ME 410 Lecture 2

Lecture Outline

I. Discussion of 'House of Lean' Terms seen in Joe's Garage
II. Types of Waste
III. Introduction to 5S

Types of Waste

- **Lean Manufacturing = Eliminating Waste**
- The 7 Principle Types of Waste (originally categorized by Taiichi Ohno, developed of TPS)
  - **Overproduction**. Production of product prior to demand (pull). Overproduction increases work in progress (WIP) and manufacturing lead time (MLT). It also aggravates the other 6 types of waste, as it must be transported, stored, and inspected.
  - **Transportation**. This is the waste of moving parts around. It occurs between processing steps, between processing lines, and happens when product is shipped to the customer.
  - **Overprocessing**. This is the waste of processing a product beyond what the customer wants. Engineers are typically the culprits when they make specifications beyond customer needs in the design stage.
  - **Movement**. The unnecessary movement of people, such as operators and mechanics waling around, looking for tools or materials.
  - **Inventory**. This is the classic, most problematic waste. All inventories are waste unless the inventory translates directly to sales.
  - **Making defective parts**. This waste is often called scrap. But its more than the actual part, it includes the effort and materials used to make it.
- Hold all waste in a **CLOSED MITT**:
  - **Complexity**. The waste of doing things the hard way.
  - **Labor.** Human effort that adds no value to the product of service. Not uses the talents of workforce.
  - **Overproduction.** Making too much, too soon, too fast.
  - **Space.** Using more space than is required to manufacture a product.
  - **Energy.** Using more energy (people and machine) than is required to build the product.
  - **Defects.** Waste of inspection, repair, and scrapping of material to which value has already been added.
  - **Materials.** Any use of materials in excess of what is needed to create value.
  - **Idle Materials.** Waste of materials "sitting around" without having value being added to them
  - **Transportation.** Excessive parts and materials around the plant, stacking and un-stacking, etc.
  - **Time.** Any activity that consumes time without adding value; waiting for equipment, materials, etc.

Introduction to 5s

- The 5S system refers to the following order process:
  - **SERI – SORT**. Perform "Sort Through and Sort Out," - red tag all unneeded items and move them out to an established "quarantine" area for disposition within a predetermined time. "When in doubt, move it out!" – avoid future-proofing
  - **SEITON – SET IN ORDER.** Identify the best location for remaining items and label them. "A place for everything & everything in its place". Make things easy to get and easy to put away properly.
  - **SEISO – SHINE or SWEEP.** Systematic Cleaning. Clean everything, inside and out. Use visual sweeps to ensure everything is where it should be and that junk is not accumulating.
  - **SEIKETSU – STANDARDIZE.** Create the rules for maintaining and controlling the first 3 S's. Use visual controls. Steps to standardize:
    - Establish guidelines for the first 3s conditions. (i.e. mop floor daily, remove waste when waste bin full).
    - Attain 3s conditions.
    - Make the standards visual.
    - Maintain and monitor conditions.

    Guiding rules: Streamline for the humans, not the machines; address all repetitive work; make standardization worksheets visible.
  - **SHITSUKE – SUSTAIN.** Ensure adherence to the 5S standards through communication, training, self-discipline and rewards. Persistent application of the 5s requires a supportive work culture.

Lean Manufacturing Terms

- **Andon** – System of flashing lights used to indicate production status in one or more work centers; the number of lights and their possible colors can vary, even by work center within a plant; however, the traditional colors and their meanings are:
    - green - no problems
    - yellow - situation requires attention
    - red - production stopped; attention urgently needed
- **Autonomation** – In Toyota parlance, automation with a human touch; English translation of **jidoka**. Workers do not stand around and watch while machines do their work.
- **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.
- **Cycle time** – the normal time to complete an operation on a product. This in NOT the same as **takt** time, which is the allowable time to produce one product at the rate customers are demanding it.
- **Error-proofing** – a manufacturing technique of preventing mistakes by designing the manufacturing process, equipment, and tools so that an operation literally cannot be performed incorrectly; an attempt to perform incorrectly, as well as being prevented.
- **Flexible manufacturing system** – an integrated manufacturing capability to produce small numbers of a great variety of items at low unit cost; an FMS is also characterized by low changeover time and rapid response time.
- **Heijunka** – A production scheduling/leveling tool, essentially to distribute **kanban** cards in an efficient manner.
- **Jidoka** - a Japanese word which translates as **autonomation**; a form of automation in which machinery automatically inspects each item after producing it, ceasing production and notifying humans if a defect is detected; Toyota expands the meaning of **jidoka** to include the responsibility of all workers to function similarly, i.e. to check every item produced and to make no more if a defect is detected, until the cause of the defect has been identified and corrected.
- **Jishu kanri** - self-management, or voluntary participation.
- **Jutsu** - to talk, or 'the art of' (i.e., 'leanjutsu: the art of lean production').
- **Kaikaku** - A rapid and radical change process, sometimes used as a precursor to kaizen activities.
- **Kaizen** - the philosophy of continual improvement, that every process can and should be continually evaluated and improved in terms of time required, resources used, resultant quality, and other aspects relevant to the process.
- **Karoshi** - death from overwork.
- **Lean manufacturing** or **lean production** - the philosophy of continually reducing waste in all areas and in all forms; an English phrase coined to summarize Japanese manufacturing techniques (specifically, the Toyota Production System).
- **Line balancing** - equalizing cycle times [productive capacity, assuming 100% capacity utilization] for relatively small units of the manufacturing process, through proper assignment of workers and machines; ensures smooth production flow.

- **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.