

# Lean Manufacturing

## What is it?

An NTMA Technology Team  
Member Training Program



# Intro to Lean



- Lean manufacturing is systematic process of continuous improvement that is more accurately characterized as a sweeping redirection of a manufacturing company's focus. (Note that this refocusing usually occurs over time and can start on a comfortably small basis—one of the beauties of lean.)
- Basically, lean is centered around creating *more value with less work by reducing waste*.
- What the customer 'values' has to become the prime motivation for everything the company does or doesn't do.
- Every change that occurs as a part of a lean implementation has to be related to enhancing 'customer value.'
- In lean language, "customer value" is defined as that which the customer is "willing to pay for."

# Lean History

- Lean manufacturing is a generic process management philosophy derived mostly from the Toyota Production System (TPS)
- Hence the term Toyotism is also prevalent and identified as "Lean" only in the 1990s.
- It is renowned for its focus on reduction of the original Toyota *seven wastes* in order to improve overall customer value.

# The Seven Wastes

1. Overproduction
2. Waiting
3. Transportation
4. Inappropriate Processing
5. Unnecessary Inventory
6. Unnecessary / Excess Motion
7. Defects

# 1. Overproduction

- Simply put, overproduction is to manufacture an item before it is actually required.
- The simple solution to overproduction is turning off the tap.
- The concept is to schedule and produce only what can be immediately sold and shipped and improve machine changeover/set-up capability.

## 2. Waiting

- Whenever goods are not moving or being processed, the waste of waiting occurs.
- Typically more than 99% of a product's life in traditional batch-and-queue manufacture will be spent waiting to be processed.
- Much of a product's lead time is tied up in waiting for the next operation;
  - this is usually because material flow is poor, production runs are too long, and distances between work centers are too great.
- Linking processes together so that one feeds directly into the next can dramatically reduce waiting.

## 3. Transportation

- Transporting product between processes is a cost incursion which adds no value to the product.
- Excessive movement and handling can cause damage and is an opportunity for quality to deteriorate.
  - When a person is moving material, parts, etc, the opportunity cost is production.
- This does not add customer value.
- Transportation can be difficult to reduce due to the perceived costs of moving equipment and processes closer together.
- Furthermore,
  - It is often hard to determine which processes should be next to each other.
  - Mapping product flows can make this easier to visualize.

## 4. Inappropriate Processing



- Often termed as “using a sledgehammer to crack a nut,” many organizations use expensive high precision equipment where simpler tools would be sufficient.
- This often results in poor plant layout because preceding or subsequent operations are located far apart.
  - Investing in smaller, more flexible equipment where possible; creating manufacturing cells; and combining steps will greatly reduce the waste of inappropriate processing.



## 5. Unnecessary Inventory

- Work in Process (WIP) is a direct result of *overproduction* and *waiting*.
- Excess WIP/ inventory tends to hide problems on the plant floor, which must be identified and resolved in order to improve operating performance.
- Excess inventory increases lead times, consumes productive floor space, and delays the identification of problems.

## 6. Unnecessary / Excess Motion



- This waste is related to ergonomics and is seen in all instances of;
  - bending, stretching, walking, lifting, and reaching.
- These are also health and safety issues.
- Jobs with excessive motion should be analyzed and redesigned for improvement with the involvement of plant personnel.

## 7. Defects

- Poor quality has a direct negative impact to the bottom line and does not add value.
- Quality defects resulting in rework or scrap are a tremendous cost to organizations.
- Associated costs include quarantining inventory, re-inspecting, rescheduling, and capacity loss that can result in late deliveries.
- Through employee involvement and Continuous Process Improvement (CPI), there is a huge opportunity to reduce defects at many facilities.
- Every dollar saved in expenses is a direct dollar pass thru to the bottom line profit of an organization.

# Lean Manufacturing Methods to Reduce These Wastes



Although Lean was developed by a large production manufacturer, Toyota, it has many relevant application to job shops employing 1 to 1000.

- 6S (NTMA Program)
- SMED Single Minute Exchange of Die
- Standardized Work Procedures
- Cellular Manufacturing
- KanBan-Pull Scheduling System
- Inventory Reduction

# 6S (NTMA Program)



- This is a technique to create a workplace environment that is clean, well organized and efficient.
- The goal is to effectively organize our work areas to eliminate large amounts of time spent looking for things.
- An organized workplace is one that complies with the "30-second rule."
  - This rule states that anyone should be able to find anything within 30 seconds (think whether you and your co-workers can do this now).
- The 6S system of workplace organization (sort, set in order, shine, standardize, sustain, and safety) emphasizes removal of what is not used and employment of shadow boards, signs, areas boundaries, labels, and more to help everyone find what is used.

# 6S (NTMA Program)



**Sort, Set in Order, Shine, Standardize, Sustain and Safety**





# Single Minute Exchange of Die (SMED)



- This in essence is a quick changeover, or setup reduction method.
- It is a systematic means of reducing the time a piece of production equipment is down, when changing from one product to the next.
- Changeover time is defined as the time from the completion of the last good piece of one job, to the first good piece of the next job.
- The main components of changeover time are.
  - 1) Preparation (clean work area and organized paperwork, materials, tools, etc.)
  - 2) Removal and mounting of parts, tools, fixtures and equipment.
  - 3) Measuring and setting the equipment.
  - 4) Making trial pieces and adjusting where necessary.
- By watching and analyzing current changeover procedures, we can find ways to reduce each of these components and minimize equipment down time during the process.

# Standardized Work Procedures



- When we are talking about standardized work procedures, we mean that tasks are organized in the best sequence to ensure products are being made the best way every time.
- Standardized work procedures bring consistency (and as a result, better quality) to the workplace, and therefore they should be documented and given to anyone charged with completing the task.



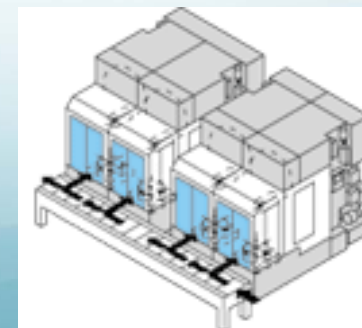
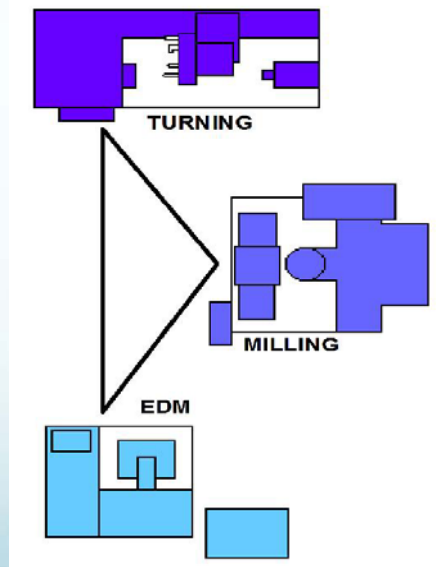
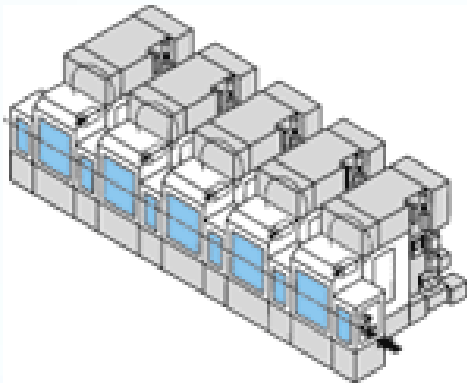
# Cellular Manufacturing



- Cellular, or flow, manufacturing is when all of the resources required to complete the product are grouped together.
- Cellular manufacturing is the opposite of the traditional departmentalized layout, in which all machines of the same type are grouped together.
- In a cellular arrangement, a company may have equipment such as CNC lathes, milling machines, grinders, vibratory finishing machines and parts washers all located in the same area.
- Furthermore, assembly operations are often completed within a cell.
- A cellular layout can more easily accommodate a single piece flow by eliminating the handling and queue times inherent to a traditional departmentalized layout.

# Cellular Manufacturing

- Different types of Cellular Manufacturing



# KanBan - Pull Scheduling System



- This emphasizes replenishment of what has been consumed.
- A pull system typically uses some type of visual signal, such as a card, an empty box, open space, or flashing light to initiate the part replenishment process.
- A pull system will control and balance the resources required to produce a product and is effective in reducing non-value-added activities such as excess inventory or not having inventory when you need it.
- Somebody took the last 1/4" dia. Endmill; you need one. Sound familiar?

# Inventory Reduction



- Improve cash flow, reduce work in process inventory and improve deliveries by implementing complete part off production methods.
- Use indexers or multiple vices in one machine to get a completed part from each machining cycle.

# Lean Science



- As important as the "science" of lean manufacturing is, the cultural changes inherent in the lean transformation are even more important. Everyone in an organization is on the lean journey together;
  - No one can be left behind and no one can stand aside and watch.
- Thus, the top leadership in an organization must not only support the lean transformation enthusiastically, but also they must be actively involved in it.
  - The CEO has to be a believer and a participant.
  - He or she must be as obsessed with customer value as the workforce on the shop floor is.

## The results of lean can include:

- Improved Profitability
- Reduced Waste
- Improved Quality
- Improved Delivery Performance
- Improved Employee Morale

# Lean Consultants

- We suggest your company can try to implement a Lean program on your own,
- Or you can hire a consultant, perhaps through your local Manufacturing Extension Program (MEP).

# Funding



- If you do not have the funds to implement, there is help available.
- Many states have funding available to small companies to aid in the implementation of an lean system, through the MEP Manufacturing Extension Program.
- There are also state funds available for quality consultants and quality training, check with your state Department of Labor.



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**Any Questions?**