

# ME 410 Lecture 3

## Lecture Outline

- I. Methodology and Building Blocks
- II. Kaizen Methodology
- III. The 5 Whys
- IV. The Fishbone Diagram
- V. Spaghetti Diagram
- VI. 5S Scorecard

## Lean Methodology

- **Lean Manufacturing is “A systematic approach to identifying and eliminating waste.”**
- **Lean Manufacturing “emphasizes flowing the product at the pull of the customer”.**

## Lean Building Blocks

- **Kanban** - a card or sheet used to authorize production or movement of an item; when fully implemented, **Kanban** (the plural is the same as the singular) operates according to the following rules:
  - All production and movement of parts and material take place only as required by a downstream operation, i.e. all manufacturing and procurement are ultimately driven by the requirements of final assembly or the equivalent.
  - The specific tool which authorizes production or movement is called a kanban. The word literally means card or sign, but it can legitimately refer to a container or other authorizing device. Kanban have various formats and content as appropriate for their usage; for example, a kanban for a vendor is different than a kanban for an internal machining operation.
  - The quantity authorized per individual kanban is minimal, ideally one. The number of circulating or available kanban for an item is determined by the demand rate for the item and the time required to produce or acquire more. This number generally is established and remains unchanged unless demand or other circumstances are altered dramatically; in this way inventory is kept under control while production is forced to keep pace with shipment volume. A routine exception to this rule is that managers and workers are continually exhorted to improve their processes and thereby reduce the number of kanban required.
- **Cellular manufacturing** – an approach in which manufacturing work centers [cells] have the total capabilities needed to produce an item or group of similar items; contrasts to setting up work centers on the basis of similar equipment or capabilities, in which case items must move among multiple work centers before they are completed; the term group technology is sometimes used to distinguish cells that produce a relatively large family [group] of similar items.
- **Total Productive Maintenance (TPM)** – A maintenance system whose goal is 100% availability of production machinery and equipment. TPM consists of activities that are designed to prevent breakdowns, minimize equipment adjustments, improve machinery safety, and make machinery easier to operate.
- **Quality at the Source** – A conceptual shift from inspecting quality at the end of a manufacturing process (or multiple processes) to continually improving the manufacturing process until it produces the quality metrics desired by the customer. **Poka-yoke** is a series of techniques to achieve error-proofing of a process to achieve **quality at the source**.

- **Point of use Storage (POUS)** – The practice of storing raw materials and sub-assemblies next to the production process that consumes them.
- **Quick Changeover** – The goal for switching the tooling at a workstation between different production runs.
- **Standardized Work** – The specified components of a production task, including: cycle time, work sequence, and standard inventory. Typically this is a visual control used to audit production (not to guide work).
- **Batch Reduction** – The effort to reduce the size of a batch through a process in order to reduce lead times.
- **5S System** – An ordered set of techniques to improve workspace practices: Seiri (Separate), Seiton (Set in Order), Seiso (Shine), Seiketsu (Standardize), and Shitsuke (Sustain).
- **Visual Controls** – Lights, signs, and other visual material designed to communicate production status.

## Kaizen Methodology

1. Select project/opportunity
2. Study design principles/best practices from previous projects
3. Prepare an analysis of the current state
4. Generate proposed solutions (future state)
5. Develop proposed solution
6. Get feedback on proposed solution
7. Revise and implement solution
8. Measure impact
9. Disseminate

## The 5 Whys

- **The 5 Whys is a question asking method used to discover the root cause of a problem.**
  - Highlights cause – effect relationship
  - Highlights problems – not just symptoms
  - Have to ask the right why questions
  - Could be any number of whys

## Fishbone Diagram

- A fishbone diagram is a tool for identifying the relationship between the problem source (causes) and the problem (effect).

## Spaghetti Diagram

- A spaghetti diagram shows the product flow (aka product streamlines) in a manufacturing facility. This diagram highlights inefficiencies in the current/present layout.

## 5S Scorecard and Audit Sheet

- A 5S scorecard is a tool to evaluate current states of 5S application and guide future applications of 5S.