Staying Demand Driven

How to sustain the Demand Driven operating model using smart metrics

By Debra Smith, CPA, and Chad Smith

PART 3 OF 3

In Part 1 of our series, we established the need for management to step into the 21st Century to keep pace with the circumstances of supply chains in today's more complex and volatile environment. In Part 2, we listed five steps to force a change from push and promote to position and pull:

1. Accept the New Normal,
2. Embrace flow and its implications for return on investment (ROI),
3. Design an operational model for flow,
4. Bring the Demand Driven model to the organization, and
5. Use smart metrics to operate and sustain the Demand Driven operating model.

Figure 1: The Gap Formula Between Flow-Centric and Cost-Centric Strategies

ΔVisibility → ΔVariability →	ΔFlow → ΔCash Velocity → $\Delta\left(\frac{\text{Net Profit}}{\text{Investment}}\right)$ → ΔROI
Core Problem Area	Plossl's First Law of Manufacturing and the Demand Driven Model

Part 1 focused on Steps 1 and 2. In the New Normal, a company's success in relation to ROI is determined by its ability to manage time and flow of relevant information and materials from a systemic perspective. Maximum revenue opportunity, as well as minimum investment and cost, is a direct outcome of better flow through the supply chain system.

Part 2 focused on Steps 2 and 3. There we made the case that the core problem blocking flow, hence ROI, is an organization's inability to generate relevant information (see Figure 1).

A change in visibility (relevant information) causes a change in variability. When access to relevant information increases, variation experienced by the organization decreases. When access to relevant information is inhibited or blocked, or we generate irrelevant information for decision making, variation experienced by the organization increases. A change in ROI inversely follows the change in variation. We used an equipment manufacturer to demonstrate the design of an operational Demand Driven model (Step 3). The model included strategically positioned decoupling and control points with appropriate buffers of stock, time, or capacity—a system designed to create visibility for relevant information that protects and promotes flow by breaking variation and negating its effects. Here we'll focus on Steps 4 and 5.

Bringing the Demand Driven Model to the Organization

To bring a strategy of flow and a Demand Driven operating model to an organization, people must be taught and then encouraged to think systemically. The new operational model must have all of its rules, tactics, tools, and metrics align to a flow-centric strategy. Managers must be able to identify the right rules, metric objectives, tactics, and reporting tools to drive flow as well as identify and remove inappropriate and outmoded cost-centric rules that block flow. In our opinion, the thinking tool set of the Theory of Constraints (TOC) offers one of the best systemic problem-solving and solution-definition options available to empower an organization to think systemically and identify conflicting policies, tactics, and measures. We call the ability to think systemically "Thoughtware." In fact, we've found that before companies make huge investments in software and hardware, they must first commit to implementing and investing in Thoughtware.

At the base of this systemic thinking lies the primary "right" financial measure—ROI. A company can't claim it has improved if it doesn't have an improvement in ROI. It's the only measure that makes net profit relative to the effort invested over time. But measuring ROI at the end of any financial period won't change the result. It's the tactical planning, execution decisions, and actions a company's people take every hour of every day that will determine where the company lands on the ROI measurement scale. Relevant information directs and focuses efforts where the greatest ROI opportunity exists because both time and cash are finite.

In most companies, it's next to impossible for a local manager to make a connection between his or her actions today and the effect those actions will have on ROI. This has led companies to create a significant number (hundreds or more) of tactical and local measures to focus and direct people's daily actions. Companies fail to grasp two important realities when they apply a whole-system rule to a local resource or area:

1. The rules that apply to define what makes the system efficient, how to maximize the efficiency of the system, and how costs actually behave in the system can't be extrapolated and applied to the individual links that make up the system.

2. The majority of these local or individual cost-centric efficiency and utilization measures are based on a Generally Accepted Accounting Principles (GAAP) definition of full absorption product cost.

Table 1 is a summary and comparison of a cost-centric efficiency strategy and a flow-centric efficiency strategy. Both provide a framework from which to derive policies, metric objectives, and tactics, but each will have very different ROI results.

Cost centric and flow centric have very different definitions of business rules (policies), metric objectives, relevant information, tactics, and actions.

Table 1: Summary and Comparison of a Cost-Centric Efficiency Strategy against a Flow-Centric Efficiency Strategy

	COST-CENTRIC EFFICIENCY STRATEGY SUMMARY	FLOW-CENTRIC EFFICIENCY STRATEGY SUMMARY
PRIMARY ASSUMPTION	Unit cost reduction = Increased Return on Investment	Protection and increase of flow (of relevant information and materials) = Increased Return on Investment
STRATEGY	Maximize resource efficiency and utilization: **Plan and schedule resource activities to ensure the lowest product cost and highest product gross margin. Focus on cost-reduction tactics, actions, and initiatives** with emphasis on labor saving, machine utilization, and inventory reductions as top priorities. **Every cost reduction increases ROI.**	Maximize system flow to market pull: **Synchronize demand and supply signals** between critical points—the control and decoupling points. **Identify and remove whatever blocks flow to and through the critical points**.
METRIC OBJECTIVES	**Gross profit product margins –** Meet the profit plan for both revenue and product cost. **Part and product standard cost –** Efficient use of all resources. **Working capital dollar targets –** Efficient use of working capital. **Cost-reduction initiatives –** Meet the profit plan. **Product cost variance analysis –** Targeted resource efficiency and cost-reduction opportunities/compliance.	**Reliability –** Consistent execution to the plan/schedule/market expectation. **Stability –** Pass on as little variation as possible. **Speed/velocity –** Pass the right work on as quickly as possible. **System improvement/waste (opportunity $) –** Point out and prioritize lost ROI opportunities. **Strategic contribution –** Maximize throughput dollar rate and throughput volume according to relevant factors. **Local operating expense –** What is the minimum spend that captures the above opportunity?
TACTICS/ ACTIONS IN CONFLICT	**Maximize all machine/labor efficiencies –** Run larger batches; extend the forecast; run only on optimal resource. **Protect budget performance –** Focus on actions to achieve standard unit cost. **Maximize margin –** Focus on lowering unit product cost. **Minimize inventory –** Enforce a dollar-value inventory threshold; postpone inventory receipt; mandate across-the-board reductions; purchase on least-cost-buys and volume discounts. **Get more volume –** Lower price and raise order minimums. **Maintain margins –** Focus on actions that lower unit cost. **Project improvement –** Identify unit-cost-reduction opportunities through increasing resource efficiency or labor reduction.	**Maximize system efficiency –** Protect scarce capacity resources; run smaller batches to pull; run on any process-capable resource. **Protect budget performance –** Focus on leveraging flow to the market. **Maximize margin –** Focus on increasing service level, premium pricing, leveraging constrained resources. **Minimize inventory –** Commit to strategic stock positions to protect the agreed-to market strategy and throughput; purchase on quality, reliability, and lead times. **Get more volume –** Focus on service, lead times, and lower order minimums. **Maintain margins –** Focus on actions that increase throughput. **Project improvement –** Identify the largest sources of variation, and remove them to lower lead times and reduce investment in all strategic buffers.
INFORMATION SOURCE FOR DECISIONS AND ACTIONS	Local resource utilization and efficiency measures; standard unit cost impact evaluated by the impact on the cost driver used to allocate overhead (fixed costs) to products. Priority is based on the impact to "my resource/area" local measures. No systemic view of product flow or net cash flows.	Visible real-time stock, capacity, and time buffer status; align priorities, and identify when, who, and why a corrective action should occur to protect flow to and through the decoupling and control points to the delivery schedule. Reason codes identify variation, its source, and the flow impact. Buffer reporting focuses corrective actions to "unblock" flow in execution and prioritize future improvement actions. All resource execution priority throughout the system is based on the purchase or work order buffer penetration status against schedule.

Cost-centric efficiency is focused on planning and executing the "best" individual resource efficiency and least unit-cost performance to deliver the business plan and maximize ROI. Low unit cost is a natural outcome, but it has no correlation to what the system spends—the system's cost to operate in the time period measured.

Flow-centric efficiency is focused on synchronizing and aligning all resource priorities to actual market demand and on the velocity of the system flow to maximize ROI. High due-date performance (DDP), short market lead times, and minimum invested capital are the natural outcomes. This has everything to do with the maximum market opportunity for the minimum system spend and investment.

These two conflicting strategies lead to opposite tactical decisions and execution actions. A company can't have two opposing strategies and expect coherent planning, execution tactics, and favorable results. Unfortunately, this is exactly where most companies and managers find themselves today—straddling a world of decisions that demand constant compromises between conflicting key performance indicators (KPIs) and objectives forcing self-imposed forms of variation into the supply chain. Becoming Demand Driven requires the organization to break the conflict over its strategy, tactics, and metrics in favor of flow, and leadership must break that conflict.

Demand Driven Operating Models and Smart Metrics

The point of discussing GAAP measures and establishing the reality of today's supply chains as nonlinear, complex systems is to create a sufficient case to challenge and debunk the current paradigm of supply chain performance as independent financial data points managed and measured through an additive series of static snapshots of GAAP unit costs. In short, the rules required to run these complex systems are fundamentally different from the current paradigm. One of the keys to managing complex adaptive systems (CAS) is to understand the importance of coherence. (See Chapter 10 of our book *Demand Driven Performance—Using Smart Metrics*.)

A complex adaptive system's success depends on coherence of all its parts. A subsystem's purpose has to align with the purpose of the greater system for coherence to exist. Without that alignment, the subsystem acts in a way that endangers the greater system it depends on. Coherence must be at the forefront of determining the signal set, triggers, and action priorities. To keep coherent, all resources/subsystems must ensure that their signal sets contain the relevant information to direct their actions and that they aren't at cross-purposes with the goals of the systems they depend on.

Based on the importance of coherence and CAS, a Demand Driven performance measurement system has two distinct components of financial and nonfinancial metrics:

1. Internal financial measures for evaluating strategic investment decisions that follow the relevant information rules for nonlinear, complex systems and complex adaptive systems. The starting point is a Demand Driven system designed to the specifications seen in Part 2 of our series. This model is used to determine the strategic investment required to deliver the strategy to the market and is a core part of the sales and operating plan (S&OP).

2. Day-to-day nonfinancial measures for manufacturing and distribution operations. These are control point and decoupling point buffers, feedback loop systems, and smart metrics used to measure a supply chain performance management system. The primary goal is system coherence and signal synchronization with the defined strategy or model.

Four of the six smart metric objectives in Table 1 maintain system coherence in day-to-day operations planning and execution. The first three are nonfinancial, and the fourth is a mix of both financial and nonfinancial elements.

1. **Reliability –** Consistent execution to the plan/schedule/market expectation within the model.
2. **Stability –** Pass on as little variation as possible.
3. **Speed/Velocity –** Pass the right work on as quickly as possible.
4. **System Improvement/Waste (Opportunity $) –** Point out and prioritize the lost ROI opportunities.

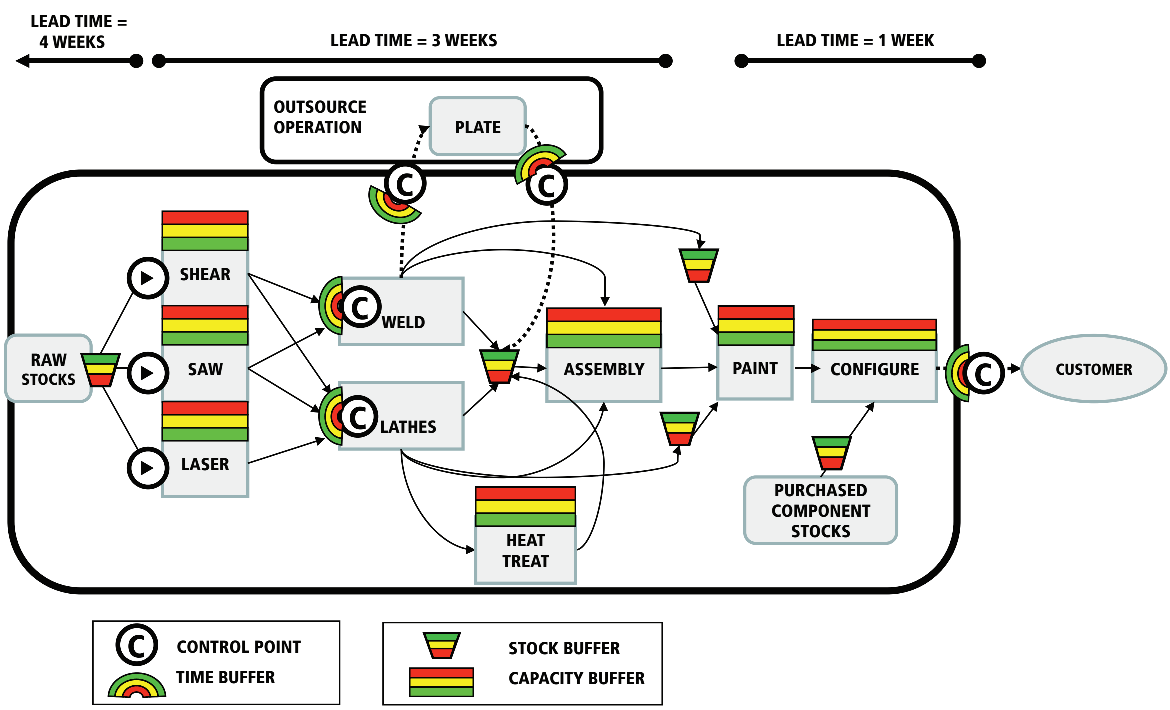
Now we'll show you how smart metrics achieve these objectives.

The Power of Pareto and Smart Metrics

Nonlinear, complex systems are best explained with Paretian distributions or "rules" because they model the large effects of the very few relevant system factors. In linear systems, Pareto distributions focus on the 80:20 rule—80% of the outcome can be attributed to 20% of the events factors. In nonlinear, complex systems, the ratio rule is much higher at 99+:1. The fact that a complex system can be understood and managed from a limited set of factors that govern the whole system is the key to making the complex simple. Smart metrics use a Paretian view to focus on a visible feedback loop of strategic buffers of stock, time, and capacity and the status of the critical points they protect. Aligning all resource schedules and priorities to these few visible focal points creates system coherence and a feedback measurement system focused on ensuring the first four smart metric objectives.

The most important thing for managers to manage is the events outside the targeted limits at the control and decoupling points. In particular, a shift of managers'

Figure 2: **Completed Demand Driven Design Model**



attention from the center of the distribution (the averages in a normal distribution) to the tails (the outliers in the Paretian distribution) reveals solutions to existing problems and promising opportunities for market growth, process improvement, working capital minimization, and less expedite-related waste. This Paretian view of statistics is the math and logic of complex nonlinear systems. Smart metrics focus on the strategic control points and decoupling points. The events occurring in the tails of the strategic buffer zones trigger action to keep flow on track. Purchasing, planning, scheduling, and deployment decisions are determined and prioritized, and execution is synchronized by the buffer zone penetration priorities. Events in the tails are measured and trended to determine resource and asset performance as well as focus improvement opportunities and investment.

Let's look at an example that demonstrates the use of smart metrics. Figure 2 is the Completed Demand Driven Design Model (Figure 8 in Part 2).

The following assumptions apply to our example company:

◆ The organization has embraced a strategy of flow-centric efficiency.

◆ A Demand Driven design strategy has been completed, and decoupling and control points have been chosen to protect the lead-time strategy depicted in Figure 2.

◆ Demand Driven MRP (DDMRP) methodology has been used to determine the stock strategy at the decoupling points, and initial zone parameters have been set to absorb supply and demand signal variation.

◆ The time and capacity buffer zones have been initially sized to protect flow with the minimum investment, given finite capacity of the control points, actual market pull, and feeding resources variation. They are resized dynamically over time as changes occur in capacity, market pull, and variation.

◆ The organization has created the ability to visibly display these buffers in real-time status.

◆ The organization has the ability to finitely schedule its control points and choke flow to the pace of the control points.

Stock Buffers, Pareto Analysis, and Smart Metric Objectives

Here we're going to provide a short overview and example of a feedback loop system that comprises smart metrics for strategic stock buffers. (This abbreviated example is excerpted from Chapter 11 of our book.) In Figures 3 through 6 we'll demonstrate how a Paretian view is used with stock buffers to ensure that the smart metric objectives and supply chain coherence are achieved.

Figure 3 is a spectrum view that exists with all inventories at the single item or aggregate level. The line running in both directions represents the quantity of inventory. As you move from left to right, the quantity of inventory

Figure 3: The Two Universal Points of Inventory

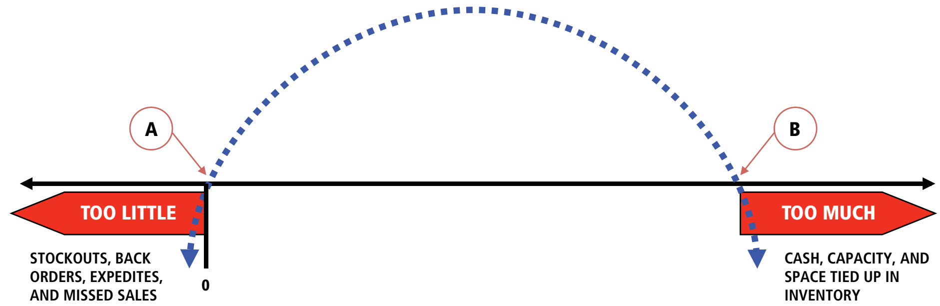
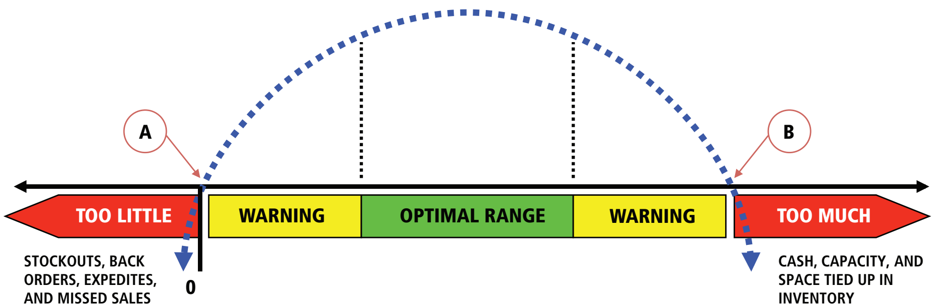


Figure 4: The Optimal On-Hand Inventory Range



increases; from right to left, the quantity decreases.

Whether at the single SKU/part number or at the aggregate inventory level, there are two very important points on this curve:

Point B, where we have too much inventory and excess cash, capacity, and space tied up in working capital.

Point A, where we have too little inventory and the company experiences shortages, expedites, and missed sales.

If we know that these two points exist, then we can also conclude that for each SKU/part number, as well as the aggregate inventory level, there's an optimal range somewhere between the two points. This optimal range is depicted in Figure 4.

As inventory quantity expands out of the optimal range and moves toward point B, the return on working capital captured in the inventory becomes less and less. The converse is also true as inventory shrinks out of the optimal range and approaches zero or less than zero (the typical quantity when we start to have too little). Placing point A at the quantity of zero means that inventory becomes too little when we are out of stock. Placing point A at less than zero (e.g., –1) means that inventory becomes too little when we are out of stock but have demand—the definition of a true shortage.

This is particularly important when we consider that most companies' inventory alignment displays a troubling picture when overlaid on this type of graph. Figure 5 shows what's known as an inventory "bi-modal" distribution. The bi-modal distribution has a relatively large distribution of parts in the "too much" range while, at the same time, having a relatively large distribution in the "too little" range and a relatively small distribution in the optimal range. Worse yet, individual parts tend to oscillate back and forth between too much and too little. The bi-modal distribution and the oscillation associated with it are representative of the bullwhip effect and are a huge challenge to supply chain coherence.

In a sample of more than 400 manufacturing companies polled by the Demand Driven Institute, more than 90% report the bi-modal distribution to a severe degree. The bi-modal distribution is devastating to flow and is a major source of expedite-related expense and waste. As it relates to stock buffers, the power of Pareto and smart metrics is aimed at the identification and elimination of the bi-modal distribution.

Figure 6 shows the inventory spectrum with the DDMRP buffer management color-coded ranges inserted. The color-coded zones and planning algorithm are designed to keep the on-hand position in the optimal range. The optimal on-hand range is in the lower portion of the yellow zone. This range serves as the primary specification limits to judge on-hand inventory performance to prevent the bi-modal distribution. The average on-hand

Figure 5: **The Bi-Modal Distribution**

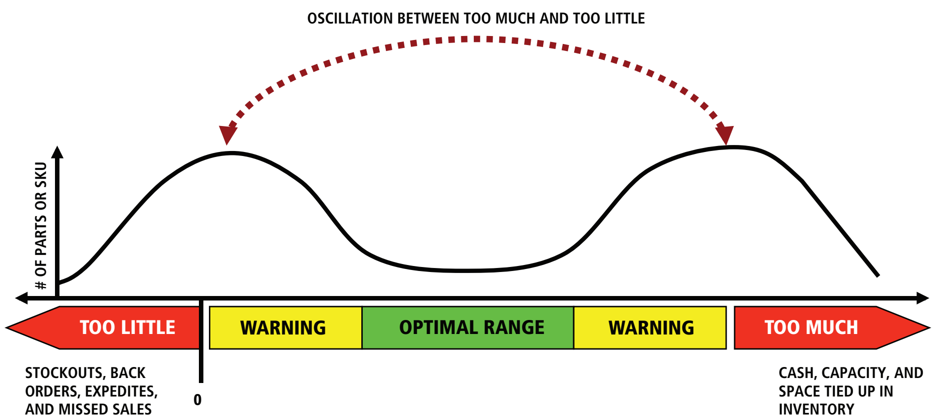
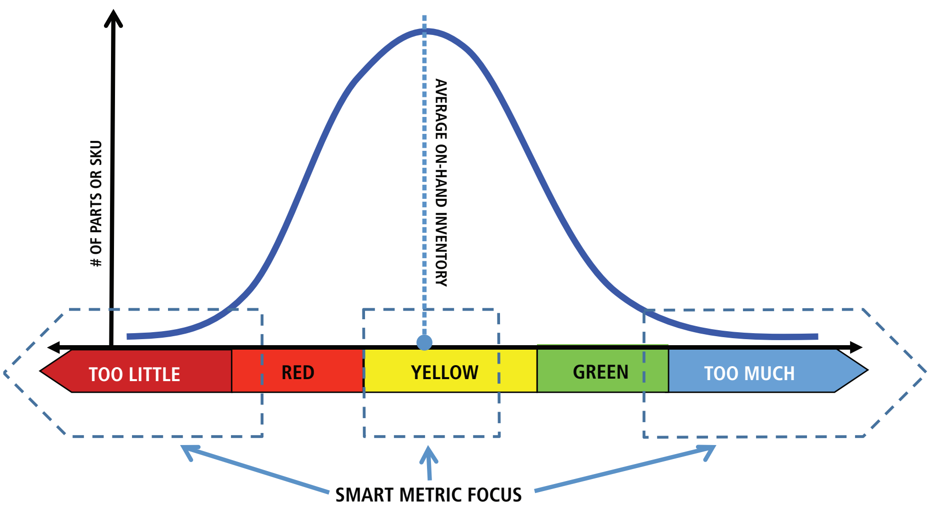


Figure 6: **Target On-Hand Inventory and the Outliers or Tails on Both Sides of the Distribution**



target position is the point in the yellow zone that equates to the red zone plus half of the green zone. For a detailed understanding of both the math and principles of DDMRP and strategic stock buffers, we recommend the third edition of *Orlicky's Material Requirements Planning* by Carol Ptak and Chad Smith (McGraw-Hill Professional, 2011).

Only after you understand and establish the zones can you begin to apply Paretian principles to focus on the outliers (the tails) and drive on-hand inventory toward the optimal range and out of the bi-modal distribution. The on-hand range specification limit and the emphasis on the distribution tails establish a performance measurement index to trigger buyers, planners, schedulers, operations resource managers, and deployment to take action when events drive the on-hand inventory too far outside the optimal range. All daily inventory performance is based on managing the events occurring in the tails to keep material flowing and available to meet market demand.

Reporting on the Tails

Figure 7 shows trend reporting of parts with on-hand inventory that repeatedly enter or reside in the tails. The top graph shows parts with unacceptable service levels. It focuses on the left tail and shows the number of days over a 180-day period that each part has spent in three different categories prioritized by the severity of the potential net loss to the system:

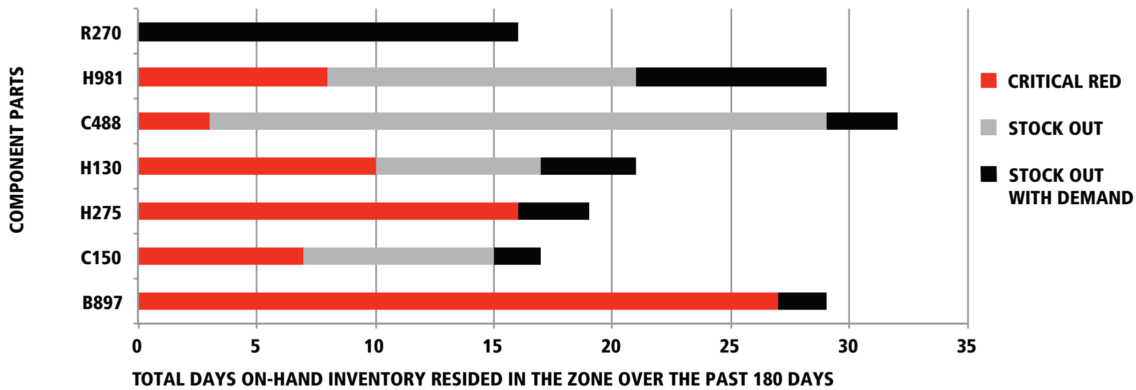
1. Parts stocked out with demand,

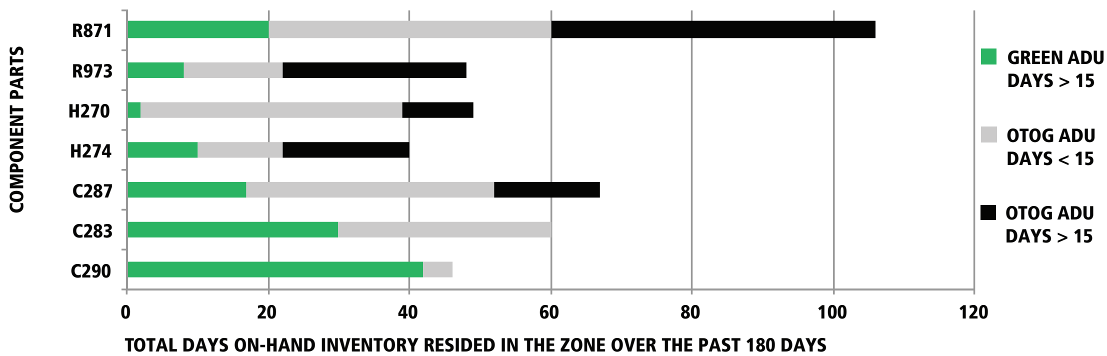
2. Parts stocked out with no demand, and

3. Parts in the critical red zone (the lower half of red) penetration.

Finance clearly can see why, where, and how much cash outflow and strategic investment is required to align the stocking levels and buffer protection to the change in demand pull and/or to protect the market from increases in supply variation. A sales review can check the product sales trend against the sales plan and

Figure 7: On-Hand Inventory Performance Measures Focus on the Parts Trending in the Statistical Tails





signal the need for an increase in the buffer zone levels. A planning review can check if supply variability and/or lead time have increased and require an increased red-zone protection and/or an alternate source of supply. Regardless of the cause, these parts require an additional investment in either capacity or stock to support market targets and/or decrease expedite-related waste. Operations must act to improve the availability of these parts to keep the system reliable and stable and to protect the market lead-time strategy and revenue opportunity. The parts in Figure 7 are a major source of system variation. They destabilize the system, making it less reliable, less responsive, and more wasteful. Measuring and prioritizing process improvement and strategic investment around these parts and the cause of their poor service performance achieve all of the six strategic objectives of smart metrics: system reliability, stability, speed/velocity, focused process improvement, maximum strategic contribution, and minimum operating expense spend.

The bottom graph shows parts with unacceptable rates of flow. It focuses on the right tail and shows the number of days over a 180-day period that each part has spent in three different categories prioritized by poor flow rates:

1. Parts with on-hand inventory over the top of green (OTOG) with less than 15 days of average daily usage (ADU),

2. Parts with on-hand inventory OTOG that exceeds 15 days of ADU, and

3. Parts with on-hand inventory in the green zone.

The choice to break categories based on an ADU greater than 15 days ensures that parts with moderate and better flow are excluded from the trend reporting and focused only on parts that require review and action. Finance clearly can see the cash flow implications and working capital performance of the parts with poor flow performance:

- **How much = the variable cost per parts × (target on-hand – actual on-hand)**
- **How long = (target on-hand – actual on-hand)/average daily usage**

Parts with on-hand inventory over the top of the green zone indicates the need for a sales review to check the product sales trend against the sales plan and/or a planning review of order policies and batching rules. If the low-flow velocity is the result of manufacturing batches and/or purchase minimums larger than the pull rate requires, they should be reduced where possible. These parts are a major source of system waste. They reduce speed and consume cash, material, capacity, and space and create contention for scarce resources. Reviewing buffer status trends by part and by planner provides the benchmark to track improved performance and pinpoints where to focus increased investment and improvement efforts. Setup reduction opportunities and batch size challenges for those parts using minimum order quantities (MOQ) or minimum order cycles (MOC) are an integral part of the process improvement feedback loop.

A Quick Recap

In this article we've discussed the smart metrics objectives in relation to stock buffers. The objective is to drive toward maintaining a single or uniform distribution curve across those strategic decoupling points with an on-hand inventory target position centered inside the specification range (typically in the lower half of the yellow zone of the buffer). When that centering occurs, we achieve the four day-to-day smart metrics objectives that ensure system coherence: reliability, stability, speed/velocity, and system improvement.

The results are that shortages are minimized and velocity is protected. Unnecessary expenditures are prevented, and basic planning assumptions and information are relevant. Materials are available, and lead times are reliable, which results in a more stable schedule and reliable execution. At the same time, a minimization of overages protects velocity, prevents margin erosion through discounts, prevents write-offs due to obsolescence, reduces space requirements, and allows common components and materials to be better leveraged against multiple parent items.

In today's globally competitive environment, new decision-making tools are required to monitor, measure, and improve the business based on the reality that it's a complex adaptive system. A Demand Driven information system is designed to plan, execute, and focus/prioritize improvement using a visible, real-time feedback loop focused on the flow to and through strategic control points and decoupling points. This is designed to align all with the system view and strategy and keep coherence.

The points for measurement and real-time feedback are relatively few, and they are strategically chosen to protect critical resources and/or hand-offs between processes or subsystems. These strategic buffers of stored time (stock, time, and capacity) are sized to break the accumulated dependent variation of dependent event supply chain systems that feeds and amplifies the bullwhip effect and to provide visibility and synchronization to resource managers so they can act. The combined buffer feedback systems of stock, capacity, and time provide all relevant information needed to judge the state of the entire chain and direct attention or action as well as focus opportunities for improvement and investment. Real-time exception feedback is needed to identify issues and their root causes proactively so people can take timely, appropriate action. They are also trended over time to provide focus to direct improvement efforts and permanently remove recurring issues or events that routinely block flow.

Now that you have a framework to work from that provides relevant information for smart metrics, you can help your company become Demand Driven and achieve better flow through your supply chain. **SF**

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