

# LEAN

# MANUFACTURING:

*"A systematic approach to identifying and eliminating waste through continuous improvement by flowing the product at the demand of the customer."*

*--Lean Manufacturing Guide*



This white paper breaks down the definition of Lean Manufacturing into easy-to-digest concepts and shares the real-life example of a subject company working towards the goal of lean.

## Lean Simplified Part 1

This is Part 1 of a series of white papers on lean manufacturing.



# Lean Simplified

## Part 1

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With all the discussion, books, websites, and other materials on the topic of lean manufacturing it's hard to know which resources are credible, much less understand the mounds of information that one has to sift through to find the most relevant facts. The purpose of this whitepaper is to do just that: simplify the concepts of lean manufacturing and present them in a manner in which the manufacturer can determine exactly what is needed in the production operation, and why.

This paper will also take you on a journey with a leading global supplier of reference test fuels and re-manufactured organic solvents, as they persist along the lean manufacturing path.

### **What is Lean Manufacturing?**

Lean Manufacturing Guide defines lean manufacturing as: “A *systematic approach to identifying and eliminating waste through continuous improvement by flowing the product at the demand of the customer.*”

Let's break the definition into parts and look at each more closely. First, we'll look at *identifying and eliminating waste*. Various resources have identified slightly different numbers and specific types of waste. But generally speaking, they are all represented within the following, easy-to-remember acronym:

- D** = Defects and Rework
- O** = Overproduction
- W** = Waiting (Idle Time)
- N** = Non-Value Added Procedures
- T** = Transportation
- I** = Inventory
- M** = Motion
- E** = Employees Under Utilized

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**Defects and rework** are probably the most easily identifiable wastes because they are tangible. For example, defects and rework cause companies to spend time correcting mistakes in paperwork or fixing physical problems with machines.

**Overproduction** can point to the obvious waste: turning out more product than what is needed by the consumer. But it can also mean overproduction of other items such as running too many reports and too many copies of them, over-engineering by adding more to the process than what is needed, or having unnecessary order points.

**Waiting** waste can come from many sources. In general, waiting waste is time between tasks when no work is being done. But other areas where employees are potentially waiting are often not considered, such as: trucks to be unloaded, next production step, searching for materials, supervisor signatures, poorly configured work centers, or poor plant layout.

Anything that does not add value to the customer is considered a **non-value added procedure**. These are the items that a customer doesn't pay for such as company reviews, inspections, production monitoring, and anything else that could be considered counter productive.

Many manufacturers are not only manually moving products, materials, and other items or resources throughout the building, but they are moving them unnecessarily. This is considered **transportation waste**. Another contributor to transportation waste is the poor location of shipping and receiving peripherals.

**Inventory** wastes can come from both shortages and excesses. Having a shortage of a material can put a batch ticket on hold resulting in the expiration of the other materials for that batch. Having an excess of a material simply results in wasted resources. Inventory waste can also come from having a poor setup for stores and bins.

**Motion** waste is different than transportation waste in that motion is the movement within a work area vs. the company as a whole. Often motion waste comes from poor organization of a work area, resulting in poor process flow within the area and poor work flow from one work center to the next.

The value of a trained employee often goes unnoticed by many upper management officials. But that is precisely what the **“Employees Under Utilized”** waste is. Employees not only need adequate training for their primary job, but they also need to be cross trained in other related areas. Additionally, applying an employee's skills and creativity where it best fits in the company is a benefit to both the employee and employer.

By eliminating waste, manufacturers can do more with less: less time, inventory, people, space, equipment, labor, and money. To identify wastes in the work environment manufacturers need to determine the components of the process that do not add value to the customer. This doesn't mean just the scraps, rework, or other garbage. By looking carefully at each of the eight identified potential wastes just described, companies can begin the process of implementing lean.

# subject company:

When our subject chemical process company (GPC) accepted the challenge to implement lean practices, the lead team looked at each of the eight areas of waste. The waste that was most readily identifiable was the amount of clutter in inventory control. There was a significant amount of excess material in storage that was being saved “in case it was ever needed.” Management recognized that the excess had to go in order to make room for materials that were currently needed in production. Inventory control and inventory reduction became primary goals for reducing waste and improving efficiency.

Continuous Improvement: Lean principles aren't concepts companies can apply once and consider themselves done; lean principles are ongoing. It requires a cycle of constant evaluation through each stage of the manufacturing process to find gaps between what is happening in the process and what should be happening based on the demand of the customer.

One of the challenges at GPC in implementing lean practices was helping employees understand that each goal accomplished is a milestone, not an end. Often in traditional working environments, once a target has been reached, employees relax and feel as though their work is done. Lean practices demanded that GPC workers remain focused on continuous improvement and maintaining momentum implementing further waste reduction projects.

We have repeatedly pointed out customer focus throughout this paper, so let's look at the last part of the definition: by flowing the product at the demand of the customer. This is where we need to look at the five basic principles of lean:

1. Specify Value
2. Identify the Value Stream
3. Flow
4. Customer Pull
5. Pursue Perfection

**Specifying value** is the most critical principle. If you're asking yourself, “But, *which* value?” you're asking the right question. The same lean process, identifying wastes and other aspects we have yet to cover, applies to all corporate values. For the sake of simplicity, we will only address the customer value. If a product has features that add cost but not value, the customer will not likely purchase the product. For instance, if a customer wants a basic shirt, but the manufacturer adds a pretty logo, the cost will go up but the shirt will not have improved in overall quality, thus creating waste, and ultimately, not meeting the demand of the customer.

The **value stream** is the set of all the specific actions required to bring a product through the critical business tasks: from raw material to finished product. The development process stream runs from design concepts to engineering to production launch. The fulfillment process stream involves the management of the product from order-taking, to scheduling delivery, to getting the finished product to the customer.

The **flow of a system** is identifying each of the steps of production and lining them up in a continuous format. Eliminating waste and processes between steps improves development and response times. This can be more easily visualized when we think about how we bake cookies at home. A typical consumer response might be something like: “We get all of the ingredients out of the cupboards, put them on the counter, and begin adding and mixing them as the

recipe calls for them.” On the other hand, a lean description might look something like this:

1. Determine how long the process will take.
2. Locate the recipe and determine whether ingredients are on-hand.
3. Create or clean a work surface for preparation.
4. Gather all the ingredients and position them for use on the work surface.
5. Gather the necessary tools for preparation.

Following the steps of this process saved the cookie maker a bundle of time because both ingredients and tools were located in advance. The lean process also ensured a clean work surface and allocated ample time to do the job correctly.

**Customer pull** is just the opposite of customer push. Often customer push methods create long response times in which companies try to convince customers that they want the item that was already designed and produced. Production scheduling is based on sales forecasts rather than actual requests.

Customer pull production, on the other hand, is dictated by what the customer requests the manufacturer to make. This is also known in the manufacturing industry as “Just In Time” production (JIT).

Lastly, **pursuing perfection** demands perpetual review from beginning to end of the manufacturing process, with the goal of reaching zero waste. In reality, perfection is never really reached because no matter the outcome of each review, there is always room for improvement in reducing cost, effort, time, space, and/or mistakes.

GPC has embraced value stream mapping as a tool for identifying steps in their manufacturing processes which are truly valuable to their customers. By quantifying the value of the various steps in any process, the company has been able to ‘lean out’, or re-create their operating practices to deliver the value while eliminating the steps that truly do not add value.

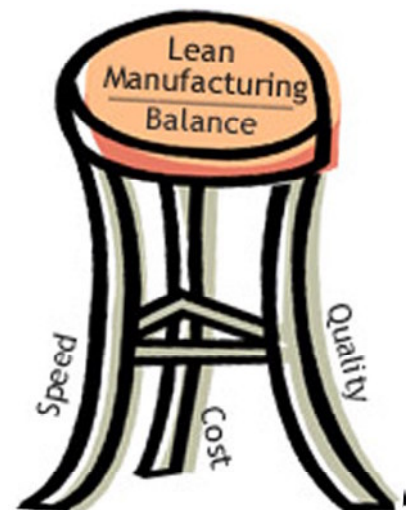
## ***What Lean Manufacturing Is NOT***

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The primary focus of lean manufacturing is speed and inventory reduction, while delivering product quality that meets clearly defined customer specifications. Again, looking at the value to the customer (both internal and external), manufacturers must be careful to balance the cost and time invested into a product with the quality demanded by the consumer. It is much like a three legged stool: speed, cost,

and quality representing the three legs. Each leg must be raised or lowered in proportion to the other legs, or the stool is out of balance. Since the primary focus of lean manufacturing is to improve speed, this leg becomes the pivotal leg upon

which the other two must balance. Keep in mind, however, that just because lean focuses on speed, it does not mean quality is compromised. The very nature of the principles of lean manufacturing improve the quality of the product.



# *The Benefits of Lean Manufacturing*

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The benefits of lean manufacturing are so numerous that they are quite difficult to simplify. For all practical purposes, let's say there are five overriding benefits, with all the additional benefits falling into one of the following categories:

1. **Material Handling** – Utilizing lean principles means that materials are moved less, shorter distances, and with simpler routes. These add up to a significant savings for the manufacturer in the form of fewer delays, less tracking efforts, and less confusion. In other words, material handling becomes more efficient.
2. **Inventory, Scheduling, and Production Control** – With a customer demand flow to production, companies are able to reduce the amount of on-hand inventory. This decreases potential waste of both expired materials and floor space for storage and manufacturing. Fundamentally, excess inventory hides problems. By reducing inventory levels, manufacturers discover a wide variety of process improvement opportunities that, once corrected, help them to become much more effective competitors in today's marketplace. By reducing inventory levels they are also able to increase inventory turns which means the inventory will be more in balance with current demands. This, in turn, creates better supplier relationships as manufacturers regularly re-order. From a scheduling perspective, creating more batches in smaller lot sizes enhances the overall manufacturing flexibility. The less inventory a company has in its value stream, the shorter the lead time from customer order to delivery.
3. **Quality** – In traditional manufacturing, quality becomes compromised when a product is discovered to be defective. Because a product

must move many times, often between several departments, it is very difficult to pinpoint where the defect occurred. With a single piece flow, the defect affects only a single part, thus eliminating long hours of isolating and investigating different parts of the process to find the problem. Forming an effective problem solving group across departments also becomes a challenge as nobody wants to take responsibility. With single piece flow, each team is focused on its own responsibilities and is motivated to avoid future defects.

4. **Employee** – As mentioned above, in a lean manufacturing environment, each team is focused on its goals and work results. Problems are typically identified right away, and team members receive immediate feedback on their work. Team success fosters employee morale. With team problem solving, the focus is directed to the processes and not the individuals. In addition to a boost in morale, employees will also benefit from a safer work environment. Less inventory means less clutter; fewer people and machines means more light and space. And a better layout of machines makes the physical work for employees easier.
5. **Customer** – Improved quality mixed with shorter and reliable response times is a recipe for happy customers. Having happy customers ultimately impacts the bottom line for the manufacturer as each customer becomes a repeat customer.

The team at GPC is realizing many of these benefits, and continues to explore opportunities for creating efficiencies. GPC management remains firm in their commitment to continue down the Lean Manufacturing path. The rewards, as we will read more about in Part 2, are measurable and motivating.

## *Summary*

No matter the type of manufacturing you are in, these basic lean principles, applied and adhered to, serve to improve all aspects of the company operations. If your company is not already engaged in a lean process, it is clearly time to think about it and look closer at lean practices.

—Charles Theisen, CPIM, CIRM

### *About the Author*

Charles (Chuck) Theisen is a Supply Chain Industry Specialist with over 30 years of experience in Supply Chain operations and business systems. His operations experience includes production scheduling, materials management, transportation management, business system support, and business systems management. Chuck has many years of experience in Supply Chain operations and consulting including warehousing, shop floor control, and related information systems. His consulting experience includes systems selection, implementation and usage, and operations and process improvement. He is a seasoned professional with strong communication skills, experienced in working with all levels in an organization.

Currently, Chuck is the Director of Implementation Services for ProcessPro, developers of ProcessPro® Premier ERP software. He works extensively with clients of ProcessPro to improve their Supply Chain effectiveness, with the primary focus on Materials Management and Manufacturing Operations.

### *About ProcessPro*

**ProcessPro** is the developer of the leading ERP software, ProcessPro® Premier, for the highly-regulated process industry. Excelling in the small to mid-sized market, ProcessPro provides an affordable ERP solution to those who must adhere to strict QC and government regulations including FDA, cGMP, 21CFR Part 11, Bioterrorism, HAACP, and more. ProcessPro® Premier seamlessly integrates all aspects of plant operations, from beginning order entry through manufacturing, packaging, shipping, and accounting.

ProcessPro® Premier is a fully-integrated, real-time solution. This ERP rises above other industry software in production capabilities, financial integration, user interface, system functionality, flexibility, and more.

ProcessPro® Premier is available with full source code and can be customized to fit an organization's unique business needs. For more information, visit [www.ProcessProERP.com](http://www.ProcessProERP.com).

### *About GPC*

GPC is a leading global supplier of paint solvents, test fuels, and paint-system recycling technology for the automotive industry. Their customers include automotive manufacturers and suppliers, as well as chemical and pharmaceutical companies, in the United States, Canada, Mexico, Europe, and South America.

The company has supplied custom-blended solvents, test fuels, calibration fluids, and refined products to the automotive industry for over 70 years. Its products are used in OEM assembly, engine, and component plants, and throughout the industry's supply chain.

GPC manufactures paint-related products and cleaners for a wide variety of industrial uses, as well as calibration testing fuels for use in the automotive industry. Paint-related products include paint-line and booth cleaners, purge solvents, and thinners.

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