USE VMI TO IMPROVE FORECASTING

By Larry Lapide, Ph.D.

(This is an ongoing column in The Journal, which is intended to give a brief view on a potential topic of interest to practitioners of business forecasting. Suggestions on topics that you would like to see covered should be sent via email to llapide@mit.edu).

I’ve always been a big believer that using downstream supply chain information can improve demand forecasting and planning. I’ve written several columns that discussed various aspects of this during my 12-year tenure in writing for the Journal of Business Forecasting (JBF). These discussed the potential use of downstream data including (as I’ve defined them): customers’ orders and replenishment forecasts, retailer warehouse withdrawals, Point-of-Sale (POS) data and forecasts, Vendor Managed Inventory (VMI), and Collaborative, Planning, Forecasting and Replenishment (CPFR) information. In these articles I proposed that one should be able to improve forecasting by leveraging these types of information since they are generated closer to the consumer. As such, demand changes ought to be detected sooner and be subject to less distortion from the “Bull Whip” effect that adds more noise to consumption demand as it moves up the supply chain. Generally, I’ve been preaching that these downstream data sources ought to provide much better “demand signals” than a manufacturer’s orders and shipments.

VMI DATA OUGHT TO BE USEFUL

Almost seven years ago I wrote an article in the Winter 2001/2002 issue of the JBF, titled “VMI Can Be Good for Your Forecasting Health.” In it I talked about the fact that the history of VMI had been mixed because often customers, such as retailers, had been coercing their suppliers to manage their inventories for them for free, with little perceived gain to the suppliers.

However, I maintained that when done well, VMI programs can improve inter-company supply chain operations because they help a supplier better coordinate product flow to customers. In this regard the benefits of VMI include ensuring that:

- A manufacturing customer’s production operations are not disrupted by material shortages.
- A distributor or retailer customer is not caught short on product availability.
- Neither a customer nor its supplier is holding more inventory than absolutely necessary to meet consumer demand.

While these benefits are worthy, they do not include what I believe to be the most important benefit of VMI: Improving the planning processes that indirectly help lead to these benefits, as well as others.

It seemed to me that if a supplier is managing a customer’s inventories and placing inventory replenishment orders for it, the supplier should have a good idea what that customer will need over the next several weeks. After all, to place these orders, a supplier’s VMI account team has to be working closely with the customer to ensure inventory is available for regular “turn” business, as well for any incremental promotional business that is generated from promotions that the customer will be running in the future.

DISJOINT PROCESSES AND SYSTEMS HAMPER VMI USE

I believe supplier forecasters have not been able to leverage VMI to improve their forecasting because of the dearth of VMI data available to them. This is primarily due to organizational as well as system constraints. Regarding the former,
VMI programs are typically supported by a supplier’s account team, comprised of customer-facing Sales and Logistics personnel. The team is chartered with managing a customer’s inventories and is primarily responsible for ensuring product supply. Customer stocking locations are treated by the team as just another location where inventories need to be managed.

When initiating a VMI process with a customer, a supplier’s main focus is externally oriented. That is, an account team will mainly be concerned with getting VMI to work well for the customer from a transactional viewpoint, and have minimal plans to possibly tie VMI to the supplier’s internal planning processes at a later date. Thus, VMI processes and systems are set up to focus solely on execution, not planning processes. Over time, busy customer-facing account teams do not communicate a customer’s replenishment needs to their forecasting and planning organizations.

Regarding the system constraints, since the VMI systems are initially set up to be independent of the other supplier systems, over time, any plans to connect them usually fall by the wayside as the IT department moves on to other priority projects. It becomes harder and harder to integrate the VMI systems into the internal planning systems. Eventually it winds up to be the case that unless someone becomes passionate about a belief that VMI data can yield significant benefits, no one wants to bother to do the business-case analysis needed to start an integration project.

This leaves forecasters and planners with little information about the customers’ future needs, except those they can glean from historical “sell-in” sales to that customer.

**A CASE STUDY IN USING VMI**

So while I’ve been discussing how the use of VMI information ought to be able to improve demand forecasting and planning (since I wrote that article almost seven years ago), I’ve been at a loss to find a company that has proved it to be the case, or even tried to do so. Most forecasters I’ve discussed it with didn’t think it was worth the effort.

That was until this past academic year when a large consumer products company decided to sponsor an MIT graduate student to look into it for them, as a part of his thesis research. I advised this student and I am pleased to report that his findings convinced the sponsor that there were significant gains to be gotten from leveraging VMI in short-term forecasting—for up to four weeks out. (Xihang Kou’s thesis is referenced below for more detail).

The analysis the student conducted used weekly historical demand data and forecasts for two product lines, a Dry and a Temperature-Sensitive product line. Demand data was collected for 29 products sold to two grocery retailers that differed in terms of the amount of promotions they conducted. The first, Customer A, extensively leverages weekly promotions to market merchandize, while the second, customer B, is an everyday-low-price marketer that runs few promotions. These were specifically chosen to assess whether VMI data was more valuable in terms of the amount of promotions they conducted. The first, Customer A, extensively leverages weekly promotions to market merchandize, while the second, customer B, is an everyday-low-price marketer that runs few promotions. These were specifically chosen to assess whether VMI data was more valuable in terms of the amount of promotions they conducted. The first, Customer A, extensively leverages weekly promotions to market merchandize, while the second, customer B, is an everyday-low-price marketer that runs few promotions. These were specifically chosen to assess whether VMI data was more valuable for promotional forecasting, than to forecasting for regular “turn” business.

For each customer four (4) types of data were collected:

1. Demand Planning Forecasts (generated by the Demand Planning department of the supplier)
2. Shipments (to the grocer from the supplier)
3. VMI Forecasts (of the grocer’s store demand generated by the grocer)
4. DC Inventories (in a grocer’s distribution centers [DCs])

Using this data to go back into history, a grocer’s weekly DC Replenishment Plan (RP) for each product was estimated for one to four weeks out. The plans were generated using three inputs: Starting DC inventories, VMI forecasts, and the VMI planner’s inventory replenishment policies for a DC.

The crux of the analysis involved comparing the forecast accuracies of using the Demand Planning (DP) Forecast and the Replenishment Plan (RP) to forecast actual shipments to each grocer’s DC for four weeks out. Mean Absolute Percent Error (MAPE) was used as the measure of forecast accuracy.

Table 1 represents summary findings from the student’s thesis. It depicts weekly forecast accuracy (i.e., MAPE) from one to four weeks out for each customer, and is broken down for Customer A by promotional versus non-promotional weeks. (As an aside, note that while the MAPE’s may seem high, recall that forecast error here is measured by week, by SKU, and by a customer’s DC [i.e., ship-to location], and there are no benchmarks around for this granularity of forecasting, that I know of.)

As can be noted for Customer A, the grocer that promotes weekly, the RP forecast experiences less than half the weekly error of the DP forecast for all weeks; One, two, three, and four weeks out. In addition, while this holds for both promotional as well as non-promotional weeks, the RP is even more accurate than the DP forecast during promotional weeks, with MAPEs over 66% lower. Since the grocer promotes heavily, weekly variation in its shipments is very high as noted by the magnitude of its forecast errors compared to Customer B’s. So the RP is even more accurate than the DP forecast because the VMI account teams can incorporate more realistic VMI impacts into the forecasts during promotional weeks, which the corporate demand planners lack knowledge of.

Similarly for Customer B, the grocer that is an everyday-low-pricing marketer, the RP forecast experiences significantly less weekly error than the DP forecast for two, three, and four weeks out. The
RP forecast MAPEs are 37%, 42%, and 47% lower, respectively. Also note that since this grocer does not promote heavily, MAPEs are a lot lower than Customer A’s.

So summarizing the student’s findings, the analysis showed that using the RP forecast rather than the DP forecast to forecast shipments to grocers would substantially increase the forecast accuracies for both regular “turn” and promotional demand, more so for the latter. The findings spurred the sponsor into doing a more thorough analysis to help justify starting a project to integrate their VMI systems with their internal forecasting and planning systems.

The findings also (happily) support a premise I’ve held for almost seven years: “VMI Can Be Good for Your Forecasting Health.” You might want to do your own analysis to prove it and add more reason to help your customers manage their inventories of your company’s products.

Table 1 from Xihang Kou, “Vendor-managed Inventory Forecast Optimization and Integration,” MIT Master’s of Engineering in Logistics thesis, June 2008.

**TABLE 1**

<table>
<thead>
<tr>
<th>MAPE Product DC week</th>
<th>Demand Planning Forecasts</th>
<th>Replenishment Plan Forecasts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Week out</td>
<td>2 Week out</td>
</tr>
<tr>
<td>Customer A</td>
<td>205%</td>
<td>214%</td>
</tr>
<tr>
<td>Non-promo Week</td>
<td>164%</td>
<td>175%</td>
</tr>
<tr>
<td>Promo Week</td>
<td>456%</td>
<td>452%</td>
</tr>
<tr>
<td>Customer B</td>
<td>59%</td>
<td>73%</td>
</tr>
</tbody>
</table>


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