Worximity

EBOOK

LEAN MANUFACTURING AND INDUSTRY 4.0

Worximity Technology
Smart Factory Analytics

Reduce production costs with real-time monitoring

INTRODUCTION TO

Lean manufacturing principles

The lean method of production in manufacturing systems was first brought to public attention by John Krafick in 1988 when he published his article “Triumph of the Lean Production System.” This article helped people to begin to understand the benefits of using lean principles in a production system with the overall goals of reducing waste and maximizing efficiency.

However, it was not until the book “The Machine That Changed the World,” by Womack, Jones and Ross was published in 1990 that the lean method became widely known and sought after.

Due to lean being a method, there are many industries that it can be applied to and each industry that lean is applied to can have vastly different steps in which to achieve reduced waste and maximum efficiency.

Lean Manufacturing focuses on the way in which employees and managers collaboratively work. According to The Economist, the manufacturing industry’s gross value added has risen at about a four-percent rate per year. In order to remain competitive, most industries need to at least keep pace with, if not exceed this rate moving forward.

By implementing lean methods of production into the manufacturing system there is no doubt that waste will be reduced and efficiency will increase; leading to higher gross value added, higher profits, safer working environments and happier customers. Modern Lean Manufacturing methods have evolved to encompass an ever-wider range of tools and techniques.

An overview of contemporary Lean Manufacturing tools, techniques and terms is outlined below.

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Types of Waste Identified and Combated with Lean Manufacturing

The Eight Types of Waste per the Toyota Production System (TPS)
The most successful implementation of Lean Manufacturing to date is widely acknowledged to be when Toyota created the Toyota Production System (TPS), which focused on reducing the eight types of waste (or Muda, which is the Japanese word for waste).

These eight contributing factors to overall waste slowed down manufacturing times, led to lesser quality products, lost money and created unhappy customers. Toyota used lean as a method of manufacturing their cars, but the concept of lean and the methods that Toyota used to make their products so successful can also be applied to the manufacturing industry as a whole.

The eight types of waste that Toyota identified when they implemented the lean method are:

- Defects
- Overproduction
- Waiting
- Non-Utilization
- Transport Waste
- Inventory
- Motion
- Excess Processing

A handy way to remember these 8 types of waste is by the acronym DOWNTIME!

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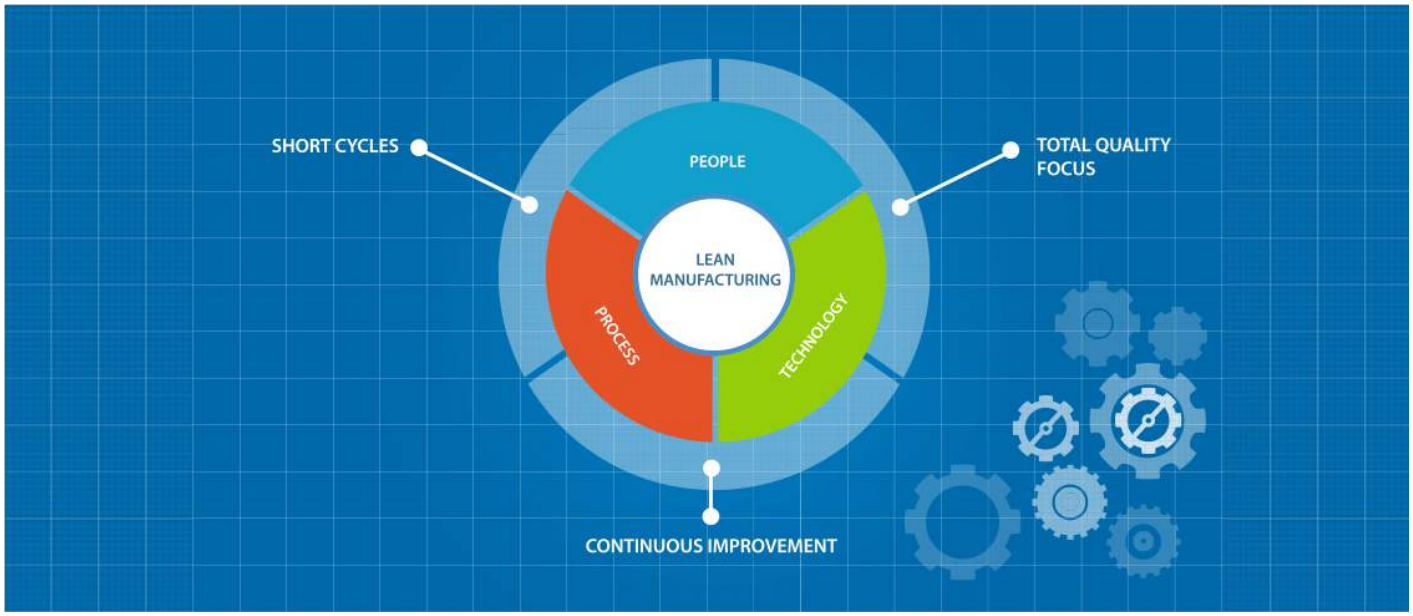
The 3 Ms of Lean Manufacturing

In 2003 James Womack, a contributing author to “The Book That Changed the World,” which is the book that helped make the lean method of production famous.

Beyond the traditional lean manufacturing forms of waste, the TPS also established other causes of inefficiency other than the 8 types of waste (Muda) described above.



Muri (Overburden) is created through the overburden of an unreasonable amount of work. This can be either of a worker (mental or physical) or a machine. By creating a standardized process of production, similar to Henry Ford's assembly line, TPS is able to: increase efficiency, create an easy to follow workflow, reduce costs and increase employee morale because there will be little confusion as to what each person's role is within the production system. This theory can be applied to Lean Manufacturing because Lean Manufacturing seeks to standardize the way in which goods are fabricated ensuring that any waste related to Muri is no longer an issue at a manufacturing site.

In addition to Muda and Muri, the third issue that the TPS identified and that is applicable to Lean Manufacturing is Mura which means: unevenness, irregularity and lack of uniformity. This relates to inventory and parts within a manufacturing project.

If the parts for a project are ordered ahead of time and received ahead of time it is possible that the projects needs will change, therefore wasting resources to purchase unnecessary parts. By keeping Mura in mind and enabling a Just-In-Time system (JIT), which is when one piece of a project must be in its final stages before the next piece of the project is produced, the amount of waste produced will be limited.

The JIT system creates a pull system, requiring each step to give a green light to the next step so that there will never be an excess of inventory. Lean Manufacturing relies on the JIT system and pull method so that once one part of the manufacturing phase is nearly completed the next part can begin. This also reduces the wait time (TAKT time) on a manufacturing site leading to maximum efficiency and an on-time completion of the project.

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The 5 S's - Workplace Organization Methodology

The 5's of lean manufacturing are based on five Japanese words and are ways in which a manufacturing system can help achieve a lean production method, effectively reducing waste and maximizing efficiency.

The 5's are: Seiri (sorting), Seiton (straightening), Seiso (systematic checking/cleaning), Sieketsu (standardizing) and Shituske (sustaining). By utilizing these five methods of workplace organization a manufacturing system can improve their management, employee morale, speed of work, quality of work and minimize the risk of accidents.

The benefits of integrating these workplace organization methods are enormous and are essential parts of creating a truly lean production facility.

The 5 S's are:

1. Seiri (Sorting)
2. Seiton (Straightening)
3. Seiso (System Checking/Cleaning)
4. Seiketsu (Standardizing)
5. Shituske (Sustaining)

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Value Stream Mapping (VSM)

Value Stream Mapping (VSM) is a lean management method for analyzing, enhancing and redesigning a manufacturing system's current method of production for the future to reduce waste and maximize efficiency. VSM is achieved by using advanced software that electronically maps out all steps of the production system that are value-adding and non-value adding.

By utilizing the software and creating a VSM, the management team of a lean manufacturing system can get a better understanding of how to create an end product that is defect-free.

The flow of the workplace will also be clearly shown, resulting in each individual better understanding their role. An important aspect of the VSM is not just focusing on the flow of material, but also focusing on the flow of information within the workplace. The flow of information is essential in a lean system because if the information is not passed along properly confusion will ensue and issues will arise during the manufacturing process.

The VSM is an ever-changing document that is continuously updated with information in order to aid in the Lean Manufacturing process.

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Kanban

Kanban is a scheduling system that is printed out onto paper cards or electronic tablets and is applicable to Lean Manufacturing, it was first used in the TPS and was very effective in aiding the TPS to reduce waste and maximize efficiency. The TPS found Kanban as an efficient lean tool when they studied the way that supermarkets restock shelves and modeled Kanban after that.

Kanban's main focus is to control the amount of inventory in a supply chain so that there is not an overproduction of goods. Kanban is able to control the amount of inventory in a supply chain by creating a limit in regards to the amount of work in progress that can happen at any given time. Kanban seeks to create products based on demand rather than expectations, therefore utilizing the JIT method as well as creating a higher quality end product that will make the customer satisfied with less waste and maximum efficiency.

Kanban is visualized via paper cards or electronic tablets and will alert manufacturers when there is a low amount of one specific inventory item. These cards or electronic systems can respectively; show employees in the line of production or automatically message managers when the inventory is low and that they must initiate the pull method. The pull system is a proven method within lean where more products are not made or ordered until a green light is given by the proceeding step, therefore reducing overproduction waste and increasing efficiency.

Kanban also utilizes a bin system that creates pull within the Lean Manufacturing process. Bins are placed on factory floors and are filled with inventory based on initial demands. There is also a stock room where supplies that are not immediately needed are stored and then the supplier of the inventory will have inventory on hand for when the manufacturing site has low amounts of a specific inventory.

The bin system acts as a revolving cycle where once the bins on the floor get low the stockroom resupplies them, then once the bins in the stockroom get low the supplier resupplies the manufacturing site. This repeating process is an effective means to reduce the amount of waste created in a manufacturing system.

There are six essential rules Toyota identified when using Kanban in the Lean Manufacturing process. These rules are:

1. Proceeding processes pick up the number of items indicated by Kanban in earlier processes
2. Preceding processes produce items in the quantity and sequence that are pre-determined by Kanban
3. No items are made or transported without a Kanban
4. Always attach a Kanban to a product
5. Defective products are not moved forwards, but rather analyzed and fixed. This creates a 100% defective free end product that is sold to the customer.
6. Reducing the number of Kanban increases sensitivity.

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Jidoka

Jidoka is the Japanese word for Automation, which is the method developed by TPS and used in lean that seeks to use advanced technology to prevent errors in the products created during the manufacturing process, which in turn reduces waste and increases efficiency.

The mistakes that are made during the manufacturing system can be detected automatically so that employees can fix the mistakes, which leads to a defect-free product. These mistakes can also be analyzed to figure out where mistakes are most likely to occur and how to stop them from happening in the future.

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Poka-Yoke

The Japanese term Poka-Yoke can be translated into English as mistake-proofing and is used within the context of Lean Manufacturing. Mistake proofing the manufacturing system is essential to reducing waste and creasing maximum efficiency. Poka-Yoke was created by Shigeo Shing, a Toyota engineer who helped create TPS, he also made the distinction between a mistake and a defect. A mistake is when something goes awry during the manufacturing process, but it can still be fixed. A defect is when the final product has a mistake that was not fixed during the manufacturing process, therefore rendering it unsellable and wasteful. Mistakes that are made during the manufacturing process that are not corrected will lead to a defective end product that cannot be sold to the end customer. Poka-Yoke will create a standardized process that is simple and easy for employees to follow so that they do not make any mistakes during the manufacturing process.

There are three steps that Poka-Yoke utilizes in order to check products for mistakes and stop any defective products from being finished:

1. Contact Method
2. Fixed Value
3. Motion Step

BECOMING A SMART FACTORY

Speeding up the process with IIoT

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Download our 4 steps implementation e-book in order to discover the easiest and most effective way to start your digital transformation. Who should manage the project? Where and when to start? What should be measured What ROI you will get?

YES, PLEASE.

BOOK A DEMO WITH OUR INDUSTRY EXPERT

Ready to discover our smart manufacturing technologies? Pick the right time for you and it will be our pleasure to walk you through our product designed for manufacturers seeking to achieve the effectiveness level of a smart factory.

YES, PLEASE.

IDENTIFY THE CHAMPION IN YOUR TEAM

It is important to identify a change champion, who "can be defined as a person working at any level of the organization who is skilled at initiating, facilitating, and implementing change. Download our checklist to easily identify your champion.

YES, PLEASE.

CALCULATE YOUR ROI

A smart factory always improves the productivity...But by calculating your potential ROI, you will surely be more motivated to invest resources in your digital transformation.

YES, PLEASE.

GET A QUOTE

Fill in this small form to find out the real budget you'll need in order to benefit from the following: automatic collection of your production data, real-time data analysis and a simplified access to all your production data.

YES, PLEASE.