



Lean Manufacturing

This guide teaches you the ropes of Lean manufacturing and its ability to transform workplaces.

Introduction

Lean manufacturing has transformed not only the way companies produce goods but also how they think about waste, efficiency, and safety in the workplace. In manufacturing, it's easy to get tunnel vision when it comes to processes and improvement—if it's not broken, then a million other things deserve immediate attention.

Manufacturing experts have long discovered that devoting time and energy into evaluating processes with an eye toward improving efficiency and cutting down on unnecessary waste. And this is what Lean manufacturing is all about: improving processes.

History of Lean

Lean ideas have appeared in industry for centuries. Examples include:

- The shipbuilding industry in Italy in the 1500s where a basic version of continuous flow was used
- Henry Ford's auto plants in the early twentieth century where equipment was placed in the order it was utilized



Leaders at the Toyota Motor Company in Japan, however, were among the first to bring together many of these ideas into a cohesive methodology. This system, called the Toyota Production System (TPS), began to emerge at Toyota after World War II when the automaker was seeking ways to make itself more competitive and to streamline processes.

The term Lean manufacturing itself emerged in the late 1980s among researchers, writers, and consultants who had studied the way automobiles were produced in Japan. “Lean manufacturing” is often used in the West to refer to the Toyota Production System.

Several books published in English in the nineties helped spread TPS ideas around the world, and today, companies in a wide variety of industries and countries utilize Toyota’s methods.

Goals of the Toyota Production System

The Toyota Production System aims to:

- **Streamline processes**
- **Increase efficiency**
- **Improve productivity**
- **Respect people**
- **Please the customer**

Many of these goals are achieved by identifying areas of waste. This is often done by examining the current state of the workplace, sometimes using what is called a value stream map. This map looks at the way materials or information flow through the process, where materials are stored, when materials arrive, the time it takes for steps in the process to occur, and more. It provides people with the information they need to assess the value creation process from beginning to end.

When a business examines the current state, it should look for three types of activities:

- Value-added
- Non-value-added
- Waste

For an activity to be value-added, it must meet several criteria:

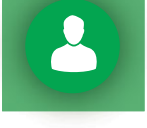
- Customers will pay for the activity
- The product changes in some way
- The work is done correctly without defects

These activities are the most important part of a process from the perspective of the customer.

Non-value-added activities consist of those tasks that must be performed, but that the customer doesn't see as adding value to the actual product. For example, complying with a government safety regulation during the manufacturing process may not influence the customer's decision to buy the product, but it is something that must be done anyway.

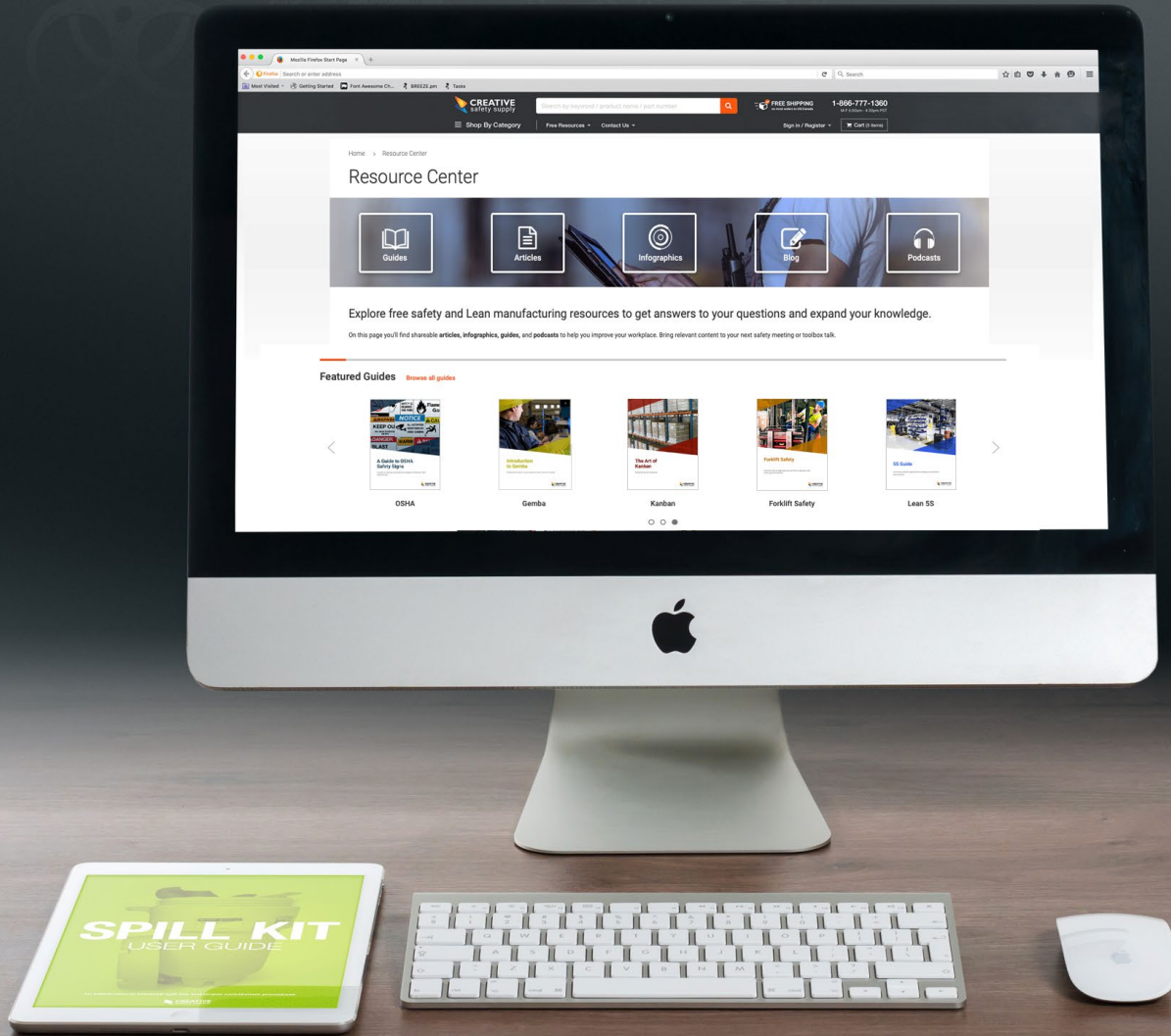
The third type of activity-and the most problematic-is waste. Waste doesn't add value and it doesn't need to be done to complete the product or service in question. This is what Lean seeks to eliminate.

In Japanese, this waste is called muda. There are 7 main types of muda:

	Defects products or services that don't meet company standards
	Waiting the down time between steps in a production process
	Motion people or equipment moving more than necessary
	Inventory making/storing more than meets customer demand
	Overproduction producing more of a product than customer demand requires
	Excessive Processing steps that don't add value for customer but cost resources
	Transportation unnecessary movement of materials in production processes
	Non-Utilized Talent not making full use of employees

An eighth waste, unutilized talent or skills, is often added as well.

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In addition to identifying these types of waste, Lean also tries to eliminate mura, or unevenness in production, and muri, the overburden of people or equipment.

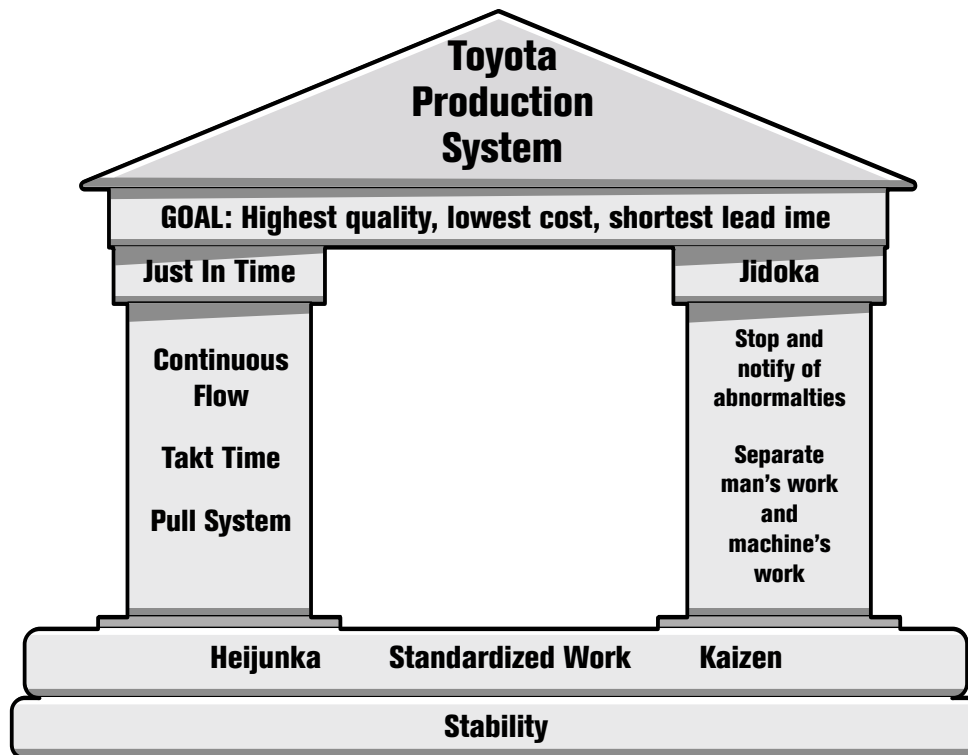
These problems with the flow and level of production can lead to fatigue, breakdowns, safety issues, and other undesirable situations.

In a Lean operation, processes flow smoothly and contain the least amount of waste possible. This allows high-quality products to be delivered to customers on time, in the quantities they desire, and for a price they are willing to pay.

Lean does not mean layoffs

When people hear the term Lean, they often worry it means eliminating people. This is not the case. In Lean, people are what make the system work. Respect for people is an integral part of Lean. People understand their own tasks and processes and are in the best place to try to improve them. Rather than seeking to eliminate people, a Lean workplace should seek to eliminate waste. When this means a task is eliminated, the person who performs that task should be reallocated elsewhere rather than let go.





The Toyota Production System “House”

TPS and Lean involve many tools that organizations can use. Some of these tools are fundamental to Lean and are necessary for creating a successful Lean environment.

These concepts and tools are often depicted in the form of a house, called the house of lean.

At the top of the house are the goals of TPS: create high-quality products at a low cost with the shortest lead time possible. (Lead time refers to the amount of time it takes to complete a product from start to finish.)

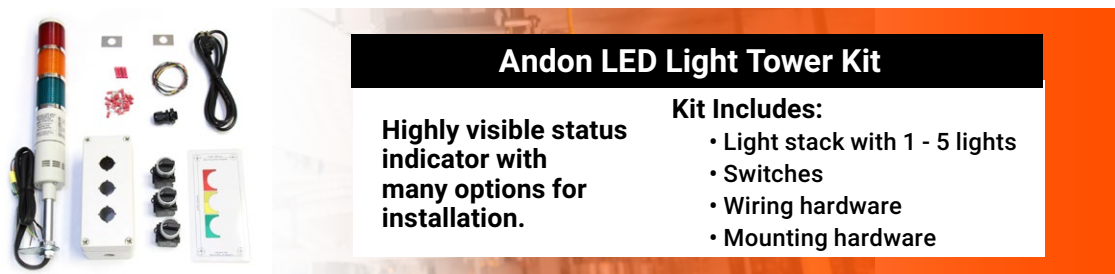
Beneath these goals are two pillars that are what keep TPS running: Just-in-time production and jidoka.

Considered to be the basis for TPS, Just-in-time (JIT) production refers to a method of production based on customer demand instead of on traditional demand forecasting. In JIT, when a customer orders products, this triggers the upstream process to begin making those products.

This method is often referred to as a pull system because production is pulled by customer orders. A pull system is preferable to a push system (demand forecasting based on projections and historical data) because it allows a business to reduce wastes such as excess inventory and overproduction. Within this system, the term takt time refers to the amount of time it takes to fulfill customer demand, and processes are adjusted to takt time to prevent overproduction or underproduction.

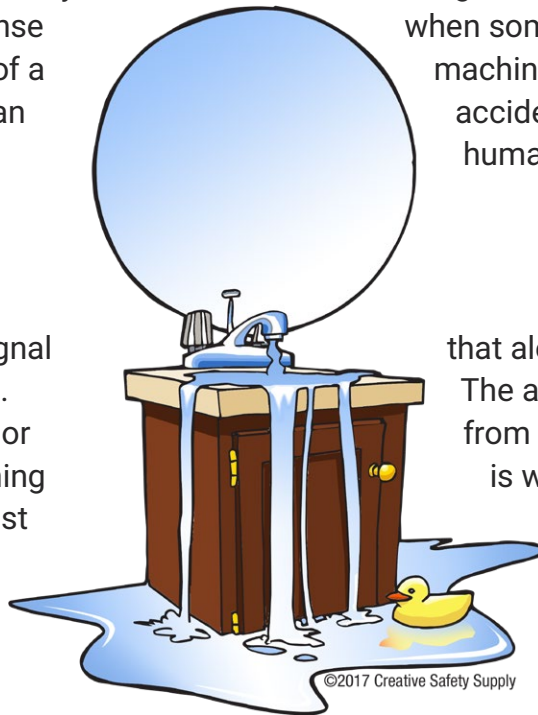
Jidoka, the second pillar, means “autonomation” or “automation with a human touch.” In a manufacturing process, this could mean machines are designed so they automatically stop when something goes wrong. This way, defects are immediately detected. This also frees up people to oversee more machines at one time. Jidoka helps improve quality by catching defects so the problems that cause them can be resolved.

Several other Lean tools such as poka-yoke and andon boards/signals can be used in conjunction with jidoka.



Poka-yoke means “mistake proofing.” Poka-yoke techniques prevent errors from occurring, and they’re common even in everyday life. For example, bathroom sinks have a hole near the top to prevent water from overflowing if someone accidentally plugs the sink and leaves the water running. In a manufacturing facility, machine guarding techniques such as light curtains sense when someone is too close to a machine and automatically turn it off to prevent an accident. Poka-yoke is simple, but it prevents problems.

An andon is a signal with the process that changes color to signal something where people post the status of common. All reinforce jidoka issues.



that alerts people to a problem. The andon could be a light from green to yellow or red is wrong. Andon boards information about production are also of these andons help by alerting people to

Like all Lean manufacturing concepts, TPS also relies on other concepts to like Heijunka, Standardized work, and kaizen.

Kaizen: the engine that keeps Lean going

Kaizen, a Japanese term that translates roughly to “continuous improvement,” is the Lean concept that holds the power of consistency and longevity. How often have you seen a facility try to implement some new change or process, only to see it be abandoned for the status quo a short time later? Kaizen combats this by instilling a new attitude companywide, one that focuses on how to make processes better every step of the way.

Kaizen can be defined as the philosophy and practice of continuous improvement. It refers to the practice of looking for ways to improve work processes on a regular basis. The practice involves small, incremental changes rather than large changes. With Kaizen, all people within the organization look for possible improvement opportunities, not just managers or executives.

Without Kaizen

- No structure to the improvement process; few set procedures
- Goals are not defined or are vague/difficult to measure
- Changes are made to processes infrequently; little reflection on their effectiveness
- No plan exists for improvement; improvement is haphazard

With Kaizen

- Consistent, ongoing process of improvement takes place
- Improvement process has clearly defined, measurable goals
- Constant review of successes occurs and the improvement process itself is evaluated
- Consistency of the process leads to new, higher goals

Kaizen's methods called for the use of what's called PDCA cycle, which stands for Plan, Do, Check, Act.

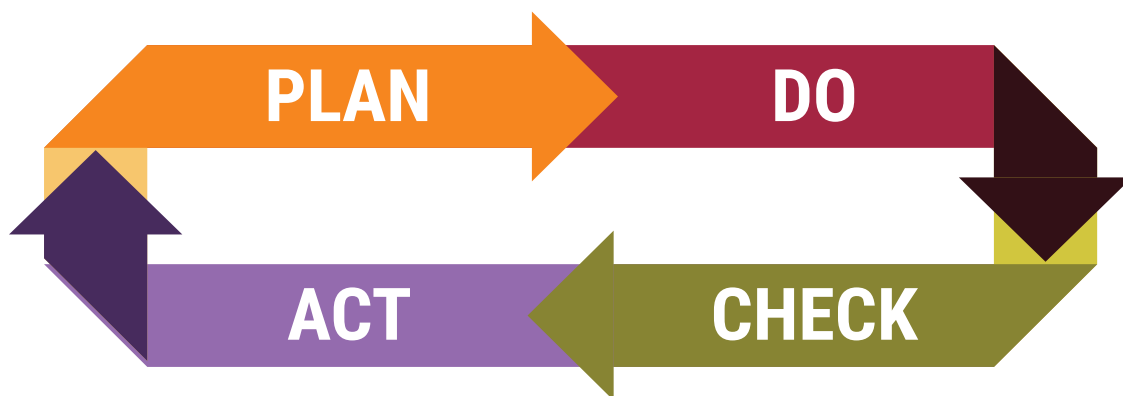
Plan: Now divided into two steps - define goals and targets as well as decide on ways to reach the end goal.

Do: Now divided into two steps - participate in education and training as well as implement the plan.

Check: Analyze the results to verify whether or not the plan has had the intended effect.

Act: If the results of the cycle were not satisfactory go back to plan. If the results were satisfactory, standardize the solution.

The PDCA cycle functions a bit like the scientific method with people testing out hypotheses to see what works and then developing new procedures based on outcomes.



Kaizen doesn't have an endpoint

A key thing to remember is that these cycles are ongoing. Standards are important to have, but they aren't set in stone. Workplaces are dynamic and business conditions change, so standards must change, too.



The goals of Lean manufacturing are to reduce waste, improve quality, and ultimately please the customer. The continuous improvement of kaizen helps Lean organizations achieve these goals.

Lean manufacturing highlights the importance of eliminating waste, which is defined as unnecessary work that does not add value for the customer.

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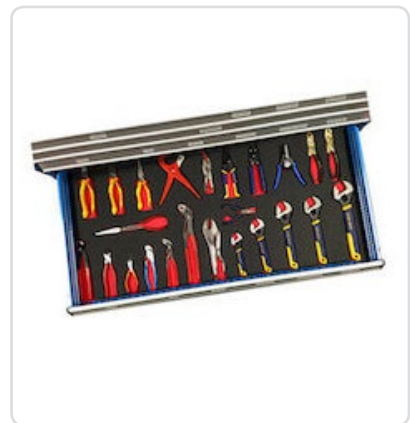
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