Toyota Production System (TPS) is one of the most admired lean manufacturing systems in existence.

- They have a process of continuous improvement.
- Work is completely specified as to content, sequence, timing, and outcome.
- Services and goods do not flow to the next available person or machine, but to a specific person or machine.
- Employees are stimulated to experiment to find better ways to do their jobs.
- Improvements to the system must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible organizational level.

**Continuous improvement**
- Build an organizational culture and value system that stresses improvement of all processes
- Part of everyone’s job

**Respect for people**
- People are treated as knowledge workers
- Engage mental and physical capabilities
- Empower employees

**Standard work practice**
- Work shall be completely specified as to content, sequence, timing, and outcome
- Internal and external customer-supplier connection are direct
- Product and service flows must be simple and direct
- Any improvement must be made in accordance with the scientific method at the lowest possible level of the organization
Lean Systems

- **Lean systems** are operations systems that maximize the value added by each of a company’s activities by paring unnecessary resources and delays from them.

- **Just-in-time (JIT) philosophy** The belief that waste can be eliminated by cutting unnecessary capacity or inventory and removing non-value-added activities in operations.

- **JIT system**: A system that organizes the resources, information flows, and decision rules that enable a firm to realize the benefits of JIT principles.

Characteristics of Lean Systems

- Pull method of work flow
- Quality at the source
- Small lot sizes
- Uniform workstation loads
- Standardized components & work methods
- Close supplier ties
- Flexible workforce
- Line flows
- Automation
- Five S
- Preventive maintenance

Poka-yoke is the concept of foolproof devices or techniques designed to pass only acceptable product.

Quality at the source is an organization-wide effort to improve the quality of a firm’s products by having employees act as their own quality inspectors, and never pass defective units to next stage.

ANDON = to notify management, maintenance, and other workers of a quality or process problem

JIDOKA = automation with the human touch

Poka-yoke, Jidoka, and Andon
Jidoka
when imperfections drive evolutions

- Toyota is famous for the quality control it applies to every step of the production process.
- Our equipment is designed to point out areas for improvement.
- Production is interrupted as soon as an imperfection is detected.
- Any abnormality is directly solved and constitutes an opportunity for learning how to make things better.

That is the substance of Jidoka.

- It is the true beginning of positive evolution. And it guarantees maximum product quality at all times.

Pull method of materials flow
Quality at the source

- Small lot sizes
- Uniform workstation loads
- Standardized components & work methods
- Close supplier ties
- Flexible workforce
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- Automation
- Five S
- Preventive maintenance

Characteristics of Lean Systems

Small lot sizes have the advantage of reducing the average inventory level

Jidoka
when imperfections drive evolutions

Reduce Lot Sizes

Inventory is at the minimum level necessary to keep operations running

JIT Inventory Tactics

- Use a pull system to move inventory
- Reduce lot sizes
- Develop just-in-time delivery systems with suppliers
- Deliver directly to point of use
- Perform to schedule
- Reduce setup time
- Use group technology

Figure 16.4
Chapter 9

Characteristics of Lean Systems

- Pull method of materials flow
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Characteristics of Lean Systems

Reduce Setup Times

1. Initial Setup Time
2. Separate setup into preparation and actual setup, doing as much as possible while the machine/process is operating (save 30 minutes)
3. Move material closer and improve material handling (save 20 minutes)
4. Standardize and improve tooling (save 15 minutes)
5. Use one-touch system to eliminate adjustments (save 10 minutes)
6. Training operators and standardizing work procedures (save 2 minutes)

JIT Layout

Reduce waste due to movement

JIT Layout Tactics

- Build work cells for families of products
- Include a large number operations in a small area
- Minimize distance
- Design little space for inventory
- Improve employee communication
- Use poka-yoke devices
- Build flexible or movable equipment
- Cross-train workers to add flexibility

Table 16.1
Chapter 9

Characteristics of Lean Systems

- Pull method of materials flow
- Quality at the source
- Small lot sizes
- Uniform workstation loads
- Standardized components & work methods
- Close supplier ties
- Flexible workforce
- Line flows
- Automation
- Five S
- Preventive maintenance

Another tactic used to reduce or eliminate setups is the one-worker, multiple-machines (OWMM) approach, which essentially is a one-person line.

Automation plays a big role in lean systems and is a key to low-cost operations.

...paring unnecessary resources ...removing non-value-added activities

1. **Sort**: Separate needed from unneeded items (including tools, parts, materials, and paperwork), and discard the unneeded.

2. **Straighten**: Neatly arrange what is left, with a place for everything and everything in its place. Organize the work area so that it is easy to find what is needed.

3. **Shine**: Clean and wash the work area and make it shine.

4. **Standardize**: Establish schedules and methods of performing the cleaning and sorting. Formalize the cleanliness that results from regularly doing the first three S practices so that perpetual cleanliness and a state of readiness is maintained.

5. **Sustain**: Create discipline to perform the first four S practices, whereby everyone understands, obeys, and practices the rules when in the plant. Implement mechanisms to sustain the gains by involving people and recognizing them via a performance measurement system.

Lean Systems at New Balance Athletic Shoe Company

- The Lawrence plant makes footwear styles exclusive to the North American market. Most new designs are first made at Lawrence and then transferred out to other NB American plants, all of which follow the same production methods.
- NB migrated away from the shoe industry’s traditional batch and queue method towards small-lot, cellular flow production.
- Operators never pass on a defective unit, and they always check the prior operator’s work as well as their own.
- When deciding how many shoes of each style to schedule, NB thinks of “sales orders” and not “production orders.”
- Instead of pushing shoes to the market, NB uses more of a pull strategy. Its production schedules are driven by market demand.
- NB’s work flow is uniform and it fosters teamwork and a culture of continuous improvement.
The Kanban System

Kanban means “card” or “visible record” in Japanese & refers to cards used to control the flow of production through a factory. Kanban is a signalling system to trigger action.

- Kanban is the Japanese word for card
- The card is an authorization for the next container of material to be produced
- A sequence of kanbans pulls material through the process
- Many different sorts of signals are used, but the system is still called a kanban

Advantages of Kanban

- Allow only limited amount of faulty or delayed material
- Problems are immediately evident
- Puts downward pressure on bad aspects of inventory
- Standardized containers reduce weight, disposal costs, wasted space, and labor

Organizational Considerations

- The human costs: Lean system implementation requires a high degree of regimentation, and sometimes it can stress the workforce.
- Cooperation & Trust: Workers and first-line supervisors must take on responsibilities formerly assigned to middle managers and support staff.
- Reward systems and labor classifications must often be revamped when a lean system is implemented.
- Existing layouts may need to be changed.

Process Considerations

- Schedule Stability: Daily production schedules in high-volume, make-to-stock environments must be stable for extended periods.
- Setups: If the inventory advantages of a lean system are to be realized, small lot sizes must be used.
- Purchasing and Logistics: If frequent, small shipments of purchased items cannot be arranged with suppliers, large inventory savings for these items cannot be realized.