Two Things Every CFO and COO Should Know About Inventory Control

Finished Goods and Raw Materials inventories are vital parts of most companies' invested capital. However there are many, many managers who suffer due to informal inventory management approaches.

- Companies set policies for parts based on cost of parts or profitability of products which, in fact, have no bearing on the amount of inventory that should be stocked for a particular part—more on this later.
- Managers experiment with inventory policies. For instance, declaring some arbitrary inventory reduction goal, say 40%, and then setting the organization on a course to attempt the goal whether or not it is achievable. Until customer service starts to suffer, everyone is in. Then it's all hands on deck to order whatever is required to recover customer service levels after inventory has been cut too low.

We call this poorly informed goal setting approach "experimenting with the supply chain." When one manager's policies don't work that manager moves on to "other career opportunities." Another manager comes in and tries something different which may or may not work and this continues until some stability and suitable results occur. This may work out for the organization over the long term but it's an inefficient way to manage and hell on individual managers.

A more efficient and profitable way to manage a business is to apply a scientific and predictable approach to inventory management. **Factory Physics inventory performance curves provide an evolution of operations science as applied to business.** This approach applies not only to material inventory but also to smooth and controlled management of accounts payable—two major components of working capital optimization. To begin to understand this approach there are two primary concepts to know:

1) What your practical perfect world looks like
2) How much inventory you should have in your world

What your Practical Perfect World Looks Like

Before we get to your practical perfect world, let's define everyone's perfect world. This in itself is a useful exercise because it provides an upper limit on performance. Many managers set goals without understanding anything about the limits of performance so they don't know what is realistic.

In everyone's perfect world, demand and supply are perfectly synchronized. All demand is met exactly on time at minimum cost. This means maximum profit and cash flow. Machines and people are 100% utilized, they are completely flexible to make any product at any time and morale is as high as possible. In this world, you would have zero finished goods and zero raw materials. Zero finished goods because as soon as you make anything, a customer shows up and says, "That is exactly what I wanted. Thanks!"

They pay you cash on the spot and walk away happy. There are zero raw materials because as soon as you need anything a supplier shows up with exactly the materials you need in exactly the right quantity to exactly the right specifications. Nice world huh? At Factory Physics Inc. we always get smiles, smirks or disbelieving stares when we describe this perfect world. Unfortunately, no one lives in this perfect world because of one word—variability.

With variability—and there will always be variability—your practical perfect world looks different than the perfect world. In your world, there is variability in demand. Customers want different colors, sizes, technical specs for products and they order varying quantities at varying times. There is variability in supply. Suppliers deliver late or early. They insist on minimum order quantities that don't usually match customer demand. As a result of variability, companies will always have raw materials and finished goods inventory.

Every executive should know what their practical perfect world looks like. In your practical perfect world, you achieve the best performance possible with whatever level of variability you have. For inventory, this means having the least amount of inventory on hand to achieve whatever service level you desire.

For simplicity, we will stick to a discussion of materials that companies willfully stock. These are usually items with repeatable mid to high volume demand. The logistical construct of a *stock point* exists for all companies even those that have make-to-order or engineer-to-order products but that's another discussion. As a great aid to understanding the behavior of inventory, operations science provides visual *performance curves* that enable executives to achieve predictable results. See *Factory Physics for Managers*[i] for more discussion on performance curves. For inventory management there is a special case of performance curves called efficient frontiers. Figure 1 shows a set of efficient frontier curves for a sample of 100 parts, could be either raw material or finished good parts.

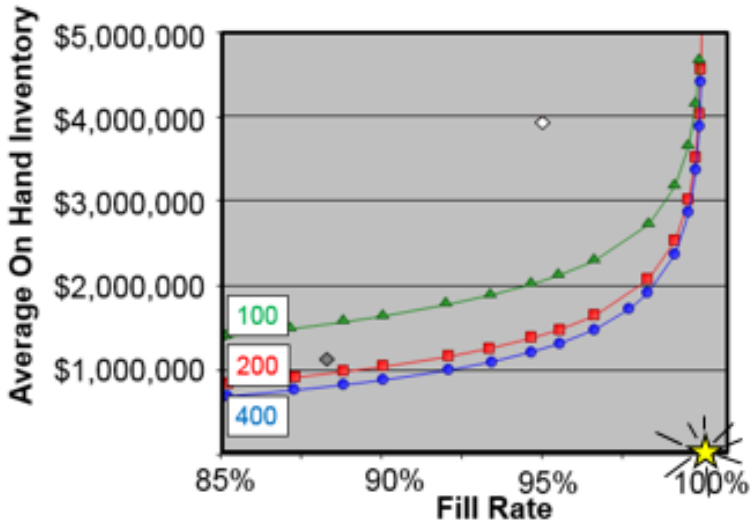

Figure 1: Efficient Frontier Curves for a Set of 100 Parts (plot courtesy of Factory Physics Inc.)

If you want to know what your practical perfect world looks like for inventory, you need your efficient frontier curve(s). For a short description, in Figure 1 the y-axis is average on-hand inventory and the x-axis is fill rate or the likelihood that you have parts when demand appears. The green, red and blue curves represent different options for ordering parts. The green curve is based on order sizes associated with 100 orders per period (week, month, etc.). So for the sample part set of 100 parts, that's an average of one order per period per part.

- Green curve – order each part once per period
- Red curve – order each part twice per period
- Blue curve – order each part four times a period

This analysis shows that doubling order frequency (going from the green curve to the red curve) does provide some inventory reduction except at really high fill rates. However doubling order frequency again does not provide much additional benefit. This is very important information to know when determining safety stock levels and order management activity.

Another great visual from the efficient frontier curves is that variability moves a company away from perfect performance. The star burst in Figure 1 at 100% fill rate and 0$ inventory shows where a company could operate if there was no variability. Distance away from the star burst is an indication of the amount of variability in your business. *Whatever level of variability you have, you can optimize performance.*

How much inventory you should have in your practical perfect world

So how much inventory do you need in your practical perfect world? That is an important strategic decision for executives. Using the efficient frontiers it's a matter of choosing what curve and where on the curve you want to be. If the 100 parts are all in finished goods, going from 100 reorders per period to 200 reorders per period would double the number of shop orders. On the other hand, if your company is on the blue curve at a 99% fill rate, you could maintain the same amount of finished goods with half as many shop orders—being on the blue or red curve yields the same amount of inventory at 99% fill rate. This could have major capacity implications if you have significant setups. If we're talking raw materials, fewer purchase orders to manage is better so the curves have strategic implications in that area as well.

The sequence to remember in determining how much inventory is right for your company is:

1) **Determine your company's efficient frontier curve**
   The information needed to calculate the curve is, for each part:
   i. Demand and demand variance
   ii. Replenishment time and replenishment time variance
   iii. Cost
   That's it. This is information that any company has. Note that cost is included because it is required to value inventory but cost is not a driver of inventory requirements. Certainly cost influences demand but the fundamental drivers of inventory requirements are demand and

replenishment time. See the discussion of Variance of Replenishment Time Demand in *Factory Physics for Managers*[ii] for more discussion on this point.

2) **Determine where your inventory is performing compared to your curve**
   If you are off the curve, there's an opportunity for improvement by moving to the curve. However, the opportunity is not always a reduction in inventory. If your company's inventory performance is designated by the white diamond in Figure 1, you have a huge opportunity. There is plenty of opportunity to move to a curve, reduce inventory (move down on the y-axis) and improve fill rate (move to the right on the x-axis). However if you are at the gray diamond, (bottom left, next to the "200" box) improvements in fill rate on the red or green curve will require more inventory and there's not much benefit to be gained by moving to the blue curve either. The gray diamond is not a joyous position to be in but at least you know where you stand. Any CFO understanding that assessment should not be expecting big financial windfalls from inventory reduction. Forewarned is forearmed.

3) **Move to a curve**
   Pick a point. That means you are deciding on your tradeoffs. What's right for one company is not right for another. What's right for one set of parts might not be right for another. Sure, sales people will say that they want 100% fill rate. But, they're not crazy. Show them that they could get 99.9% fill rate with $5 million in inventory or they can get 99% fill rate with $3 million in inventory and they won't ignore the obvious opportunity.

   Once you pick a point on a curve, you have selected a set of policies for the parts in the analysis. Could be reorder point and reorder quantity OR safety stock and days of supply, depends on what type of policy you are using to manage your inventory. These policies are then used to manage inventory using your planning/ERP system.

If you are not managing to your efficient frontier curves, you are guessing on inventory. If you are managing to your efficient frontier curves, you will know exactly what your accounts payable should be at any time for raw materials. This provides a financial gauge for purchasing and finance personnel to make most effective use of a company's cash. Using inventory performance curves to understand and control your practical perfect world provides predictable, optimal performance. Don't experiment with your company's performance.

For more information on applying practical operations science to your business, contact:

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[i] Pound, Bell and Spearman, *Factory Physics for Managers: How Leaders Improver Performance in a Post—Lean Six Sigma World* (New York: McGraw Hill, 2014) 92-98.
[ii] ibid