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A Ventyx Whitepaper:

Leveraging Inventory for Maximum ROI

How inventory optimization helps asset intensive enterprises reduce costs and increase productivity




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Executive Summary

Asset intensive enterprises face unique inventory challenges. Businesses in industries like mining, utilities, transportation, government and defense must hold and manage large, expensive maintenance and production inventories. Lack of a critical part at the wrong time can be costly: Unplanned shutdowns mean lost revenue and customers, and, in some cases, will have safety or environmental impact. Rapidly evolving requirements in compliance and risk management mean increasing pressure to manage assets to higher standards, while fluctuating markets and rising production costs deplete margins.

Inventory managers are challenged to keep inventories as lean as possible while still maintaining required service levels to maintenance. To meet these challenges and maintain a healthy bottom line, asset intensive organizations are looking for ways to leverage the utmost value from lean inventories. Gaining even a small edge in inventory management efficiency can pay huge financial dividends.

Inventory optimization — employing statistical processes to keep inventories at the most ideal levels to both drive productivity and keep costs low — can generate significant savings and free up working capital. Optimization also means ensuring that the true importance of each item to maintaining production is reflected in stock levels. Asset intensive organizations with large inventories can use this approach to drive down inventory costs while maintaining top productivity.

A well-functioning inventory optimization process provides the means and capability to make better-informed decisions faster. With a best-of-breed inventory optimization solution, an inventory manager will have tools to keep inventory lean while avoiding potentially costly stock-outs. By enabling collaboration between the supply and maintenance functions, an inventory optimization solution helps drive greater efficiency and productivity. With the right tools, processes and techniques in place for successful inventory optimization, asset intensive organizations can mine greater revenue streams from critical stock and equipment.

To help asset intensive enterprises manage maintenance and production inventories for optimal cost, efficiency, and return on investment (ROI), Ventyx launched the Ventyx Critical Inventory Optimization (MCIO) solution. With MCIO, production and maintenance inventory managers have the technology tools to automate the sophisticated analysis functions necessary to continuously assess and adjust critical inventory levels, enabling them to cut inventory costs, eliminate waste, and ensure top performance.

Unique Inventory Challenges for Asset Intensive Enterprises

For asset and maintenance intensive organizations, keeping facilities and equipment at top performance not only requires huge and expensive maintenance, operations and repair (MRO) inventories, but also stores of auxiliary items, like tools and proper clothing and protection for employees. A conundrum for asset intensive businesses is that inventory values and costs are rising, while production output levels have remained the same. Rising costs can quickly consume production margins and take a bite out of profits.

These rising costs are carrying costs, which are the costs of holding onto inventory. The industry average range of carrying costs is from 25% to 55% of total inventory value. Therefore, a $100M inventory has carrying costs between $25M and $55M annually. Savings of 10% on total inventory would be a $10M reduction, which is a savings of $2.5M to $5.5M annually, year over year of bottom line profit. Those savings don't even include the mitigation of risk to production disruption due to critical part stock outs.

Carrying costs consist of:

- Cost of Money – 6-12%
- Taxes – 2-6%
- Insurance – 1-3%
- Warehouse Expenses – 2-5%
- Physical handling – 2-5%
- Clerical and Inventory Control – 3-6%
- Obsolescence – 6-12%
- Deterioration and Pilferage – 3-6%

The Conflict Between Carrying Costs and Maintenance

The nature of inventories that asset intensive businesses must hold is extremely complex, combining sheer numbers of unique items with very high capital investments. Inventories may range from tens of thousands to millions of individual line items and may be valued in the tens of millions to hundreds of millions of dollars. Different items move in and out of inventory at varying speeds, from very fast – several turns in a week – to as slow as one turn every few years. For example, a maintenance department may issue dozens of pairs of work gloves per day. On the other hand, a utility may need to stock a certain expensive spare that my get used once in a decade. For the enterprise, these items must all be evaluated from the perspective of what is the ideal, most cost-effective – optimal – number of items to have on hand at any time.

The maintenance managers usually want to hold as many items as possible, “just to be sure,” in case of unplanned breakdowns or supplier stock-outs. Their job is to avoid costly breakdowns due to unplanned outages. Inventory managers, on the other hand, need to closely monitor and manage the cost of acquiring and holding inventories, while still meeting the service levels maintenance requires. While the maintenance staff is anxious to avoid stock-outs of critical materials that might prolong a shutdown, the CFO is pressuring the inventory manager to minimize stock levels to avoid tying up working capital in inventory.

This fundamental conflict frequently results in an inflated inventory that still leaves maintenance staff feeling unsure that there is really sufficient stock of critical equipment spares. Resolving this problem requires a unique approach that brings together the needs of maintenance and supply and enables them to work together for a common solution.

The ultimate goal of inventory optimization is to have the right amount of inventory, at the right price, in just the right places, to meet service and revenue goals — but no more than that. To ensure that stock levels truly reflect the importance of each item to maintaining production, the inventory optimization process takes into account the many variables used in classifying each and every item that must be purchased: cost, lead time, criticality, and usage profile (frequency of use, historical usage).

Through this process, inventory managers can satisfy the CFO’s demand to keep capital investment and inventory holding costs as low as possible, while being able to reassure maintenance that they’ll have what they need to ensure maximum productive uptime of essential equipment. Best of all, the enterprise can reap significant savings.

A Success Story: QAL Cuts Inventory by 14 Percent

Queensland Alumina, Ltd. (QAL) is one of the world's largest alumina refineries, producing some 4.0 million tonnes of the world's best smelter grade alumina per year. With an estimated value of $60 million AUD, QAL is a joint venture of Rio Tinto Alcan Alumina & Bauxite Company.

The Challenge

QAL had no way to accurately measure and monitor inventory levels to minimize the risk of a critical stock-out. "We wanted a system that was flexible so that we could apply inventory management strategies that reflected our experience along with those supplied by an analytical tool," said supply superintendent Brian Warner. QAL turned to the Ventyx Critical Inventory Optimization (MCIO) solution.

The Ventyx Solution

"MCIO, with its modern software platform, easy to use screen layout, readily customizable reporting tool and the fact that you could see how the recommended settings were calculated, made it an obvious choice," said Warner. "MCIO can be implemented and operating at less cost and in a shorter timeframe than its competitors. The MCIO rollout has been a very smooth process with completion on time and within project budget," he added. And, the solution gives the extended inventory management team the ability to easily collaborate while focusing on individual areas of responsibility.

The Results

Providing consistent, demonstrable results over time, the MCIO solution has helped QAL reap significant inventory savings while also reducing the risk of production disruption due to critical items being stocked at too low a level:

- All critical items identified and stock levels optimized to prevent stock-outs.
- Global control of stock levels over the entire inventory making adjustments easy to suit changing circumstances.
- A site wide understanding of the concepts involved and a lexicon of terms enabling site wide buy in on the process.
- Accurate Planned Delivery Times calculated every order cycle for each material to improve reliability of maintenance scheduling and stock level calculations.
- Vendor performance improved by allowing for review of delivery performance at low levels.
- Fully integrated with SAP to enable materials to be constantly readjusted to optimal levels through a simple monthly automated process.
- Improved vendor management and performance by using the solution to review vendor delivery performance at the SKU level.
- $5 million AUD in savings

> "Queensland Alumina has realized a 14 percent net reduction in inventory holding while mitigating the risk of production loss due to stock-outs at our Gladstone alumina refinery using Ventyx Critical Inventory Optimization."
>
> BRIAN WARNER
> SUPPLY SUPERINTENDENT
> QUEENSLAND ALUMINA, LTD.

Gut Feel Is No Substitute for Accurate Forecasting

Even with a thorough understanding of the principles involved in setting stock levels, the sheer volume of items involved limits the inventory manager's ability to make a difference to more than a small percentage of items. Inventory optimization efforts, where conducted at all, have most often been a manual process. Doing it just once a year is labor-intensive and prohibitively expensive.

A basic role of an Enterprise Asset Management system is to automate replenishment of a stock item when the stock on hand has fallen below a nominated minimum value. In many cases Min/Max or ROP/ROQ (see sidebar) settings are influenced more by a desire to avoid stock-outs than the goal of achieving a realistic balance between the cost of holding the item and the value of the item to the business.

Yet, an arbitrarily "safe" Min/Max combination can be cut by as much as 50 percent without affecting the service level over many replenishment cycles. And, the value of capital tied up in inventory will be reduced significantly. The process is complicated – but relying on gut feel can be expensive.

Fundamentals of Inventory Replenishment:

Min/Max and ROP/ROQ

The replenishment process follows either the Min/Max method or the Reorder Point (ROP)/Reorder Quantity (ROQ) method. The terms Min and ROP are actually synonymous.

Using The Min/Max method, the system will order to a nominated maximum value from whatever the stock on hand value happens to be after falling below the minimum value: Suppose the Maximum (Max) = 20 and the Minimum (Min) = 10. If the stock on hand (SOH) was initially sitting at 15 and an issue of stock occurred of 8, causing the SOH to drop to 7. The Min would be broken and an order placed for 20 – 7 = 13.

Using The ROP/ROQ method, the system will order a nominated quantity after the ROP has been broken: Suppose the ROQ = 12 and the ROP = 10. If the SOH was initially at 15 but an issue of stock occurred of 8 that would then drop the SOH to 7. The ROP would then be broken and an order placed for 12.

Guiding Principles for Industry Optimization: Classify, Forecast, Automate

To truly provide the inventory control an asset intensive organization needs, an automated inventory optimization system should provide robust functionality to support these guiding principles:

- Inventory classification
- Criticality analysis
- Catalogue cleansing
- Lead time analysis
- Usage forecasting
- Usage profiling
- Displayed calculations
- Automation
- Accountability

First, the organization will identify the inventory segment where the greatest savings can be made, and apply these eight key principles. An iterative process is employed to analyze and optimize the classification of items in order of greatest need.

Inventory Classification

Inventory classification is a cornerstone of successful inventory optimization. Items are classified according to how critical (must-have or convenient-to-have) the piece is, how frequently it is used, how long the lead time to procure and other characteristics. Examples of inventory analysis tools and classifications include:

- Criticality Code - Identifying a range of items from “show stopper” to convenience item
- FMS (Fast Medium Slow) Code - Describes issue frequency: Fast Moving, Medium Movement, Slow Movement, or Dead = No Issues)
- “ABCD” Usage - where A = top 10 percent by annual usage, B the next 20 percent, C the bottom 70 percent through to D indicating dead items
- Lead time - Items with long lead time compared to those which are readily available
- Hazardous items - items that must be documented properly to meet compliance requirements

These classifications may then be applied to an item in combinations such as:

- Fast moving/Hi Use
- Critical item/Slow moving
- Critical item/long lead time/hazardous materials
- Potentially Obsolete – no usage for some years

The inventory manager can create as many classifications as necessary and then determine a management strategy appropriate to each classification. Safety stock levels are set line by line, taking into account criticality level and lead times.

Criticality Analysis

Safety stock should be determined by the criticality of an item. Criticality weighting is also very important in addressing safety and regulatory compliance. Rules-based functionality will assign criticality codes and automatically reassess classifications to readjust inventories to optimal levels. Communication between maintenance and supply staff is greatly enhanced by providing a criticality code and circumvention code matrix with an agreed scale of stock-out costs.

Catalogue Cleansing

Ineffective cataloguing hampers optimization of inventory stock levels; common examples of poor cataloguing look like this:

- The same item is held under two stock codes such as a “Twist drill HSS” being held as both 6.5mm and ¼ “
- Item descriptions that confuse users, who then end up purchasing the item on direct purchase — like “Pliers Slip Joint” when the user wants “multigrips”

Cleansing the catalogue starts with focusing on specific groups of items, e.g. “Personal Protective Equipment” or “Motors AC”, and cleansing the catalogue by group. The inventory optimization tool will then guide less experienced cataloguers to the most appropriate descriptions, enable new items to be catalogued with the minimum of keystrokes, provide a clearly established workflow and ensure that inventories are kept lean right from the start. Consolidated stock codes.

Lead Time Analysis

Supplier lead time is a key factor in determining the minimum stock levels that need to be held. It is not sufficient just to know the delivery time promised by the vendor or even the average lead time over past delivery cycles; for critical items it is also vital to know at a glance the worst-case delivery time.

Accurate knowledge enables setting the stock minimum to optimal quantities and it enables one to plan maintenance schedules more accurately. Vendors with highly variable lead times can be easily identified and any issue addressed.

Usage Forecasting

Stocking level decisions are heavily influenced by expectations of future usage. By applying the right statistical forecasting algorithms to past usage rates, one can achieve an accurate estimate of future usage. The focused forecasting[1] approach — running a suite of standard forecasting algorithms and then applying the coefficient of variance analyses to determine which algorithm has the best fit with the historical usage profile — is an effective method of making accurate estimates of future inventory needs. But running the entire suite of algorithms on every item in the warehouse is complex intensive calculation process.

With the right technology tools to carry out this task, inventory managers can quickly and effectively apply inventory optimization principles across a great many items. EAM systems alone often lack the capability to calculate optimal inventory for each item based on accurate historical data, set inventory parameters to the optimal levels and continually readjust levels as circumstances change over time.

Accurate and consistent adjustment of MIN/MAX or ROP/ROQ levels require an analytical tool that can automatically analyze the key parameters of each individual stock item on a regularly-scheduled basis and readjust stock levels according to set internal guidelines. The focused forecasting approach is a very accurate predictor of future use — but here again, inventory managers need the right tools to run the complicated algorithms and variance analyses.

[1] *Focus Forecasting - Computer techniques for Inventory Control: Revised for the twenty-first Century - Bernard T Smith - Revised edition - Copyright 1997 printed in the USA. Library of Congress Catalogue Card no 97-91580 0123456789*

Usage Profiling

The usage profile has as profound an effect on setting optimal stock levels. A sophisticated inventory optimization tool will select a set of algorithms appropriate to different usage profiles:

- **Items with Frequent Usage -** These items are identified as having an FMS Code of “F” (Fast – issued in at least 20 months in the past 2 years) or “M” (Medium - issued in at least 3 months in the past 2 years). Such items have a sufficiently robust usage history for forecasting to be made with an acceptable level of confidence. The full range of statistical inventory control functionality can be employed.

- **Slow Moving/Sporadic Use Items** - These items are identified as having an FMS Code of “S” (Slow – Some issue in the past 2 years but fewer than 3 usage months). Forecasting algorithms are of dubious use with such items and the lead time is generally irrelevant as the interval between uses is generally much longer than the lead time. A sensible approach to the management of these items is to hold multiples of the Average Issue Quantity (AIQ) or the Set Size (the number of items needed to carry out a task). The Bills of Material from the maintenance schedules gives a reliable indication of the set size for each stock code. The number of multiples of the AIQ or SS can be adjusted in accordance with the Criticality of the item.

- **Non Moving/Dead Items -** These items are identified as having an FMS Code of “D” (Dead – No issues in the past 2 years). With no usage, these items may be held as insurance against a failure or as spares for a maintenance activity with very long scheduling periods. The criterion for holding these items should be based on the cost of a Stock-out of the item weighed against the price of the item. By classifying such items as “catalogued but not stocked”, a reservation for an item can be raised and the item bought in for a scheduled activity. Should an item be required to be on hand for an emergency or breakdown situation then the criticality assigned to the item will be higher and the appropriate approach would be to stock the item.

Automation

Automation frees supply staff from the need for day-to-day control in the management of stock levels. A sophisticated inventory optimization tool will enable any item to be flagged to be automatically monitored, with new Min/Max or ROP/ROQ settings being recalculated as changes occur over time.

Generally, changes in both usage and price will cause a recalculation to occur. This automation is essential to ensure the benefits gained through the initial optimization do not dissipate over time, leading to unnecessary inventory holdings and inadvertent stock-outs. The system should have the capability to automatically determine which algorithms to run on an item. For example, if an item had an FMS Code of “S” (Slow) but usage increased over time to now have an FMS Code of “M” (Medium), the calculation engine should automatically switch over and apply the algorithms appropriate for the new situation. And, the system should also include the facility to flag items so users can be notified if the calculated changes exceed predetermined guidelines.

Accountability

One cannot expect supply and maintenance staff to put their careers on the line supporting recommendations that cannot be verified. It is virtually useless for a system to generate recommended stock level settings if it does not provide evidence of how those levels were calculated. It is unacceptable for a provider of this type of software to claim that the algorithms used are their intellectual property and therefore confidential. A viable inventory optimization system will enable the user to display, and print, a log of all calculations carried out in achieving the recommended settings.

Powerful Reporting

An inbuilt suite of reports must be readily available that provide users and management clear visibility of inventory status. The KPIs for inventory performance improvement need to be agreed upon, with each stakeholder able to select the suite of KPIs to be reviewed.

Conclusion

In today's market, as production has leveled off or decreased, many inventories have not followed suit. Fewer sites run 24x7, reducing the cost of downtime and offering better opportunities for planned maintenance activities. Inventory managers are torn between the need to minimize resources tied up in inventory and the urging of maintenance managers to increase stock levels because they are focused on avoiding the risk of stock-outs that result in costly plant unavailability.

Asset intensive organizations with large, high-value inventories can achieve millions of dollars in savings through an effective inventory optimization approach. A focused approach to inventory optimization moves the organization beyond the traditionally adversarial relationship between the supply and maintenance functions that arise from a fundamental difference of focus when considering the level of inventory held on each item, especially critical items.

While any qualified inventory manager will be familiar with the inventory optimization theories and algorithms, the difficulty is that applying these concepts to each inventory stock item is complicated and labor-intensive. A sophisticated and intelligent inventory optimization software tool will empower the manager to apply his/her skills across the entire inventory. Automated analysis of usage and ongoing adjustment of stocking levels and reordering points ensure that inventory stock levels are adjusted and continually readjusted to their optimal settings.

The primary aim of inventory optimization is to keep inventories at intelligent levels, based on usage profile and how important the item is to the business. Minimizing inventory holdings frees up working capital, while maximizing availability of critical items to increase productivity of the maintenance function and the assets themselves, achieves the aims of the supply area, maintenance teams and the CFO.

About Ventyx

Ventyx, an ABB company, is the world's leading supplier of enterprise software and services for essential industries such as energy, mining, public infrastructure and transportation. Ventyx solutions bridge the gap between information technologies (IT) and operational technologies (OT), enabling clients to make faster, better-informed decisions in both daily operations and long-term planning strategies. Some of the world's largest private and public enterprises rely on Ventyx solutions to minimize risk, enhance operational and financial performance, and execute the right strategies for the future.

To learn more about Ventyx solutions visit **www.ventyx.com** or contact a Ventyx sales representative today.