

# LEANING OUT THE MRO SUPPLY CHAIN



**When applied to the MRO supply chain, the material flow and inventory management principles and techniques popularized by Toyota can improve availability, shrink inventory and reduce purchasing and management costs.**

Hoarding stuff just-in-case it's needed someday is a fundamental facet—and occasional neurosis—of the human condition. In the work environment, much of the “stuff” that people hoard is maintenance, repair and operations (MRO) supplies. Because that inventory is hidden, quite literally, it often sits unused and forgotten, wasting space and purchasing dollars that could have been put to more productive uses.

The approach to operational efficiency popularly known as “lean manufacturing,” which is derived from the Toyota Production System (TPS), targets such inventory and other types of waste, and pushes organizations to continuously enhance customer value. This white paper reviews some of lean manufacturing's key principles and supply chain management practices, and how they can be applied to managing the MRO fulfillment process.

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### What Does a Lean Supply Chain Look Like?

Manufacturers have been experimenting with lean practices on their production floors for decades. In recent years, financial firms and hospitals have been applying the techniques to the administrative areas of their organizations to improve quality and boost capacity.

The lean principles and objectives that can be applied to any type of organization include building quality into work

processes, standardizing best practices, reducing lead times, focusing on what adds value to customers and continuously improving. These goals are realized by eliminating “waste” in the value stream. A value stream encompasses all of the actions—value-creating and non value-creating—required to bring a product from concept to launch, and from order to delivery. <sup>1</sup> **Table 1** lists the seven types of waste (and supply chain equivalents).

**TABLE 1: THE SEVEN TYPES OF WASTE**

Lean Production	Lean Supply Chain
1. <b>Overproduction</b> — making items before they’re needed	<b>System complexity</b> , elaborate scheduling systems and managers working around mismatches between the formal schedule and actual needs.
2. <b>Waiting</b> (goods in stasis while waiting for the next process)	<b>Lead time</b> , too much time from one step to the next.
3. <b>Excess movement</b> when shifting goods from one process to the next	<b>Transport</b> , excessive conveyance among facilities and companies.
4. <b>Inappropriate processing</b> that does not add value to the customer	<b>Space</b> . In lieu of processing, space becomes a value factor and excessive space for storing inventories is waste.
5. <b>Unnecessary inventory</b>	<b>Inventory</b> at any point in the fulfillment stream.
6. <b>Excess motion</b> that can also compromise health and safety	<b>Excess effort</b> , fulfillment-stream members working at cross-purposes, which creates rework, confusion, and excessive motion.
7. <b>Defects that</b> result in rework, scrap or complaints.	<b>Packaging</b> , the wrong types of goods in the wrong quantities resulting in damages, excessive inventories, and corrections downstream.

<sup>1</sup> Lean Lexicon, Lean Enterprise Institute, 2003

Sources: Lean Lexicon, Lean Enterprise Institute; Building a Lean Fulfillment Stream, Robert Martichenko, Kevin von Grabe



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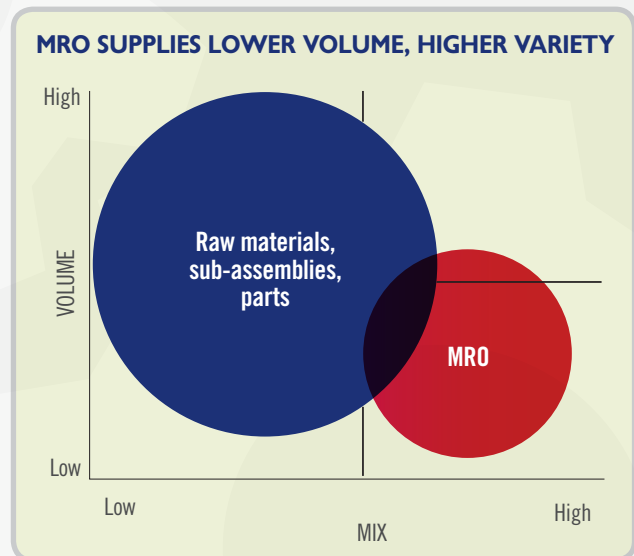
In addition to leveraging a variety of tools to eliminate waste, lean proponents place a strong emphasis on the ability of people at all levels of an organization to identify and solve problems. This requires employees to assume responsibility for recognizing and responding to issues—defective product for example—as they arise.

More mature lean organizations extend this perspective to their supply chain relationships. “In the emerging world of lean production, supply chain managers seek to create win-win relationships with a small and stable supply base by focusing on the shared value creation process—what we call the value stream—that flows through the supplier firm into the buyer firm,” writes James Womack.<sup>2</sup>

To build such relationships, lean supply chain managers rely less on competitive bidding and market forces to optimize service levels and prices, and work more closely with key suppliers to eliminate inefficiencies that increase costs, sharing the financial benefits of any improvements. In many cases, after value streams have been mapped out and analyzed (which we explore in more detail below), the sources of waste and extra costs can be linked directly to internal behaviors and practices, such as excessive engineering design changes and erratic ordering practices. The sources of inefficiency in MRO purchasing and inventory management practices can be identified and addressed in a similar way.

For clarity’s sake, as we define it, MRO supplies include all of the machinery, tooling, parts and consumables used to create a product that are not part of the final product. It also includes all of the items needed to maintain the facilities where raw materials and the final product are manufactured and stored. This includes cutting fluids and lubricants, office supplies, shop supplies, furniture, light fixtures, toolboxes, safety protection and other consumables. These supplies tend to be lower volume and higher variety compared to the raw materials, sub-assemblies and parts that directly go into a product, which is where supply chain management and rationalization efforts are typically focused.

Although it can account for up to 40 percent of procurement costs<sup>3</sup>, purchasing and storage of MRO supplies tends to be highly decentralized. Buying processes, vendors and inventory management practices for the same type of supplies often differ between departments and facilities. Such characteristics, from a lean management perspective, can add up to huge opportunities to reduce waste, reduce costs and improve productivity.



For example, starting at the beginning of the ordering and replenishment process, applying lean practices to MRO procurement can eliminate unnecessary paperwork and other activities that provide little internal or external value. Rationalizing and automating procedures and transactions can both improve productivity and reduce opportunities for error.<sup>4</sup> As a result, the purchasing departments at lean companies tend to operate with half as many employees as comparable ones that are not lean.<sup>5</sup>

<sup>2</sup> Skills for the Lean Supply Chain & Purchasing Professional, James P. Womack, Lean Enterprise Institute

<sup>3</sup> The Case for Managing MRO Inventory, John Donnelly, Supply Chain Management Review, 2013.



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When implementing lean, many organizations start with some well-known tools. Applying these tools develops employee understanding of the underlying lean principles. In the following sections we explore some of those tools, and how they apply to MRO inventory management and replenishment.

### 5S: Organize for Efficiency

Many lean initiatives start with a workplace organization methodology known as 5S. Originating in Japan, 5S has been loosely translated into English as 1) sort, 2) set in order, 3) shine, 4) standardize and 5) sustain. It's more than a housekeeping exercise. Whether 5S is being implemented in a factory or lab or administrative area, the ultimate goal of such a program is to help employees do their job more efficiently and effectively by improving organization, order and cleanliness.

The initial "sort" phase of 5S can be a revelation. It starts with opening cabinets and drawers, boxes and bins, toolboxes and closets, looking at everything and asking, "Do we need it, or not?" Secret stashes that no one knew about are uncovered. Obsolete parts for equipment that is no longer around are unearthed. Unused material and supplies, quite costly in many instances, are disposed of. And useful parts can be returned to central inventory.

Ultimately, the clutter is cleared out and large amounts of space are freed up by eliminating hidden stores, removing unused equipment and getting rid of excess storage space. The next step is to assign and mark storage locations so the work space remains orderly. Everything is given a designated place, as indicated by visual indicators.

**MRO Inventory Management:** A well-organized storage area, like a tool crib, maximizes use of available space. Productivity is improved because needed parts and supplies can be found quickly.



### Value Stream Mapping: Learning to See

If no one fully understands the product flow or service flow, it's difficult to improve a process, especially one that spans multiple departments and organizations. Value stream maps provide such visibility.

When creating a value stream map, employees from different areas and departments use simple icons to illustrate the flow of material and information. A key element of the exercise is the documentation of value-adding and non-value-adding time, which shows where inventory tends to wait for the next step (one of the seven types of waste). Attacking these bottlenecks tends to speed throughput and reduce order-to-shipment lead times, dramatically in many cases. Applied to a supply chain, elements of such a map may include transportation links, delivery steps, shipping and receiving processes.

Once they complete a "current state" map, and analyze the various sources of inefficiency, the process improvement team draws a "future state" map. Creating a future state map helps establish improvement priorities, sets accurate targets, and rationalizes the tradeoffs across the value stream. Subsequent efforts to implement the agreed-upon future state typically increases cooperation and collaboration between departments and function.

<sup>4</sup> *Lean Thinking for the Supply Chain*, Bruce Tompkins, Principal, Tompkins Associates, 2004

<sup>5</sup> *Lean Procurement Processes Mean Fewer Employees*, Becky Partida, APQC, *IndustryWeek*, 2012.



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For example, an improvement team at Tim Horton's, a quick service restaurant based in Oakville, Ont., mapped the organization's supply chain. They focused on the company's product replenishment process. Looking at the map, it was easy to see layers of overlapping activity. Ultimately, they implemented their future state map which centralized the product replenishment function rather than have it managed individually within each of its five distribution centers. The change improved vendor communication and efficiency.<sup>6</sup>

**MRO Inventory Management:** Mapping MRO ordering and replenishment processes can shine a light on wasteful activity and show clear opportunities for improvement. This includes the benefits of centralizing inventory management whether it is accomplished internally or as part of a vendor management agreement.

### Standardized Work: The Foundation for Improvement

The problem with engineering instructions is that they are written by engineers. In a lean environment standard work instructions are typically designed and written—with photos and illustrations—by the people who do the work everyday.

On the technical side, standard work factors in the customer demand rate, the precise work sequence, and available machines and work stations. It reduces defects and rework by building quality into the process through error-proofing techniques. However, when it's correctly adopted, standard work is not fixed. By establishing a consistent way of doing the work, it creates a baseline for improvement. When a better way of doing a task is discovered, usually by the operators themselves, everyone is retrained and the work instructions are revised.

In shipping and receiving docks, for example, standard work will identify clear procedures for unloading and loading trucks, establishing staging areas, and storing material in inventory. To be sustained, supervisors need to audit work activity regularly to make sure standard work is being followed.

**MRO Inventory Management:** Standardization of any type will tend to improve quality and productivity. This applies to inventory management practices—processes and inventory complexity—as well as maintenance procedures. For periodic work, like scheduled maintenance, standard work also improves scheduling and budgeting accuracy.

### Just In Time: Enterprise-wide Inventory Visibility

The tighter the alignment between demand and supply, the thinking goes, the less the opportunity for waste in its various forms (See Table 1) to creep into the fulfillment process. Core lean priorities—making material flow, pull systems, and level loading—are facilitated by various analysis and production tools, including value stream mapping, kanban bins, supermarkets and heijunka boxes.

Tighter alignment with customer demand is embodied by just-in-time production, which strives to make and deliver only what's needed, when it's needed, in the quantities needed. It takes years of collaboration for lean manufacturers and their suppliers to align supply and demand, sharing production schedules and inventory levels throughout the production and distribution streams.

To be implemented, just-in-time production requires demand visibility up and down the value stream. When end-customer consumption is visible, all participants in the fulfillment stream can plan and schedule work based on anticipated usage.<sup>7</sup> This allows inventory buffers to be reduced while order fill rates are improved.

**MRO Inventory Management:** A variety of inventory visibility and rapid replenishment processes can better align demand and supply MRO materials, improving availability and reducing costs. Options include vending machines and other types of vendor-managed inventory, which provide clear visibility of usage patterns.

<sup>6</sup> The Lean Supply Chain: Watch Your Waste Line, Merrill Douglas, Inbound Logistics, 2013.

<sup>7</sup> Building a Lean Fulfillment Stream, Robert Martichenko, Kevin von Grabe, Lean Enterprise Institute, 2010



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### Pull Systems: Aligning Supply and Demand

In an ideal world, according to lean principles, products should move in a continuous flow from one value-adding step to the next with no inventory buffers in between. Lean manufacturers have widely implemented such workflows in work cells and assembly lines.

When “one piece flow” is not possible—as is the case with most supplier parts and high volume components, from fasteners to stampings—pull systems are the preferred method of inventory replenishment. In contrast to traditional “push” strategies that develop production schedules from forecasts—which are never 100 percent accurate—pull systems use a variety of signals to inform upstream activities when additional supply is needed. For internal processes in a single location, these visual signals can take the form of kanban bins, parts supermarkets, and other visual indicators. Physical kanban cards can be used to send replenishment signals to suppliers, but these signals are increasingly electronic.

Dramatically reducing work-in-process inventory, pull systems reduce the potential for overproduction and other forms of waste that manual or computer-based planning and ordering methods can create.

**MRO Inventory Management:** Customer-managed inventory practices—using a handheld scanner to send replenishment signals to MRO suppliers—is an example of a pull system. Coupled with paperless order processing that doesn’t require purchase orders, consolidated invoices, and other electronic procurement practices, pull systems can eliminate significant waste from MRO supply chains.

### Sustaining the Gains

One of the core philosophical elements of lean management practices that help sustain improvements and prevent back-sliding is a strong emphasis on collaboration. Collaboration across functions and between organizations is required to identify problems and root causes, and implement countermeasures.



Ongoing collaboration is especially important for MRO inventory replenishment and inventory management practices. A lack of accountability and controls, and conflicting functional priorities, can quickly undermine the implementation of lean principles and supply chain management described in this white paper.

The root causes of hoarding in the workplace generally come down to insecurity and a lack of confidence that supplies will be available when needed. If these causes are not addressed, the clutter and extra material will begin to accumulate as soon as any clean-up exercise is finished.

By making replenishment processes more predictable and reliable, lean supply chain management practices can reduce the tendency to keep extra MRO supplies on hand just in case it’s needed. As described in this article, applying 5S, value stream mapping, standardized work, pull systems, just-in-time practices, workplace collaboration and other lean tools and methodologies to MRO inventory management and replenishment can improve availability, shrink inventory and reduce purchasing and management costs.



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