

Synchronous Solutions

The continuous pursuit of excellence

Lean Manufacturing

Lean Manufacturing is a systematic approach to identifying and eliminating waste through continuous improvement efforts.

That's the *official* definition. It is more precisely a set of process tools, each designed to accomplish a specific objective.

- Value Stream Mapping - Plant/Flow Layout.
- Kaizen - Continuous improvement activities.
- 5S - Workplace Organization and cleanliness.
- TPM - Equipment Preventative Maintenance.
- SMED – Setup/Changeover Reduction activities.
- Kanban - Pull Mentality and inventory control.

These tools, which can be implemented together or separately, form the concepts of the Lean Manufacturing System. Lean is actually a derivative of the Toyota Production System (TPS) developed by the Japanese auto manufacturer in the 1970's. **Lean Thinking**, a book by Jim Womack published in 2003, describes an *Americanized* version of the TPS process.

The Lean approach is focused on eliminating waste in all its forms. The approach uses a number of Japanese terms in its process. Waste (called **Muda** in Japanese) is defined as “consuming resources without creating value.” Waste, in this context, would include idle inventory of any type and “ineffective resources” meaning nonproductive equipment and/or people. The Lean system has identified **seven categories of waste**:

- **Over production.** The ultimate Lean system is “single piece flow” meaning that no inventory item is ever idle. One operational step is authorized to work only if the following operational step is about to be out of work.
- **Waiting.** Timing is also critical. No operational step should ever need to wait on product to process. Any idle machine or person is undesirable.
- **Unnecessary transportation.** Distances traveled are meticulously studied and minimized. Since there is generally little work-in-process in a Lean system, equipment is located so that a short “hand-off” can be achieved.
- **Process inefficiencies.** Every process step is expected to meet and maintain a desired level of productivity relative to its standard.
- **Excessive inventory.** As stated, idle inventory should not be allowed.
- **Excessive motion.** Every worker and process step is studied and engineered to be as quick and efficient as possible.

- **Poor quality.** Obviously, any part that must be remade or repaired is a waste.

Value Stream Mapping involves plotting all the activities necessary for a product family. The objective is to identify all non-value-added activities. The book describing this concept is Learning to See, by John Shook published in 1998.

Continuous Improvement. Another Japanese term used is **Kaizen**, which is a focused, team approach designed to break the status quo by making immediate changes, i.e. continuous, incremental improvement of any activity to create more value with less *muda* (waste).

5 S's – This means a safe, clean, neat, arrangement of the workplace. “Everything has a place and everything is in its place.” Always. The Five S's originated as Japanese terms, but the English translation is:

- **Sort** - eliminate the unnecessary.
- **Straighten** - a marked location for everything and every item always in its place.
- **Shine**- Clean the workplace.
- **Standardize** - Rules to maintain the clean and organized workplace condition.
- **Systematize** - Self-discipline to sustain the desired conditions.

TPM - Total Productive Maintenance. This is a company-wide, team-based effort to improve overall equipment effectiveness and minimize down-time.

- Combines the practice of preventive maintenance with quality control and employee involvement to create a culture where operators develop ownership of their equipment.

SMED - Single Minute Exchange of Dies. This is a series of techniques designed to reduce complex setups/changeovers to less than 10 minutes.

- Separating internal and external changeover activities.
- Converting internal to external.
- Streamlining all aspects of the changeover.
- Multiple iterations of the approach are used until the changeover can be accomplished in less than 10 minutes.

Kanban. This is a “pull mentality” approach to inventory control. Essentially, a Kanban is a signal that indicates the need for product at downstream operations.

- Upstream operations are authorized to work only if the downstream operations they serve are in need of materials.

Comparisons. There are many basic production strategies in use today. The following is a brief explanation of the most common ones:

- **Batch and Queue.** This is the “old school” method that modern strategies have replaced. Batches of product are processed (rather than single-piece flow).
 - Large lots to minimize setups and maximize repetitiveness.
 - Lots of work-in-process inventory is maintained to absorb Murphy.
 - Product is *pushed* through the system.
 - Generally, lead times are long and often unreliable.
- **Lean.** The focus is on eliminating waste in all its forms.
 - Single piece flow is “pulled” through the system.
 - Resource capacities are *balanced* with Takt time, which is the average time between the start of production of one unit and the start of production of the next unit.
 - Particularly well suited for mass production products like automotive parts.

- **Demand flow technology (DFT)** is a strategy for deploying business processes driven in response to customer demand.
 - It is built on principles of demand pull where the customer is the central signal to guide factory and office activity in the daily operation.
 - Commonly used in mass production products like automotive parts.
- **Synchronous Flow.** The fundamental element is that every business is a system and every system is like a chain, the strength of which is determined only by the weakest link.
 - The system's constraint (weakest link) is identified and all other elements seek to maximize it.
 - Protective Capacity is established to consume the inevitable variability in the system.
 - Throughput (\$T) is the "measure of value added" by each order and is used to create a finite schedule.
 - Predetermined inventory time (Buffers) are strategically located to protect the schedule and are managed continuously as the primary activity of Production Managers and Supervisors.
 - Lean tools (Kaizen, 5 S's, TPM, SMED, etc.) are used as appropriate.
 - Ideally suited for the custom manufacturing industry.

If you want more information on how to do all this, please contact me directly.

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