Inventory: A Path to Prevention

A white paper authored by:

John Holton of Symphony Consulting, Inc.

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The old saying goes "an ounce of prevention is worth a pound of cure." In the last twelve months, companies throughout the U.S. have been trying to find a cure for their inventory ills. The costs have been staggering, especially for high-tech companies. Not only have they expended millions of man-hours trying to dispose of stagnant inventory, but these companies have also had to take inventory write-offs worth billions of dollars. Like so many ailments, the path to prevention starts with an understanding of the elements that cause inventory exposure and ultimately an inventory build-up. This is a complex problem with complicated dynamics and a comprehensive treatment of all the issues could fill a book. The purpose of this paper is to highlight the areas that represent the greatest risk and the greatest opportunity for companies to effect a positive step towards inventory prevention.

Root Causes of Inventory Build-up:

Forecast and Sales Practices

It is obvious that over-forecasting can cause an inventory build-up. If a company forecasts and plans to build 100 units of a product but only sells 70 units, it is likely that there will be some residual inventory. What is less obvious is the underlying reasons for over-forecasting. No one has yet patented a means to create the perfect forecast. Forecasts are bound to be wrong much of the time. The degree to which they are wrong can be tied to three critical elements: people, processes, and approach.

- **People** – The question here is: how important is the task of forecasting to the people involved and how well have they been trained? Companies approach forecasting in many different ways and no particular methodology can be "right". There is however, more risk in certain situations. Is forecasting a significant portion of a person's job description with expectations and metrics clearly defined? Or is forecasting barely mentioned in the job description and does it tend to be thrown together right before a scheduled forecast review meeting? There is more risk in the latter situation. If forecasting is important to a person's job they are more likely to seek the knowledge they need to be successful. They are also more likely to put the energy into creating a better forecast.

- **Processes** – Many questions arise in this area. How well are the processes defined? What tools are used to generate the forecast? How sophisticated are the techniques? What information is included - trends, seasonal factors, cyclical patterns? How is information gathered from the stakeholders? What role do they play in approving the output? What external factors are included - competitors, industry issues, local and global economic factors? What data exists to measure accuracy and correct models over time? What checks and balances does the forecast go through before it is added to the MRP system? Who has access to the system to modify the forecast? What accountability exists for the people who manage the forecast in the system? It could almost go without saying that a robust process, with good controls and follow-up leads to a better forecast. The surprising part of our research is that, given the impact of the forecast, companies do not but more effort into refining the process.

- **Approach** – What is the stated goal or unstated goal of the forecasting process? How are the people involved measured with regards to the forecast? Is there more pressure to forecast enough to make shipments or to forecast just enough to avoid extra inventory? The company's attitude about forecasts influences all of the decision makers. If people get the message "do not miss shipments" they will forecast much more aggressively.

Another problem in the area of Forecast is the process and the policies that companies use to add new demand into the forecast. This is a problem any time demand is loaded inside of the total

lead-time of the product. The total lead-time is the amount of time it takes to secure all of the lower level materials and build, test, and package the product. If demand is consistently loaded inside of the total lead-time, chances are that some inventory will be stranded due to missing parts. The next section has a more detailed explanation of this.

The last area in this section is also related to the total lead-time. The issue is the inventory exposure that a company assumes with the difference between total lead-time and the lead-time that is quoted to customers. If a company quotes a lead-time of four weeks for its product but has a total lead-time of sixteen weeks to make the product, then the company has twelve weeks worth of exposure. In other words, the company has to begin making an investment in the product twelve weeks before it will get an order from the customer. Given competitive pressures, a company is sometimes forced to accept this exposure. The key for a company is to manage its portfolio of products such that it can minimize exposure for the company.

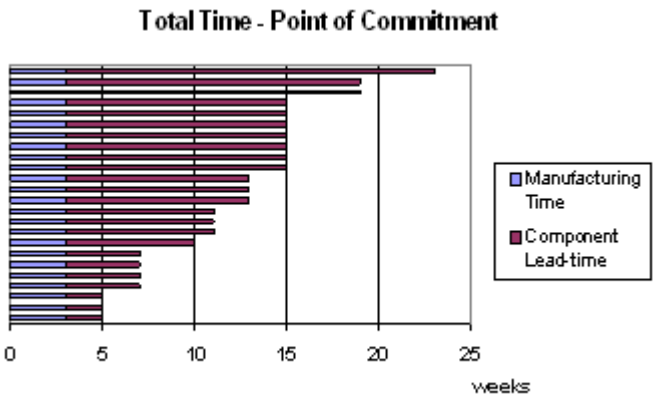
Depending on competition, ease of market entry, loyalty of the customer base, etc., a company may be able to push the quoted lead-times much closer to the actual total lead-times for specific products. On the other hand, understanding this exposure may motivate a company to look at the supply chain for key products and develop creative ways to shorten the total lead-time and reduce the exposure. For most companies, the first step is just understanding this issue and making a conscious and well-informed decision about customer lead-times, given the total lead-time and corresponding inventory exposure.

Unmatched Sets of Inventory

A product cannot ship until all the pieces to build a product are available. In most MRP systems, inventory purchases are planned with a due date close to, or equal to, the start of production for the product. For a variety of reasons, inventory does not arrive when it is expected and the bulk of the parts sit idle waiting for the last piece. The cumulative impact of this can be significant. A company that has a system that should produce 12 turns a year could easily see that drop to 8 turns a year as a result of start dates slipping an average of only 1-2 weeks.

To make this point further, consider one mid-sized company we studied. This company had revenues of about $250 million and had a product line that was low to medium volume and high mix. We looked at builds that were delayed due to missing components. We could calculate the amount of inventory that was sitting idle (material value of product minus the value of the missing piece(s)) and we could calculate the amount of time inventory sat idle (planned start date versus actual start date based on component arrival). In addition we looked at builds that were due to start in the near future. We could make a similar calculation based on any delays caused by the expected arrival of the latest component. In total, we were able to show that over 49% of the component inventory for this company was attributable to delays caused by mismatched sets of inventory. This is not unusual. The numbers get even worse when there is a time of supply shortage such as we had in late 1999 and 2000.

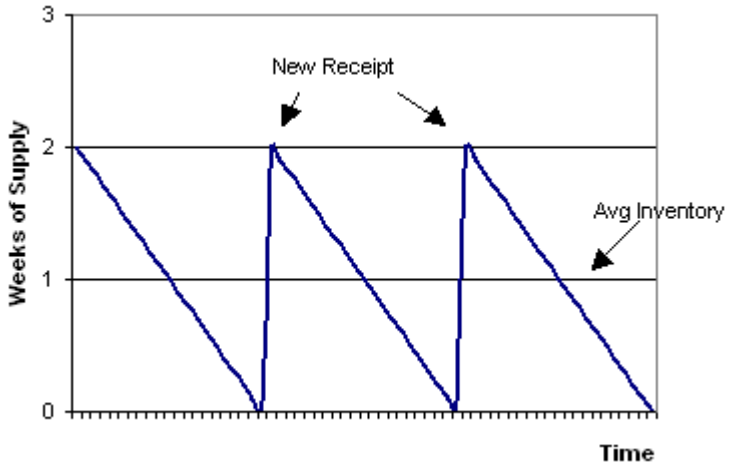
The natural question to ask at this point is: what causes the missing last part? Some of the problems are well understood: late deliveries by suppliers, quality problems that cause supply to be unavailable and stockroom control issues that cause surprise inventory shortages. For reasons other than the inventory impact, companies should have strong programs to manage these issues.



The one area that is understudied, and less understood, is the mismatched sets that are caused by unexpected demand. When new demand is loaded inside the time it takes to secure supply for each part, there is a good chance that one or more parts will be missing at the planned production start date. Most companies have not sufficiently studied, and do not fully understand, the total lead-time for their products. As a result, demand is loaded at the date it is needed and the planners and buyers do their best to meet the date. The problem occurs when these groups are set-up to fail on a regular basis because the organization lacks knowledge on what is reasonable.

To demonstrate this, let us look at an example. Company A has a product that where the average lead-time for the components is 9 weeks. The manufacturing time to convert components into finished goods is 3 weeks. Company A has no special buffer strategy for its products and regularly loads new demand at 12 weeks. That means that roughly 50% of the components are going to be ordered with less than full lead-time each time demand is added. Certainly, the buyers in Company A will work their magic and be able to secure most of the parts needed. Chances are also high that there will be one or two parts that are problems. Each time this happens, it is likely that some inventory is going to be stranded waiting for the last part. As the data had shown previously, this can have a significant impact on inventory.

Companies have two basic opportunities to deal with this problem. They can spend the time to understand their supply chain for key products and set policies for adding new demand that live within the constraints that exist. Alternately, they can work with suppliers and internal manufacturing operations to address constraints and enhance the flexibility of the supply chain to meet the requirements for changing demand. This basically means setting up a postponement model for a company's extended supply chain. This is not an easy task and companies will get the best return if they focus on strategic products. In either case, the important point is to make the reality of the supply chain's flexibility equal to or greater than what the company requires in the way of flexibility. To have the opposite (i.e. the company's requirements are greater than the supply chain's capabilities), is a recipe for frustration and unneeded inventory.



Product Changes

Companies are continuously changing and updating their products. Sometimes the purpose is to make a product better or to lower product costs. Other times, companies are compelled to update their product due to component obsolescence, reliability problems, or safety issues. Whatever the reason, each time a product change occurs there is a risk of creating unneeded inventory. This inventory falls into two broad buckets: inventory that is made excess or obsolete because it is removed from the bill of materials, or inventory that becomes stranded because the change cannot be implemented as planned and it sits idle as the situation is rectified. In both cases, the problem is usually caused by an imperfect process. Given the level of human interaction and the cross-functional coordination required, the change process is susceptible to error.

Once a decision has been made to make a change, there are two major phases to the change process: (1) setting the effective date; (2) managing the effective date based on changing conditions. Performance in each drives the results and the inventory exposure for a company. Let's explore the method of setting the effective date. Except in cases where a serious safety or quality problem is at issue, product changes can normally be phased in at some point in the future. The key to determining that point is having all of the pertinent information and driving the appropriate analysis to determine the costs of various scenarios. Unfortunately, few companies have a robust process for gathering all of the right information and even fewer have the tools to process the information and make complex trade-offs on build-outs. The result is poor decisions, and in turn, excess inventory.

Even in those cases where a thorough analysis is performed and the optimal date is set for a change, the process can falter. The business world is dynamic. An organization must manage and update the planned implementation of a change as the world changes. For example, let's say a company establishes the effective date for a change based on when a critical component is due to arrive. The supplier making the new component informs the company that there has been a glitch in the production ramp of the new part and the first deliveries will be three weeks late. Unless the company updates the effective date, there will be a pile of inventory waiting for the new part to arrive and there will be no shipments because there is not enough of the old part. Companies need to establish mechanisms to manage effective dates and to trigger action when critical assumptions change.

Order Policies, Lead-times, and System Parameters

These are the inventory drivers for a company when everything goes right. In the other categories, something had to go wrong (e.g. poor forecast, late delivery, botched change, etc.) for the inventory to build up. This category is different. An MRP system will drive inventory based

on the parameters loaded and the policies that dictate the parameters. Every system will attempt to minimize inventory based on the information it is given. When things go as planned in the system, a company is left with the fundamental level of inventory that these parameters create.

An example might help illustrate this point. If a company has an order policy for "A" parts that calls for the buyers to purchase two weeks of supply, then the system will recommend purchases in two-week buckets. Unless there is safety stock or buffer times loaded, the system will plan the next delivery of an "A" part on the day the inventory is scheduled to run out. The inventory from this part will fluctuate between two weeks at the peak and zero weeks at the low end. The average will hover around one week's worth of supply.

Until the policy and the parameters change, it is unlikely that this fundamental level of inventory will change. Another example has to do with manufacturing lead-times. If a company has its internal production lead-times set so that the cumulative lead-time for a product is four weeks then everything will be planned to start four weeks in advance of the due date for the product. Therefore, it makes sense that a company in this situation will generally have a minimum of four weeks worth of WIP inventory. Again, the system parameters drive a fundamental level of inventory.

The problem in this area occurs because many companies do not manage their parameters very well. This area gets very little attention. An example of this is the practice in many companies of setting order policy based on a part's A-B-C classification. This practice was popularized in the 1940s and '50s and is still surprisingly prevalent. The truth is that it is terribly inefficient. When asked, few companies can explain why they follow this practice. Even fewer have studied in detail the benefits of alternative methods (see Order Policy Analysis and Recommendations white paper).

Other system parameters seem to go through cycles of attention. In fact, some companies over-react and cause more harm than good. In the current economic climate, companies have been very sensitive to inventory exposure. They have cut lead-times to a bare minimum and have completely eliminated any type of buffers (e.g. safety time, safety stock, shrinkage and yield factors). While this may satisfy the need for action now, it may lead to bigger problems later. Most companies will not revisit their decisions like this until there is a crisis at the other extreme. Suddenly, faced with reasonable demand and a normal supply market, companies will find that the lead-times and buffers they have loaded are unrealistic for the market. The pendulum will swing the other way when they miss critical customer shipments and end up sitting on inventory that is stranded due to mismatched sets. Companies need to establish an on-going process to review, measure, and update these parameters so that they can appropriately manage this fundamental level of inventory.

Conclusion

The issues that drive inventory are varied and sometimes complex. Companies have been fighting the symptoms (i.e. high inventory levels) without necessarily fixing the problems. It is only through a solid understanding of the root cause of inventory that we can hope to effect a lasting improvement to the level of inventory within a company. The purpose of this paper was to increase the awareness of the underlying issues and to facilitate the movement towards prevention of inventory. Hopefully we have been successful.

John Holton is the Co-founder and President of Symphony Consulting, Inc., a Silicon Valley supply chain consulting firm. For more information, visit www.symphonyconsult.com.

