chain to prepare feedback was causing many issues downstream, not the least of which involves holding up the rest of the SIOP process, including the participation of senior executives in the SIOP committee, and in extreme cases, the proper execution of even the following month's SIOP process.

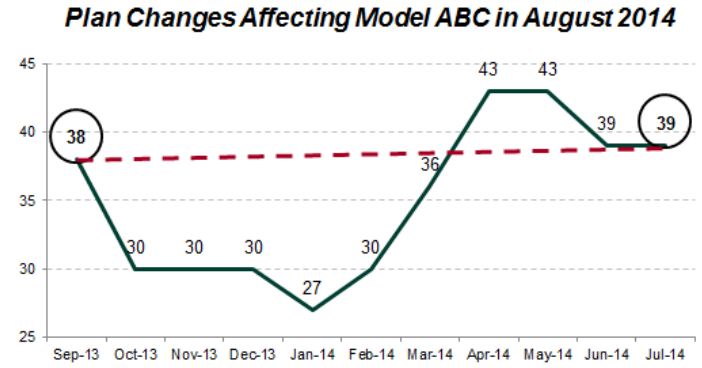


Needless to say, but when a sub-section of a 30 day process is taking 30 days by itself, there is more than one issue at play. On a high level, these could be attributed to several factors, but upon further review, Applied Value determined that the supply validation was one of the issues taking up most of the time. With over 500 suppliers, the chances are that every month at least one or two of those suppliers will have a hard time adjusting to the client's new demand requirements. However, despite the occasional lack of priority given to this topic by the company's GPSC, it is still a core activity of the team, as without proper planning for the future, the entire organization can be put on stake.

That said, let's consider the situation that a company such as this finds itself in: Most of its suppliers agree to take on the demand increases proposed to them by Supply Chain, while only a small segment has trouble achieving that month over month. However, what about suppliers that do *not* indicate that there will be any sort of trouble, but then cannot deliver when that demand actually takes place six or eight months down the line? – It is straightforward to assume then, that either that those suppliers are not taking our forecast very seriously, or they are not very serious suppliers altogether. For if they were, they would not commit to a demand spike that will put them at risk of delivering, and even more, at risk potentially losing an important account.



The figure above illustrates the aforementioned situation perfectly. Each column represents how the plan for that month increased or decreased. For example, for August 2014, the forecasts that affected it first decreased two times, then increased three times, and then decreased again. If you were a supplier for a part in this particular model, you would have seen the expected demand for that model decrease twice, then increase three times, and finally decrease once more at a level almost identical to the original one. If this kind of situation arose only once, it would not likely have a very negative impact, but as the graph shows, the situation happens for almost every forecast month. In total, suppliers are prone to stop 'listening' to the forecast, potentially hurting the supply chain down the line.



*The production level for Model ABC in August 2014 was forecasted in various Line Rate Plans, which started showing an expected production of **38** weekly machines in Sept. 2013, went through some changes, and wound up at **39** machines in July 2014, only 1 off of the original forecast*

So what is causing this discrepancy between demand communicated by Supply Chain to suppliers and the message that suppliers actually receive and act on? – The answer is forecasting accuracy. Because a company's forecasting is what determines what production or operation plans will look like for any given month, should they be consistently 'wrong' or inaccurate, then suppliers could grow not to even look at planned production increases, causing supply validation issues downstream.

The real concern with these kinds of problems, is that because we are validating supply that we are planning on using in production 6-18 months down the line, should there be a potential issue, we could be stuck way within any given part's lead-time, which in turn incurs a cost to the company. For example, during AV's latest engagement, the client sourced some of its more complex components from Europe for their US manufacturing locations. The lead-times for the parts was calculated at 90 days. At one point in time, an issue with the forecasting came up in the system, but the procurement function did not realize until well within the 90 days lead-time. In that case, AV's client had to eat up 2.5 MUSD in air freight costs just to be able to keep up with production.

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