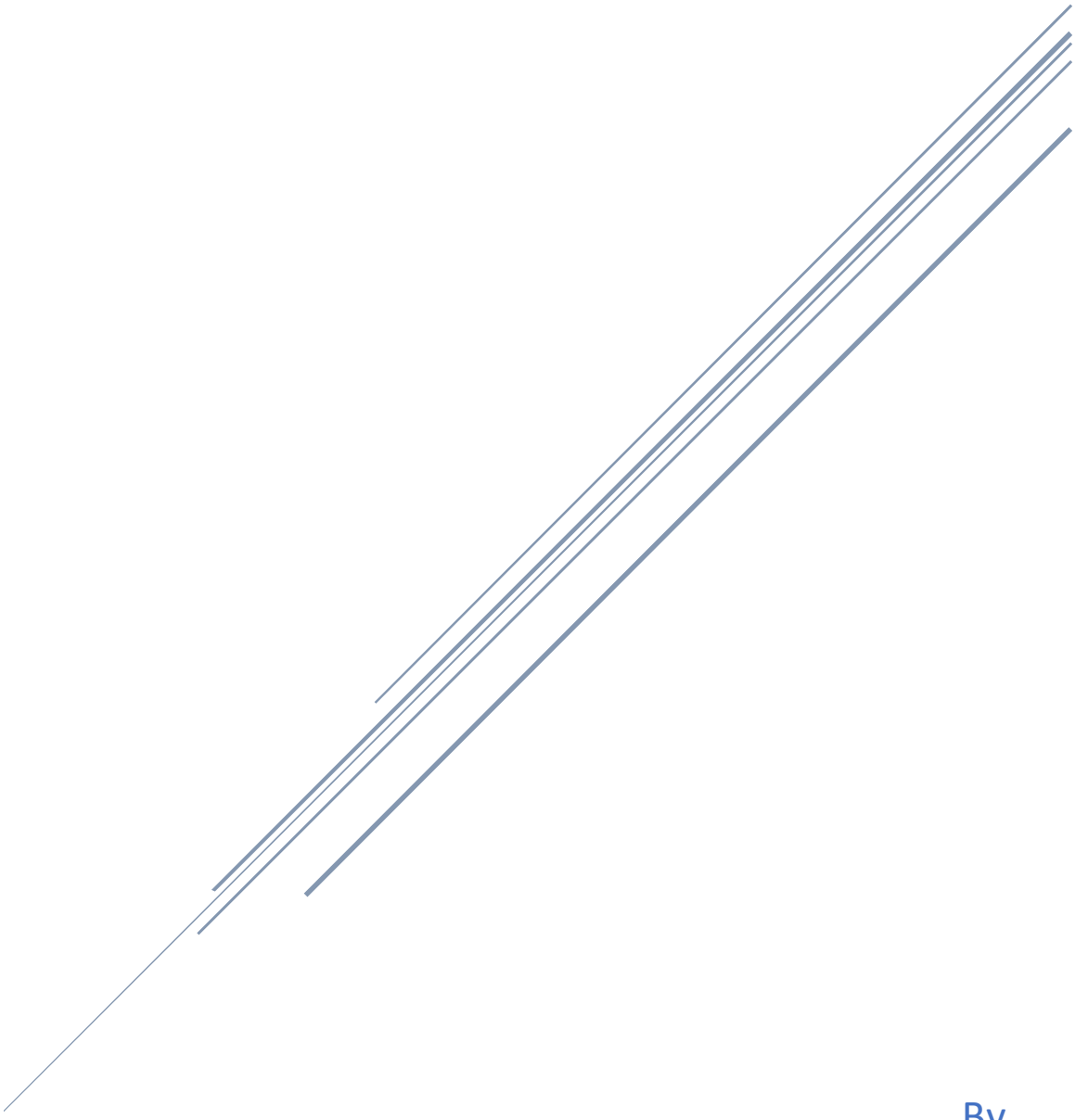
LEAN MANUFACTURING & 5S

What are they?



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Introduction

What is Lean?

Lean is the concept of efficient manufacturing & operations that grew out of the Toyota Production System. Toyota is recognized for being the epitome of lean, they have created a lean learning culture of employees at all levels that are focused on continuous improvement in everything they do, every day. The lean methodology is based on the philosophy of defining value from the customer's viewpoint, and continually improving the way in which value is delivered. This is achieved by eliminating every use of resources that is wasteful, or that does not contribute to the value goal. Lean not only allows for cost reduction while improving quality, but it can also position a company to achieve tremendous growth with minimal waste. This is done by empowering every individual worker to achieve his or her full potential, and therefore make the greatest possible contribution.

The goal of empowerment is based on the idea of showing respect for people. Respect for people extends beyond just the end customer and can include the workers, suppliers, and society. For the end customer, lean strives to maximize value delivery while minimizing waste in the process. For the workers, lean aims to maximize human potential by empowering them to continuously improve their work.

Under the lean methodology wastes, or wasteful activities, are commonly called "muda" and they are typically categorized into 8 different types. These types are defined as being defects, overproduction, waiting, unused talent, transportation, inventory, motion, and over-processing.

At the heart of the lean philosophy is the concept of "kaizen" or continuous improvement. The goal of continuous improvement is to make marginal improvements and changes that further eliminate waste in the value delivery process. To do this, lean leaders must go where value is created – commonly known as the "gemba". During a gemba walk, leaders can see the state of the work process and often spend their time developing their people. They motivate workers to actively identify problems and to look for opportunities for improvement. This can encourage greater communication, transparency, and trust between the lower level of employees and leadership.

What are the 8 types of Muda (waste)?

The first step in reducing waste is being able to recognize it and the different forms it comes in. The 8 types of waste are commonly remembered as the acronym DOWNTIME.

Defects

Defects are the most obvious type of waste and occur when the product is not fit for use. This typically results in either reworking or worse yet, scrapping the product. Both results are wasteful as they add additional costs to the operations without delivering any value to the customer. Defects are usually the result of human error or incorrect information.

Four countermeasures for defects are as follows. First, look for the most frequent defect and focus on it. Second, design a process to detect abnormalities and do not pass any defective items along the production process. Third, redesign the process so that it does not lead to defects. Lastly, use standardized work to ensure a consistent manufacturing process that eliminates or reduces the opportunities for defects to occur.

Overproduction

Overproduction occurs when manufacturing a product or an element of the product before it is being asked for or required. It may be tempting to produce as many products as possible when there is an idle worker or equipment time. However, rather than producing products just when they are needed under the "Just-In-Time" strategy, the "Just-In-Case" way of manufacturing leads to a variety of problems such as excess inventory, preventing the smooth flow of work, higher storage costs, requiring more capital expenditure to fund the production process, and excessive lead-time. Additionally, over-producing a product leads to an increased likelihood that the product or quantities of products produced are beyond the customer's requirements.

In an office environment, overproduction could include making extra copies, creating reports no one reads, providing more information than needed, and providing a service before the customer is ready. Manufacturing overproduction involves producing more products than demanded or producing products in higher batch sizes than needed.

There are three countermeasures for overproduction. First, using a "Takt Time" ensures that the rate of manufacturing between stations are even. Second, reducing setup times enables manufacturing small batches or single-piece flow. Third, using a pull or "Kanban" system can control the amount of WIP.

Waiting

This is probably the easiest waste you can recognize. Whenever goods or tasks are not moving, the "waiting waste" occurs. The waste of waiting includes people waiting on material or equipment and idle equipment. Waiting time is often caused by unevenness in the production stations and can result in excess inventory and overproduction.

In manufacturing, the waiting waste can include waiting for materials to arrive, waiting for the proper instructions to start manufacturing, and having equipment with insufficient capacity. In the office, the waiting waste can include waiting for others to respond to an email, having files waiting for review, and ineffective meetings.

Some countermeasures for waiting include designing processes to ensure continuous flow or single piece flow, developing flexible multi-skilled workers who can quickly adjust in the work demands, and leveling out the workload by using standardized work instructions.

Non-Utilized talent

Even though it was not part of the Toyota Production System (TPS), many people are well aware of the eighth waste - the waste of human potential. The eighth waste is also described as the waste of unused human talent and ingenuity. This waste occurs when organizations separate the role of management from employees. In some organizations, management's responsibility is planning, organizing, controlling, and innovating the production process. The employee's role is to simply follow orders and execute the work as planned. By not engaging the frontline worker's knowledge and expertise, it is difficult to improve processes. This is due to the fact that the people doing the work are the ones who are most capable of identifying problems and developing solutions for them.

In manufacturing, this waste can be seen when employees are poorly trained, employees not knowing how to effectively operate equipment, when employees are given the wrong tool for the job, and when employees are not challenged to come up with ideas to improve the work. In the office, non-utilized talent could include insufficient training, poor incentives, not asking for employee feedback, and placing employees in positions below their skills and qualifications.

Transportation

Waste in transportation includes the movement of people, tools, inventory, equipment, or products further than necessary. Excessive movement of materials can lead to product damage and defects. Additionally, excessive movement of people and equipment can lead to unnecessary work, greater wear and tear, exhaustion, and often, transportation may force you to pay additionally for time, space, and machinery.

In manufacturing, materials necessary for production should be easily accessible at the production location and double or triple handling of materials should be avoided. In the office, workers who collaborate with each other often should be close together.

Some of the countermeasures to transportation waste includes developing a U-shape production line, creating flow between processes, and not over-producing work in process (WIP) items.

Inventory

It can be difficult to think about excess inventory as waste, but excessive inventory is often the result of a company holding "just in case" inventories. In such cases, companies overstock themselves in order to meet unexpected demand, protect from production delays, low quality, or other problems. For accounting, inventory is seen as an asset and oftentimes suppliers will give a discount for bulk purchases. However, having more inventory than necessary to sustain a steady flow of work can lead to problems including product defects or damaged materials, greater lead time in the production process, an inefficient allocation of capital, and defects being hidden within the inventory. Excess inventory can be caused by over-purchasing, overproducing work in process (WIP), or producing more products than the customer needs. Excess inventory prevents detecting

production-related problems since defects have time to accumulate before it is discovered. As a result, more work will be needed to correct the defects.

In manufacturing, inventory waste could include broken machines sitting around, more finished products than demanded, extra materials taking up workspace, and finished products that cannot be sold. In the office, inventory waste could be files waiting to be worked on, customers waiting for service, unused records in a database, or obsolete files.

Some countermeasures for inventory include purchasing raw materials only when needed, and in the quantity needed, reducing buffers between production steps, and creating a queue system to prevent overproduction.

Motions

Wasteful motion is all of the motion, whether by a person or a machine, that could be minimized. Motion could refer to anything from a worker bending over to pick something up on the factory floor to additional wear and tear on machines, resulting in capital depreciation that must be replaced. Motion includes walking, lifting, reaching, bending, stretching, and moving. Tasks that require excessive motion should be redesigned to enhance the work, health and safety, and ergonomics of employees.

In manufacturing, motion waste can include repetitive movements that do not add value to the customer, reaching for materials, walking to get a tool or materials, and readjusting a component after it has been installed. In the office, wasted motion can include walking, reaching to get materials, searching for files, sifting through inventory to find what is needed, excess mouse clicks, and double entry of data.

Some countermeasures for motion include making sure the workspace is well organized, placing equipment near the production location, and putting materials at an ergonomic position to reduce stretching and straining.

Extra-processing

Extra-processing, or over-processing, refers to any component of the process of manufacture that is unnecessary. Painting an area that will never be seen or adding features that will not be used are examples of over-processing. Essentially, it refers to adding more value than the customer requires.

In manufacturing, over-processing could include using higher precision equipment than necessary, using components with capacities beyond what is required, running more analysis than needed, over-engineering a solution, adjusting a component after it has already been installed, and having more functionalities in a product than needed. In the office, over-processing can include generating more detailed reports than needed, having unnecessary steps in the purchasing process, requiring unnecessary signatures on a document, double entry of data, and requiring more forms than needed.

One way to counter over-processing is to understand the work requirements from the standpoint of the customer. Always have a customer in mind before starting work, produce to the level of quality and expectation that the customer desires, and make only the quantities needed.

The Tools of Lean

In our pursuit of becoming a lean manufacturer, it will be important to understand some of the lean tools available to us and how we can use or implement them into our production process to reduce and eliminate waste.

Already mentioned, **Gemba**, is a philosophy that reminds us to get out of our offices and spend time on the plant floor – the place where real action occurs.

Continuous Improvement, or **Kaizen**, is a strategy where employees work together proactively to achieve regular, incremental improvements in the manufacturing process.

Key Performance Indicators (KPI's) are metrics designed to track and encourage progress towards the critical goals of the organization. Strongly promoted KPIs can be extremely powerful drivers of behavior.

Error proofing, or **Poka-Yoke**, is a strategy of designing error detection and prevention into production processes with the goal of achieving zero defects.

Five Why's, or **5Y**, is a root-cause analysis strategy for troubleshooting, quality improvement, and problem solving, but it is most effective when used to resolve simple or moderately difficult problems. The method is simple: when a problem occurs, you drill down to its root cause by asking "Why?" five times. Then, when a countermeasure becomes apparent, you follow it through to prevent the issue from recurring.

Visual Management is the strategy of using visual indicators, displays, and controls throughout the manufacturing process to improve communication of information.

The **Pull System**, or **Kanban**, is a visual system for managing work as it moves through a process. Kanban visualizes both the process (the workflow) and the actual work passing through that process. The goal of Kanban is to identify potential bottlenecks in your process and fix them so work can flow through it cost-effectively at an optimal speed or throughput. In this type of system, components and inventory used in the manufacturing process are only replaced once they have been consumed so companies only make enough products to meet customer demand.

Standardized Work is the documented procedures for manufacturing that captures the best practices of each work process (including the time to complete each task). These documents must be "living", that is, they must remain easy to change to reflect any improvements from kaizen.

5S is a strategy for organizing the work area. It's composed of the following 5 words that begin with the letter S, which are based on their Japanese counterparts. Sort, Set-In-Order, Shine, Standardize,

Sustain and it means to eliminate that which is not needed (sort), organize the remaining items (set-in-order), clean and inspect the work area (shine), write standards for the previous steps (standardize), and then regularly apply the standards (sustain). Implementing 5S can reduce hazards and defects, cut costs, and improve efficiency.

What is 5S?

Often summarized by the philosophy “a place for everything and everything in its place”. 5S is a five-step strategy to minimize waste, maximize efficiency, and optimize productivity. This is accomplished through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. Having everything clean, neat, and in the proper location enhances productivity and quality because it helps make tools and materials easier to find, it helps standardize the work processes, and it helps make problems more visible. Implementation of this strategy "cleans up" and organizes the workplace based on its existing configuration, and it is typically the first lean method which organizations implement.

The 5S pillars, Sort (Seiri), Set in Order (Seiton), Shine (Seiso), Standardize (Seiketsu), and Sustain (Shitsuke), provide a methodology for organizing, cleaning, developing, and sustaining a productive work environment. In the daily work of a company, routines that maintain organization and orderliness are essential to a smooth and efficient flow of activities. This lean method encourages workers to improve their working conditions and helps them learn to reduce waste, unplanned downtime from reworks, and in-process inventory.

What is Standardized Work?

Standardized work is regarded as the backbone of lean processes and the basis for continuous improvement and quality. If a process is always shifting, then any effort for improvement just creates one more variation that is occasionally used and mostly ignored. Taiichi Ohno, the founder of the Toyota Production System once said, “Without standards, there can be no improvement”. Where there is no standardized work, there is no process discipline, team member accountability, reliable data, continuous improvement or lean sustainability.

Anecdote

In an episode of the TV show “Superstore,” a new employee was told to stock some shelves. A while later, a manager watches as the employee walks a few feet to a cart, grabs one item, and then walks back to place it on the shelf. The employee doesn’t take it too well when the manager suggests that it might be easier and more efficient to move the cart next to the shelves.

Similar situations often happen in the workplace. Especially if the company does not offer training or does not create policies and procedures to guide new employees.

This is where the lean manufacturing principle known as standardized work comes in.

The Three Elements of Standardized Work

Standardized work includes a consideration of these three elements and can be thought of as defining who does the task, when they do it, and how they do it.

1. Takt time

Takt time is the rate at which parts or products must be produced in order to meet customer demand. Calculated as follows: available production time per day ÷ customer demand per day = takt time.

2. Work sequence

The steps workers need to perform within Takt time, in the order in which they must be completed.

3. In-process inventory

Minimum quantity of parts, raw materials, and equipment needed to complete the work process.

Overall Benefits

Consistent, high-quality output: Because everybody is completing work the same way, there is no variation in the output. When the output is identical, it's easier to predict costs, required inventory, takt time, work sequences, and so on. Plus, customers will be more satisfied with the consistent quality of your products.

Increased efficiency: All workers are completing tasks based on the currently known best practices, meaning that the work flows smoothly and efficiently.

Reduced waste: Following specific steps reduces or eliminates defects that can cause products to be discarded or heavily discounted. Having the materials defined for the production of an item reduces the inventory lost caused from a worker taking too much of an item and not returning the excess.

Easier time making improvements: When standard work has been in place for a while, it becomes easier for those involved to see where improvements can be made. Little changes are easier to implement because employees have a better understanding of the process and can quickly see how the change can make the workflow better.

Faster problem-solving: Will standard work eliminate all problems? No. But when problems come along, it's easier to fix them because you understand the process and can quickly pinpoint where things went wrong.

Stakeholder Benefits

Employees: Workers who follow standard work procedures experience more job satisfaction and a lower rate of burnout, since there is a far lower chance of making mistakes

or experiencing miscommunication with coworkers or supervisors. Standardized work can also empower employees to identify areas for improvement, which can result in a sense of ownership and competency within their profession.

Supervisors: Supervisors who help to implement standardized work processes find that communication becomes easier, and onboarding becomes less of a hassle. When workers know exactly what to do during their shift, supervisors can find more time to address higher-priority issues that will help the organization as a whole.

Executives: If operations within an organization become more streamlined, it can help cut down on waste, increase output and free up budgetary resources for allocation elsewhere. Improved productivity is good news for executives, as are better worker communication and improved safety measures.

Customers: When organizations have standards in place to address production, quality, customer service, order fulfillment and interdepartmental communication, customers are almost always guaranteed high-quality products, efficient and effective customer service and decreased wait times. When an organization can meet (or exceed) the customer's expectations, customer loyalty and satisfaction increases.

Resistance

Though most people within an organization can see the benefit of standardized work, it's not unusual for some members to express resistance. Some workers, especially those who have been doing their jobs for many years, don't see the value of standardization when they've been perfectly successful doing things their way. Supervisors, too, may take issue with being told how to manage their own departments.

It's important to remember that teamwork is the bedrock for workplace success.

Standardization is to help improve and not undermine their efficacy. Rather than turning people into machines — or replacing them with automation — standardized work aims to make workers' relationship to their work more meaningful, successful, and satisfying.