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Taking Control: Improved Inventory Visibility Leads to Lean Success

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Executive Summary

In general, manufacturers have less inventory today than they had in past years. Partly, this is the result of cost-reduction efforts in response to a challenging business climate. But inventory levels are also lower because many manufacturers have put a lot of time and effort into lowering inventory investment through such programs as lean manufacturing, just-in-time, the use of kanban pull signals and other initiatives.

While inventory reduction is certainly a worthy goal – reducing operating expense and freeing up cash as well as having a good effect on agility and responsiveness – with less “cushion” there’s more room for error and therefore mistakes and surprises can be costly.

When looking at inventory levels and how to reduce them, it is important to understand the role that inventory plays in the dynamics of plant operations. Proper visibility and controls allow that reduction without an increase in stock-outs and other nasty surprises. Only then should we look at techniques and equipment that can help us toward our goal of painless inventory reduction.

This paper focuses on inventory inside the plant – from receipt of parts and materials to the shipment of finished products. Similar concepts and concerns apply to inventory in the supply and distribution networks but, of course, the tools and techniques will differ.

The Purpose of Inventory

Inventory serves two general purposes in a manufacturing environment. The first is to act as a decoupling point and buffer between supply and demand.

The second purpose is to compensate for variation and uncontrollable disruptions – things like unexpected scrap, inaccurate records and forecast error. It's useful to look at the different types of inventory and the purpose of inventory in each situation.

Parts and Materials

Purchased and manufactured items are often acquired in quantities that exceed actual needs for economic reasons – a demonstration of the need to decouple supply from demand for good business reasons.

Quantity price breaks and economic order quantities encourage larger orders. Fewer, large purchase orders reduce transportation and handling expense. In addition, order quantities are influenced by replenishment lead time – the longer the lead time, the larger the inventory received and carried between replenishments.

The key to raw material inventory reduction is to work with suppliers to shorten lead times and make smaller orders both economically attractive and operationally effective. Collaboration really pays off. You should be willing to share your production schedules and needs with the supplier and work together to develop a supply plan that meets your needs while at the same time allowing them to operate efficiently and reliably.

A Case for Safety Stock?

Companies will often add an additional quantity for “safety stock” as a buffer against the unknown and the uncontrollable – late delivery, higher than expected reject rates, inventory record errors, higher than anticipated usage, etc.

The proper amount of safety stock can be mathematically determined from the risk of these surprises and disruptions (history of stock-out situations, how often and the quantity short).

There is a straightforward risk-reward relationship here – the more safety stock, the higher the service level (lower risk of stock-out). If you can lower the risk, a smaller amount of stock will provide the same service level. Lower the risk by tightening up on inventory control and record accuracy, working with suppliers to improve reliability and quality, and stabilizing production schedules to reduce demand variation and uncertainty.

Work In Process (WIP)

The amount of WIP inventory is directly related to the production lead time and vice versa; the longer the production lead time, the more WIP inventory. WIP inventory serves the same purposes that it does for raw materials as outlined above – for economic reasons, decoupling, and as a buffer against variation. Decoupling, in this situation, is to accommodate different production speeds between workstations and/or work flow management in a discontinuous (intermittent) production environment.

There are a number of techniques for reducing inventory on the plant floor – far too many to go into in this paper – and the solutions will vary with the production environment. Suffice it to say that WIP inventory does serve a purpose, which is to keep production moving despite variations in rates, routings, priorities, etc. If you want to reduce WIP, be sure that you take care of the underlying reasons that it is there in the first place; better coordinating workcenter rates and reducing queues, for example. Otherwise, WIP reduction will lead directly to shortages and interrupted production schedules and/or expensive and inefficient expediting.

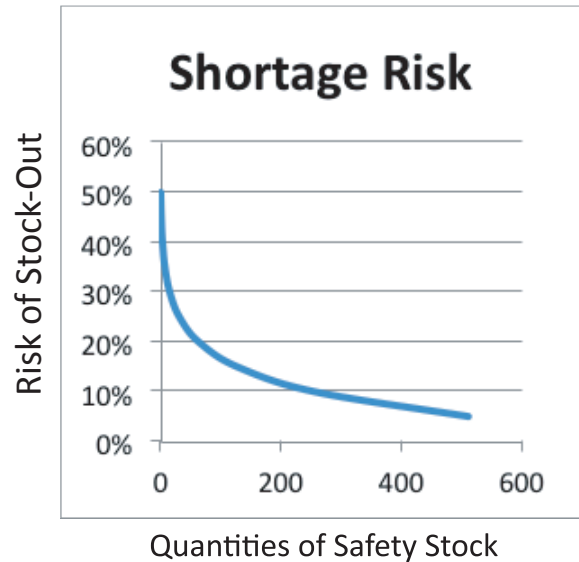
Finished Goods

As with the other types of inventory, finished goods decouple supply and demand (primarily in a make-for-stock environment) and also buffer for uncertainty – in this case the uncertainty is forecast error.

The “Right” Inventory Level

The “right” amount of inventory to provide the desired service level is easily calculated from a measurement of forecast error. Of course the economics of production lot sizing will affect inventory levels unless the plant is truly demand-driven in the sense that nothing is made until there is an order for it. Again, record accuracy, quality issues, and other variables will affect the results.

Graph 1



The Value of Accurate Information

With all three types of inventory, information, in the form of accurate records, can reduce uncertainty and lead to painless inventory reductions. Inaccurate inventory records are the root cause of many unexpected stock-outs. If your planning system thinks that there are 100 widgets in location XYZ, all 100 will be assumed to be there and will be allocated to jobs or customer orders as needed. When the worker goes to the location and finds only 97, that's a problem that could disrupt production or hurt customer service. The purpose of safety stock is to position a few extra items in stock to make up

Accurate, timely reporting provides early notification of inventory shrinkage.

for such shortages and thereby avoid the disruption. If you can reduce the potential for such surprises, you can reduce the amount of safety stock without increasing the risk of stock-out.

Accurate and timely reporting also provides early notification of impending situations like inventory shrinkage (unexpected or unplanned reduction in quantity on-hand, whatever the cause) and higher than expected usage, for example. The sooner these situations come to light, the more time you have to react and take action to expedite new supplies or change schedules to accommodate the lower available quantities.

A Look at Lean

Before getting into discussions of inventory tracking techniques, we should address lean manufacturing and the focus on eliminating non-value-adding activities. Undoubtedly, reporting activities do not add value to the product. That's why many lean initiatives seek to eliminate reporting wherever and whenever they can.

On the other hand, shortages, disruptions caused by shortages, expediting, and missing customer promise dates are much more serious wasters of time and effort that can be avoided by better records and controls. And don't forget the ability to reduce inventory, another "waste" target of lean programs, through a reduced need for safety stock. Inventory reduction can often be enabled through better reporting, even within an aggressive lean initiative. Remember that the use of kanbans and other visual techniques does not eliminate the need to maintain accurate records of in-house inventory.

Tracking Inventory Reality

Inventory tracking is all about making the computerized records match the physical reality as closely as possible, in as timely a manner as possible. Today, that means scanning to track inventory movement – primarily through barcodes. Scanning is much more timely than any manual reporting technique and has been proven to reduce errors considerably.

Most companies report the basics – purchase receipts, issues from stock to production, receipts from production to stock, and shipments to customers. And that may well be sufficient, depending on the company's needs. But even if this is the extent of the reporting, timeliness and accuracy are still of primary concern. Errors and delays increase uncertainty and increase the likelihood of stock-outs or the need for safety stock to prevent them.

Any company that is serious about inventory record accuracy will have already implemented a well-executed and managed cycle counting program. Cycle counting will help identify the source of errors and is a proven tool for maintaining high levels of inventory accuracy.

Useful Techniques

The following are observations on inventory tracking and reporting techniques that have proven useful for many manufacturers.

Receiving – label everything that comes in the door. Suppliers can provide the labels so parts are already self-identified when they arrive. Attaching machine-readable identifiers on receipt ensures that materials and parts can be tracked reliably throughout the process. Physically small and low value parts can be group tagged with labels on bins, boxes or containers.

Moves – scan everything that moves. It's good to know what you have on-hand. It's even better to know precisely where it is. While movement should be reduced wherever possible (a common lean objective), scanned movements and location detail (from and to locations) will help keep close tabs on where everything is for quick and efficient retrieval.

Locations – scan to track movement to and from locations. It is absolutely necessary to have a disciplined location identification scheme with each location tagged for scanning. Most companies use a hierarchical location numbering scheme – building or sector, aisle, bay, level, pallet – and permanently mount barcode labels at each location so picking and put-away activities can be logged efficiently.

Manufacturing – scan and load all material to lines/workcenters; scan every WIP move. There’s no benefit to tracking moves within a cell or line (continuous or flow production) but it is important to track movement between work areas in a discontinuous or intermittent work environment and outside of cells and lines in a flow work environment. Effective shop floor scheduling and production control rely on up-to-date information about job status and location. Armed with this level of visibility, companies can shorten lead times and that leads to reduced WIP inventory.

Inspection – add a quality inspection associated with every container. Many companies do a good job of scanning receipts, issues and moves but neglect automation in the inspection area. Since all items and lots are labeled, receipt into the inspection area and release to stock (or return to supplier) should also be scanned to insure timely update and correct identification and tracking.

Outside services – scan out to and in from outside firms. Outside processing can include a significant amount of your manufacturing lead time so it is important to track jobs as they go out to and come back from service providers.

Shipping – label each shipping container. Scanning makes it relatively easy to log every item that goes into a container and the identity of the container itself (as long as there is a container label with barcode). As containers are loaded onto pallets and/or moved into trucks or containers, scanning provides a full record of exactly where each part or product is and what is in every shipment. This is especially important if there is ever a need to make a claim for loss or damage, inform customers of status and projected arrival date, or to redirect product after it leaves your dock.

Batch/Lot and Serial Numbers

If your products and/or materials and parts are batch or lot number controlled or serial numbered, there is extra incentive to label everything on receipt, scan all movements, and maintain complete records of source, usage, and final destination.

Emerging Technologies

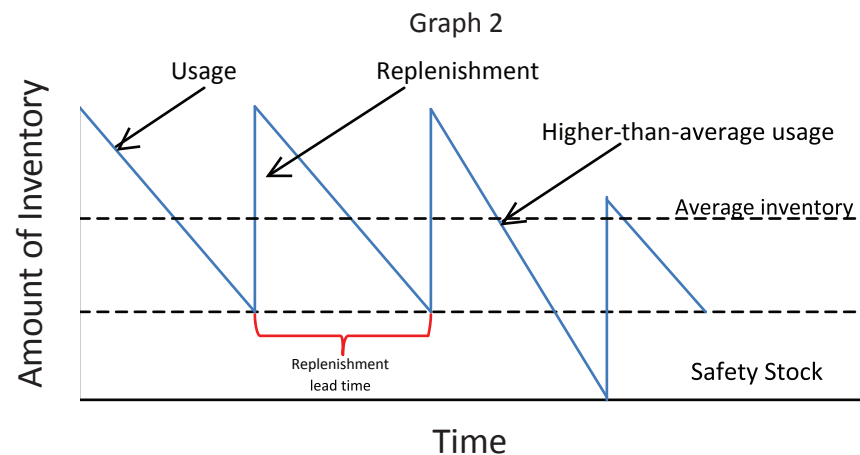
In the not-too-distant future, emerging technologies like RFID (Radio Frequency Identification) “smart” tags that communicate with readers without conscious human intervention and positioning technologies like GPS will continue to offer new and more efficient ways of tracking inventory and the movement of goods. Today, those technologies are too costly for all but the more expensive items but prices will continue to drop as the technologies mature and volumes increase. Other alternatives like voice recognition, pick-to-light, load cell-based bin management systems and others can also be leveraged to further automate the tracking function.

5 Key Considerations in Inventory Reduction

As mentioned, inventory reduction is often a primary goal of lean initiatives, since inventory adds no value and is therefore considered waste. Nevertheless, some inventory is necessary to keep production moving smoothly in a world of variation and uncertainty. The solution is to understand where and why inventory is needed, what drives the amount of inventory required, and what can be done to reduce the required amount without causing shortages.

Inventory Location

The “where” question is answered by the lead-time relationships and the decoupling points that support your market strategy: finished goods for ship-from-stock; raw materials for make-to-order; and somewhere in between for most manufacturers. Having the right kind of inventory at the right place and time is the most economical strategy.



Inventory Volume

As to “how much,” here are the factors to consider. The base amount of inventory is determined by the lead-time relationships and will no doubt vary through the replenishment cycle from a maximum amount right after receipt of the replenishment quantity to the minimum amount just before the next replenishment arrives. Average amount is halfway between these two extremes, if the flow of material in and out is relatively stable.

Minimum Level

The minimum inventory level is theoretically zero but is adjusted by the amount of “just in case” inventory, otherwise known as safety stock, you need to deliver the desired service level or risk of stock-out. Once that equilibrium is established (the right amount of inventory to deliver the desired service level), inventory can only be lowered if one of the other two factors changes. In other words, lowering inventory without changing risk (variability or uncertainty) will lower the service level (see Shortage Risk graph earlier in this report). To lower inventory and maintain the service level, the risk must be lowered. (See Graph 2.)

Consider Risk

One way to lower risk is to work more closely with customers to improve forecast accuracy. Another is to stabilize production (this is helped by a better forecast) so there's more predictable inventory usage. Shortening manufacturing lead times reduces WIP inventory and, incidentally removing excess WIP inventory (queues) will reduce manufacturing lead times in an intermittent production environment. Raw material buffers (safety stock) can be reduced with better supplier performance, such as on-time delivery and low reject rates.

Assess Inventory Accuracy

The other significant source of uncertainty is inventory record inaccuracy. An aggressive cycle counting program, with a focus on identifying and eliminating the source of errors, is the definitive methodology for improving inventory record accuracy. Reporting can be made both more accurate and more timely by the use of appropriate technologies for reporting, including barcode scanning.

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Author of six books, hundreds of magazine articles, and numerous white papers and reports, Dave is an independent consultant, analyst and freelance writer serving both the developers and the users of software and systems for manufacturers. For thirty years, Dave has helped manufacturers to select, implement, and get better results from their systems. He writes the Enterprise Insights column for APICS magazine and is a regular contributor to various industry blogs and discussion threads. For more information contact dave@daveturbide.com

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