Becoming Demand Driven

How to Change from Push and Promote to Position and Pull

PART 2 OF 3

By Debra Smith, CPA, and Chad Smith

The first article in our series stressed three key points:

1. The way to drive return on investment (ROI) has everything to do with protecting and increasing the flow of relevant information and materials through a company.

2. Supply chains have changed dramatically in the last two decades—becoming nonlinear, complex systems. The rules and the math governing complex systems are different from the rules governing linear systems.

3. The current focus of people and systems on unit cost minimization has little or no connection to driving ROI. It distorts the picture, fails to produce relevant information to drive decisions and actions, and introduces self-inflicted forms of variability that contribute to the bullwhip effect. This unit cost emphasis is typically called push and promote.

The push-and-promote mode of operation must change, and the old rules based on cost-centric efficiency must go. Companies must embrace the new position-and-pull mode of operation and adopt flow-centric efficiency rules that protect and maximize the flow of relevant materials and information. Position and pull aligns resources and efforts with actual market and customer requirements to successfully manage the more variable, volatile, and complex environment of today. To get to position and pull, companies must become Demand Driven.

How to Become Demand Driven

Becoming Demand Driven essentially is forcing a change from the conventional supply- and cost-centric model to a flow- and demand-pull-centric model. Going from push and promote to position and pull involves five steps:

1. Accept the New Normal,
2. Embrace flow and its implications for 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.

We covered Steps 1 and 2 in Part 1, and here we'll dive deeper into Steps 2 and 3.

Step 1: Accept the New Normal

As we discussed in our first article, volatility and variability are magnitudes greater than the supply chains our current tools and rules were developed to manage. Our conventional set of rules, tools, and metrics (based on linear assumptions) fail to provide relevant information for operational planning and execution in these new circumstances. Companies have a choice. They can accept these new circumstances and adjust accordingly, or they can face an increasingly uphill battle and be left behind in a hypercompetitive landscape.

Step 2: Embrace Flow and Its Implications for ROI

We also previously discussed George Plossl's first law of manufacturing:

All benefits will be directly related to the speed of flow of information and materials.

The New Normal, however, has created the need for a very important caveat to this law: The information and materials must be relevant to the market/customer expectation—actual demand pull. When the flow of relevant information and materials speeds up or is protected, revenue opportunities are maximized or protected, inventory is minimized, and unnecessary expenses are eliminated. Thus a company's success in relation to ROI is determined by its ability to manage time and flow from a systemic perspective: Minimum investment and cost are an outcome of flow, and an efficient system protects and promotes flow. All rules, tactics, tools, and metrics must be aligned to the speed of flow as well as identify and remove whatever blocks flow. The one thing most process improvement philosophies agree on is that the No. 1 enemy of flow is variability. The accumulation, transference, and amplification of variability—*not* any single discrete process's variability—are what kill system flow.

In addition, we explained system variability and exposed the conventional cost-centric efficiency strategy as one of the major sources of variation in today's supply chains. Its rules, tools, and metrics inject directly competitive tactics and modes of operation with a flow-centric efficiency strategy's rules, tools, and metrics. Attempting to satisfy the opposing rules, tactics, metrics, and actions between the two constantly flips an organization between competing and opposing modes of operation. This management oscillation is actually self-induced variation and represents a huge opportunity to improve flow performance and ROI. Why? Because it's under our direct control!

Part of understanding why a change is required is to know and quantify what opportunities are currently being missed by continuing in the status quo. It's possible to quantify the gap between the cost-centric world of push and promote and the flow-centric world of position and pull. The formula in Figure 1 expresses the gap between the strategies and the importance of relevant information. It quantifies the potential system improvement or degradation in moving from one world to the other with the following points:

- Visibility is defined as relevant information for decision making.
- Variability is defined as the summation of the differences between what we plan to have happen and what happens.
- Flow is the rate at which a system converts material to product required by a customer.
- Cash velocity is the rate of net cash generation; sales dollars minus truly variable costs (also known as throughput dollars or contribution margin) minus period operating expense.
- Net profit/investment is, of course, the equation for ROI.

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

$$\Delta\text{Visibility} \rightarrow \Delta\text{Variability} \rightarrow$$

Core Problem Area

$$\Delta\text{Flow} \rightarrow \Delta\text{Cash Velocity} \rightarrow \Delta\left(\frac{\text{Net Profit}}{\text{Investment}}\right) \rightarrow \Delta\text{ROI}$$

Plossl's First Law of Manufacturing and the Demand Driven Model

A change in visibility causes a change in variability, and that in turn causes a change in flow and ultimately ROI.

This formula starts at what makes information relevant, not at flow. If we don't fundamentally grasp how to generate and use relevant information, then we can't operate to flow. Moreover, if we're actively blocked from generating or using relevant information, then even if people understand there's a problem, they will be powerless to do anything about it. The core problem plaguing most supply chains today is *the inability to generate and use relevant information to drive ROI.*

Step 3: Design an Operational Model for Flow

The Demand Driven operating model is the positioning part of position and pull. To get the positioning right, two things are required:

- Identification and placement of decoupling and control points, and
- Consideration of how to protect those decoupling and control points from the effects of variation.

Decoupling Points

If return is related directly to our ability to protect and promote flow and if variability is the biggest enemy to system flow, then we have to design a system that breaks the variability accumulation chain. This is called a *decoupling point.*

Decoupling point*—the location in the product structure or distribution network where strategic inventory is placed to create independence between processes or entities. Selection of decoupling points is a strategic decision that determines customer lead times and inventory investment.* (See *APICS Dictionary*, 14th edition, APICS The Association for Operations Management, 2013, p. 43.)

Decoupling points represent a place to disconnect the events happening on one side from the events happening on the other side. They delineate the boundaries of at least two independently planned and managed horizons and are most commonly associated with stock positions. As a stock position, they allow demand to accumulate (the stock position drains) but allow the customers represented by those demand signals to be serviced on demand without incurring the lead-time penalty of the processes in front of the decoupling point. Where to strategically place decoupling points depends on careful consideration of the six factors in Table 1.

We'll use the example of an equipment manufacturer to demonstrate the decoupling point considerations. The longest lead time for raw stock in the component bill of materials (BOM) is four weeks; commonly used components typically take three weeks to manufacture; and the

Table 1: The Six Decoupling Point Positioning Factors

Customer Tolerance Time	The amount of time potential customers are willing to wait for delivery of a good or a service.
Market Potential Lead Time	The lead time that will allow an increase of price or the capture of additional business through either existing or new customer channels.
Demand Variability	The potential for swings and spikes in demand that could overwhelm resources (capacity, stock, cash, etc.).
Supply Variability	The potential for and severity of disruptions in sources of supply and/or specific suppliers. This can also be referred to as supply continuity variability.
Inventory Leverage & Flexibility	The places in the integrated BOM structure (the Matrix BOM) or the distribution network that leave a company with the most available options and the best lead-time compression to meet the business needs.
Critical Operation Protection	The minimization of disruption passed to critical resources or control points.

(Taken from the third edition of *Orlicky's Material Requirements Planning* by Carol Ptak and Chad Smith, McGraw-Hill Professional, 2011, p. 392)

Figure 2: A System without Decoupling Points

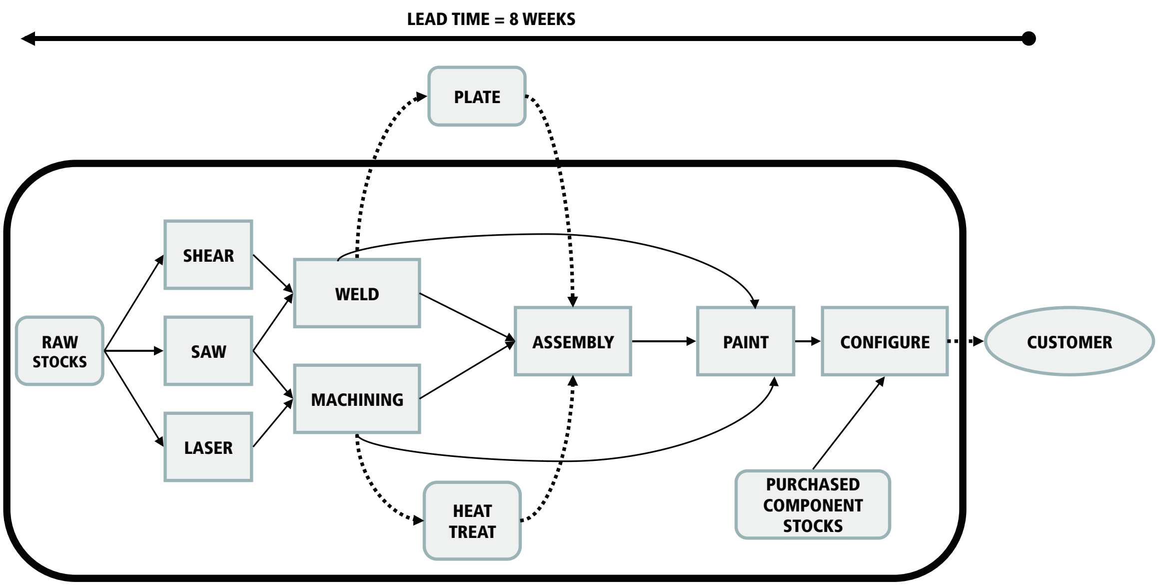
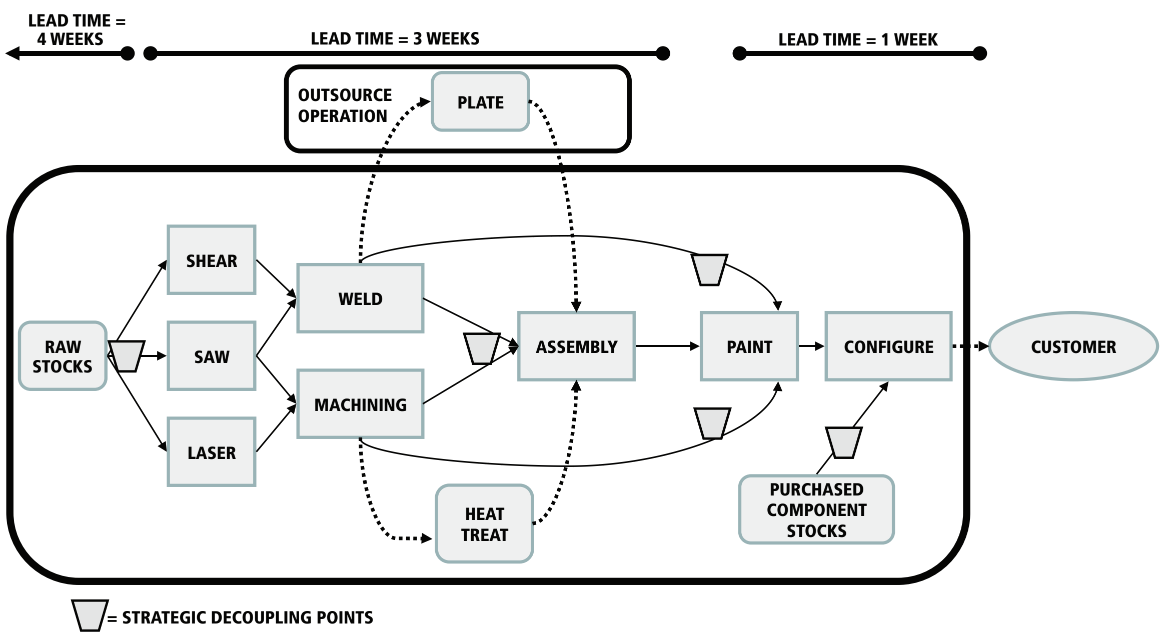


Figure 3: The Same System with Decoupling Points



time to assemble, paint, and configure an end item is one week, for a total eight weeks' lead time.

Figures 2 and 3 depict the conceptual difference between a system with no formal decoupling points and one with formal decoupling points. The bucket icons in Figure 3 represent the decoupling points. The lines running through the decoupling point icons represent the indirect connections between the two independently planned and managed sides of the decoupling point. In our example, Sales and Marketing has determined that offering one-week lead times would be a significant competitive advantage. This requires the placement of decoupling points to ensure material is available to the assembly, paint, and configure operations to meet the agreed-to market strategy lead time of one week.

Decoupling lead time is important because:

1. Adding the longest path of decoupled lead times still produces a similar lead-time number as the coupled system, but the crucial difference is that the customer reliably experiences a tremendously shorter lead time. This can be a significant market advantage.

2. Decoupling has huge implications for planning. If the planning lead time shrinks, then the forecast error over the planning lead time also shrinks. The forecast error rate grows exponentially as the planning horizon lengthens, and forecast error is generally acknowledged as the largest cause of the bullwhip effect in supply chains.

At this point it's important to note that material requirements planning (MRP) systems aren't designed to decouple. They are designed to make *everything dependent*. This is one of the inherent and critical shortfalls of modern planning systems that led to the development of Demand Driven MRP (DDMRP) systems. The rules behind DDMRP systems are documented thoroughly in the third edition of *Orlicky's Material Requirements Planning*. (You can obtain free white papers, videos, and podcasts on DDMRP at www.demanddrivenmrp.com.)

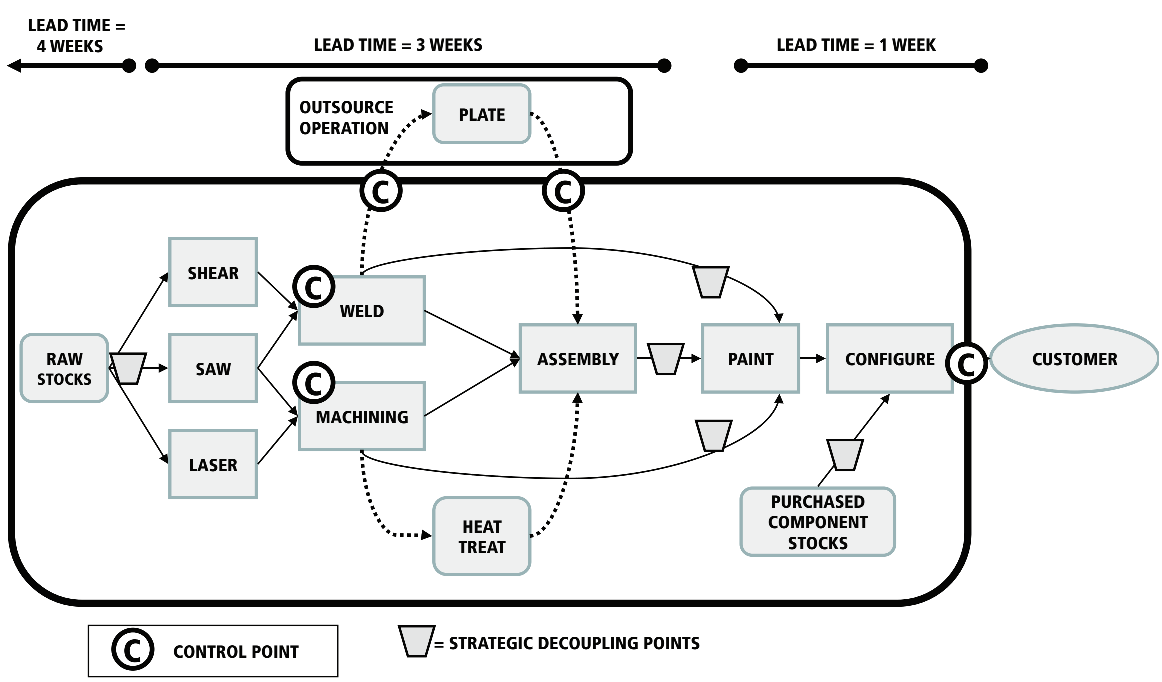
Control Points

Think of control points as places to transfer, impose, and amplify control through a system. They often are placed between decoupling points with the objective of better controlling the lead-time zones between those points. A shorter and less variable lead time results in less stock required at the decoupling point (a working capital reduction).

The 14th edition of the *APICS Dictionary* defines control points as "strategic locations in the logical product structure for a product or family that simplify the planning, scheduling, and control functions. Control points include gating operations, convergent points, divergent points, constraints, and shipping points. Detailed scheduling instructions are planned, implemented, and monitored at these locations"(p. 33).

Instead of attempting to control a complex system through the scheduling, management, and measurement of every minute of every resource, companies can assert and maintain meaningful control over a group from a few strategic places. An example might be security at an airport. While surveillance is occurring everywhere, active control is asserted at only a few points. From those few points, security across hundreds of flights and tens of thousands of

Figure 4: Decoupled System with Control Points



people can be extended with minimal disruption.

Control points don't decouple lead times; they seek to better manage execution inside the lead-time horizons in which they are directly involved. They are the first areas to be scheduled based on a requested final completion time (either the delivery to a customer or to a decoupling point). The control point schedule then drives all other resource and area schedules within that lead-time horizon. This creates a staggering effect for material release and scheduled completions (promise dates). In the Theory of Constraints, control points are called *drums* because they set the cadence of the system. In Lean, control points are often called *pacesetters*. Regardless of their name, they are the key to managing complex systems and greatly simplify planning, scheduling, and execution.

When choosing where to place a control point, a company should consider four things:

1. Points of Scarce Capacity determine the total system output potential. The slowest resource—the most loaded resource—limits or defines the system total capacity.

2. Exit and Entry Points are the boundaries of your effective control. Carefully controlling that entry and exit determines whether delays and gains are generated inside or outside your system.

3. Common Points are points where product structures or manufacturing routings either come together (converge) or deviate (diverge). One place controls many things.

4. Points that Have Notorious Process Instability are good candidates because a control point provides focus and visibility to the resource and forces the organization to bring it under control or plan for, manage, and block the effect of its variability from being passed forward.

A Decoupling and Control Point Example

In some cases, certain subassemblies and/or materials could have decoupling points, but not the end item. Figure 3 depicts this situation because there is still significant activity after the last decoupling points. In these cases, a control point (maybe more than one) will be established between those last decoupling points and delivery to the customer.

Strategically placed decoupling and control points dramatically compress lead times to meet market requirements and/or opportunities and assert or impose control throughout the system. Figure 4 illustrates the application of the decoupling and control point position factors to our example company.

The company has chosen two internal control points at weld and machining. The rationale is that the vast majority of manufactured products go through one of these areas. Also, these points have a need for carefully managed capacity because qualified and experienced welders and machinists have been difficult to find. In addition, there are three control points that qualify as exit and entry points: to and from an outside plating operation and to the customers (final shipment).

Protecting Decoupling and Control Points

We have to employ some form of dampening mechanism at these decoupling and control points to absorb variability so the points can achieve their intended purposes. This dampening mechanism is called a buffer. The three types of buffers to employ are stock, time, and capacity.

Demand Driven Stock Buffers

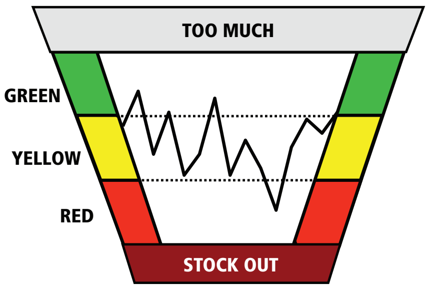
The stock buffers of DDMRP are placed at critical decoupling points to perform the following functions:

- ◆ **Shock absorption—**Dampening both supply and demand variability to significantly reduce or eliminate the transfer of variability, which creates nervousness and the bullwhip effect.
- ◆ **Lead-time compression—**By decoupling supplying lead times from the consumption side of the buffer, lead times are instantly compressed.
- ◆ **Supply order generation—**All relevant demand, supply, and on-hand information is combined at the buffer to produce an "available stock" equation for supply order generation. These buffers are the heart of a Demand Driven planning system.

The DDMRP available stock equation is relatively simple but foreign to conventional planning systems. It adds open supply to on-hand and then subtracts qualified sales-order demand. Qualified sales-order demand is limited to sales orders due today, due in the past, and future qualified spikes. By including only sales orders, the forecast and the error associated with it are decoupled from the commitment of capital, materials, and capacity. This equation is unique to Demand Driven MRP.

Stock buffers initially are sized through a combination of factors, including an average rate of use, lead time, variability, and order multiples. Then the buffers are stratified into color zones (green, yellow, and red) for easy priority determination in planning and execution. Each zone has attributes that affect its relative size, and the buffers dynamically adjust with market changes in consumption or in advance of planned or known activity, such as seasonality or promotions. Figure 5 illustrates the

Figure 5: Replenishment Stock Buffer



nature of these buffers.

Don't confuse strategic replenishment buffers with MRP's safety stock. Safety stock does *not* decouple—it seeks only to compensate for variability, assuming no decoupling or lead-time compression (i.e., a longer planning horizon). This makes it an inefficient type of dampening mechanism. Additionally, safety stock often has mechanisms (such as order launches and expedites) that can exacerbate the bullwhip effect. (An in-depth look at the DDMRP buffers is available in a white paper by the Demand Driven Institute at http://demanddriven institute.com/buffers_paper.html.)

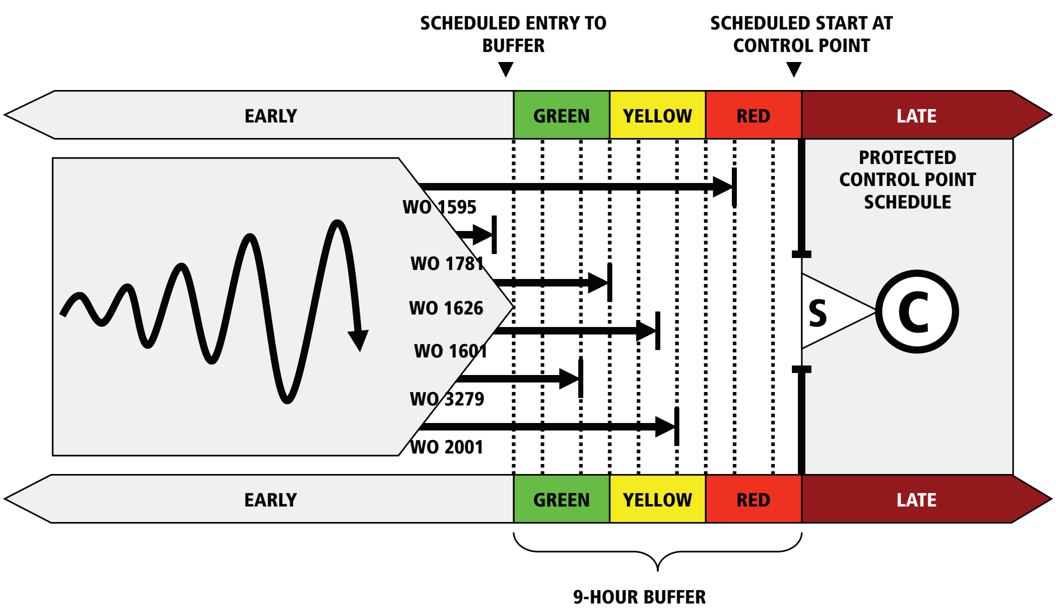
Demand Driven Time Buffers

Control points manage the activity between decoupling points or between decoupling points and customers. Their schedules pace all other resource and area schedules, so protecting the control point schedules is crucial for overall system stability and control. Demand Driven time buffers are planned amounts of time inserted in the product routing to cushion a control point schedule from disruption. Time buffers are sized based on the reliability of the string of resources feeding the control point. The less reliable or more variable that string, the larger the time buffer required to protect the control point.

Figure 6 illustrates the concept of the time buffer. The time buffer is in the middle and is the range bordered on the top and bottom by boxes containing the words *green*, *yellow*, and *red*. On the left side of the buffer is the flow of work from preceding operations toward the buffer and is represented by the shaded pentagonal figure pointed at the buffer. The squiggly line represents the accumulated variability in the flow of that work. On the right side of the buffer is the control point, indicated by the shaded box with a circle with a C inside it. The triangle with an S inside it indicates the scheduled start of work for an order at the control point.

In this example, the total buffer is nine hours of time. Each zone has been set at duration of three hours. The dotted lines that bisect the buffer from top to bottom indicate each hour of each zone. With a nine-hour buffer, work orders are scheduled to be in the buffer (buffer entry schedule) nine hours before their scheduled start time at the control point. With the existence of the variability in the preceding workflow, that will rarely happen. When the buffer is sized properly, the majority of work orders will arrive in the buffer sometime between the buffer entry schedule and the scheduled start of work at

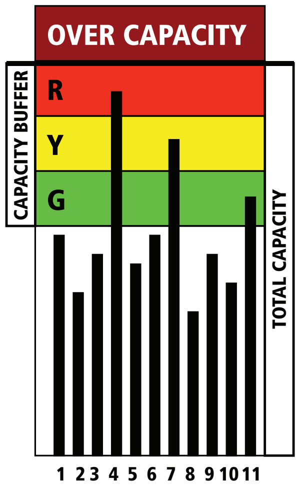
Figure 6: Time Buffer Protecting a Control Point



the control point. In Figure 6 this is depicted through the various lengths of the arrows into the time buffer. These are called buffer penetrations.

A buffer penetration occurs when work isn't in the buffer and available to the control point any time after the scheduled buffer entry time. In some cases, work actually arrives early at the buffer before the scheduled entry time. The lengths of the buffer penetrations determine the risk to the control point schedule and whether action to expedite is required in the preceding resources. The longer the penetration, the larger the risk to the control point schedule. The key is that when the length of a penetration goes beyond the scheduled start of work at the control point, a late entry in the buffer will be created. A late entry means that the control point schedule has been compromised. Taking action to prevent late entries keeps the control point and the system stable, reliable, and on time. Because these buffers are part of a system's total lead-time equation, a company can constantly strive to reduce them by identifying and eliminating the major causes of buffer penetrations in the red and late zones. We'll discuss the importance of collecting data about these penetrations and their role in smart metrics in our next article.

Figure 7: Capacity Buffers

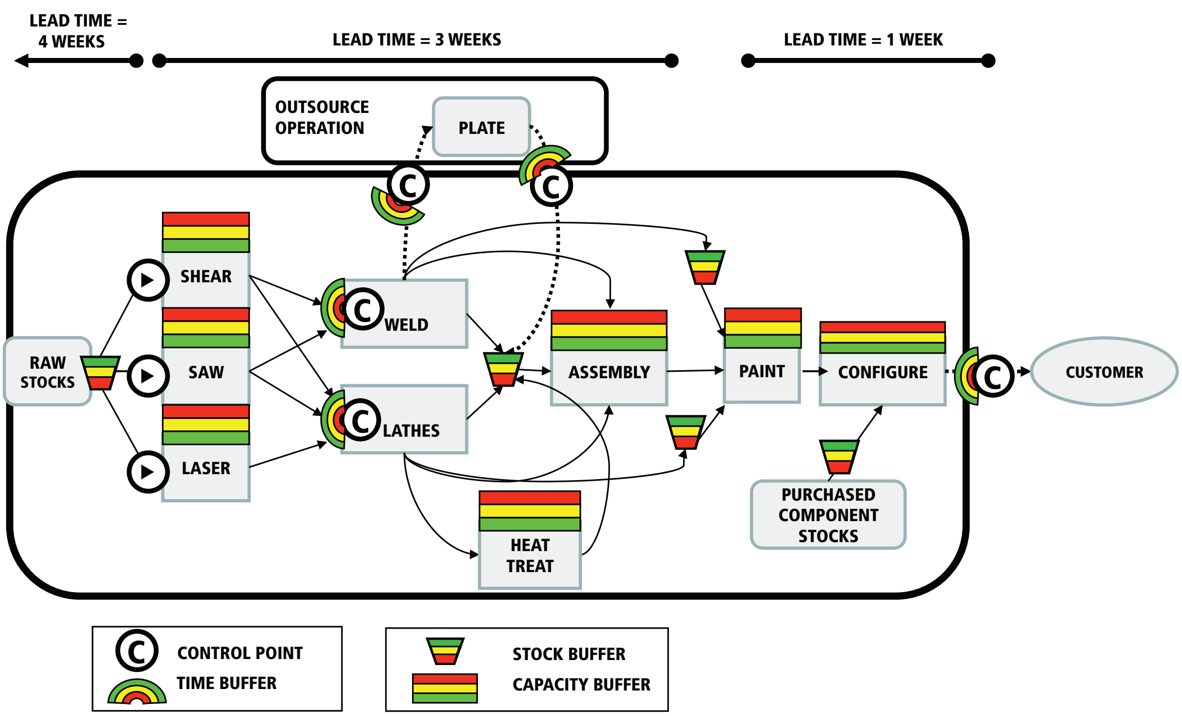


Demand Driven Capacity Buffers

Capacity buffers protect control and decoupling points by giving resources in the preceding workflow the surge capacity to catch up with variability. The ability to focus and then sprint and recover allows stock and time buffers to be reduced safely, thereby decreasing total product lead time and required working capital investment.

Figure 7 shows a resource's load requirements over 11 time periods. The black bars are meant to convey load: the longer the bars, the bigger the load. The capacity buffer is the section stratified by R, Y, G (red, yellow, green). The black bars in three of those time periods penetrate the buffer. The higher those bars go, the closer a resource gets to being overloaded in that period. A resource that's consistently loaded to red or overloaded is less responsive because it's becoming capacity constrained and should be considered for control point status or capacity upgrades. This protective capacity exists today in every resource that isn't capacity constrained.

Figure 8: Completed Demand Driven Design Model



But capacity buffers *should not* be used to improve unit cost or to drive a particular resource's utilization. In fact, the entire notion of a capacity buffer flies in the face of conventional costing policies. Capacity buffers require a resource to maintain a bank of capacity to recover from variability. This capacity can go unused. Exploring ways to create revenue opportunity with unused capacity is totally valid. What *isn't* valid is encouraging a resource to misuse its spare capacity to improve unit cost or resource efficiencies by running unnecessarily. When that happens, responsiveness goes down, and the stock and time buffers are jeopardized, forcing them to increase to compensate. The result is an increase in lead times and inventory levels and a decrease in ROI.

Figure 8 illustrates the completed design for our example company. Buffers have been inserted. The bucket icons depicting strategically replenished stock buffers have the green, yellow, and red stratification. The radial green, yellow, and red icons represent time buffers in front of the control points. The exit and entry points to outsourced plating and to the customer also have time buffers to protect their schedules. All resources that aren't control points (resources other than weld and lathes) have capacity buffers, which are represented by a stratified box in the top portion of the resource box. These capacity buffers aren't meant to convey that the organization simply plans to invest in capacity everywhere. They do mean that the company will commit to keeping more capacity in those areas relative to the finitely scheduled control points those areas feed.

Stock is an investment in both time and capacity. All buffers are interdependent and, in some cases, can even be interchangeable. Investments in stock, capacity, or time are strategic only if they protect and deliver the agreed-upon market strategy. The specific sizing, management, and measurement of these buffers, as well as the importance of their role in smart metrics, are detailed in our next article.

Operating Effectively

In a Demand Driven system, everyone's actions are driven to the same priority, and all objectives are focused on the speed of flow of the right materials and information to and through the decoupling and control points to meet true market pull.

A properly constructed Demand Driven operating model:

1. Aligns the operating model to market requirements and potential,
2. Eliminates the variability and subsequent bullwhip associated with forecast error,
3. Creates a realistic and executable schedule,
4. Dampens the impact of variability inherent in a dependent event system on system flow,
5. Provides the framework for relevant information and subsequent decision making to drive ROI in the right direction,
6. Provides visibility and priority alignment for flow across the organization, and
7. Injects no conflicting operational metrics at the tactical and execution level.

These seven outcomes are critical to being effective and competitive in the New Normal. **SF**

***Note:** Part 3 of this series will focus on the last two steps of becoming Demand Driven: bringing the Demand Driven model to the organization and using smart metrics to operate and sustain the Demand Driven operating model. We also will share the results of companies who have successfully shifted to this operating model. Sections of this article are excerpted from* Demand Driven Performance *by Debra and Chad Smith (McGraw-Hill Professional, Hardcover, November 2013) with permission from McGraw-Hill Professional.*

Debra A. Smith, CPA, TOCICO certified, is a partner with Constraints Management Group, LLC, a services and technology pull-based solutions provider. Her career spans public accounting (Deloitte), management accounting (public company financial executive), and academia (management accounting professor). She served five years on the board of directors of the Theory of Constraints International Certification Organization, has been a keynote speaker on three continents, is coauthor of The Theory of Constraints and Its Implications for Management Accounting *and author of* The Measurement Nightmare, *and received the 1993 IMA/PW applied research grant. You can reach her at dsmith@thoughtwarepeople.com.*

Chad Smith is the coauthor of the third edition of Orlicky's Material Requirements Planning *and the coauthor of* Demand Driven Performance—Using Smart Metrics. *He is the cofounder and managing partner of Constraints Management Group (CMG) and a founding partner of the Demand Driven Institute. Chad also serves as the program director of the International Supply Chain Education Alliance's Certified Demand Driven Planner (CDDP) program. You can reach him at csmith@thoughtwarepeople.com.*