Principles of Lean Manufacturing

Continuous Improvement

Key Learning Points

- Definition of Lean
- Traditional Manufacturing Vs Lean Manufacturing
- Lean Terminology & Tools
- Teamwork
- Application of Lean Tools
- Impact of Lean Manufacturing

Defining Lean

Lean is:

A systematic approach to identifying
and eliminating waste through
continuous   improvement by flowing
the product at the pull of the customer
in pursuit of perfection.

Lean Principles

- Understanding value - specified by the customer
- Identify the Value Steam
- Eliminate non value added steps
- Make the Value Stream Flow
- Let the Customer Pull the product
- Strive for Perfection

Definition of Value Added

Any activity that increases market form or function of the product.

Non-value added is any activity that does to add market value or is not necessary

Why map a Value Stream

- **Make work visible-** improves communication and understanding
- **Identify Improvement** Opportunities- Eliminate the non value added steps and reduces variability
- **Determine the cause of problem or condition**
- **Training and Communication**

Value Stream Mapping
What we mean by Value Stream Mapping:

- Follow a product's production path from beginning to end (customer to supplier)
- Carefully draw a <u>visual representation</u> of every process in the <u>material and information</u> flow
- Then ask a set of questions and draw a "Future State" Map of how value should flow

Value Stream Mapping
summary

- Create lean tool kits
- Get the big picture by visualizing more that a single flow
- Recognize waste and sources
- Creates a common language
- Make flow visual

What is Standardized Work?

- Repeatable and reliable operations, safely carried out, with all tasks in the best known sequence using the most effective combination of people, material, machines, and methods.

Three Elements of Standardized Work

- **Work sequences**: well understood and documented and including quality standard
- **Standard in-process stock**: minimum quantity of material needed for processing
- **Demand**: good understanding of how much to produce in a given period of time

Why Standardize Work?

- Maintains productivity, quality, and safely
- Provides basis for tracking performance against demand
- Provides a basis for effective training and cross-training
- Is the springboard for continuous improvement initiatives

Visual Controls

- Simple visual signals that give the operator the information to make the right decision.

- They are efficient, self-regulating, and worker-managed:
- Kanban
- Color-coded die, tools, pallets
- Delineation of storage areas, walkways, and work areas
- Andon lights

Why Make it Visual?

- Easily understood
- Supports a diverse workforce
- Supports workplace safety
- Allows immediate assessment of conditions by workers, team leaders, and managers

Why Consider Changing Plant Layout

- Reduce movement of people and materials
- Reduce work in process
- Allow better flow of production
- Support better communication
- Maximize capacity of Machines, floor space and materials handling systems.

Managers need to Change

- Managers must:
- Earn Trust
- Promote and reward participation
- Provide skill training and systems that allow successful completion of work.

Manager's Changing Role

- From telling to selling
- From criticizing the mistakes to rewarding the almost rights
- From manger decision making to worker driven continuous improvement

Workers to Change

- Learn new skills
- Participate in teams and surface ideas
- Make decisions, take risks and make mistakes
- Share responsibility for implementing change
- Support continuous Improvement

Why Do Teamwork

- Cross train and multi-skilled employees
- Process quality, not inspection
- Camaraderie and improved morale
- Organized focused on a common goals

- **Involved Employee Make the Best products**

Why Consider Batch Size Reduction?

- Improve customer response time
- Lower inventory carrying cost
- Reduction of space between operations
- Fewer defects from storage, stacking
- Greater flexibility and higher variety

Point of Use Storage

- Raw materials, parts, tooling and gauging, stored at the workstation where they are used
- Visual small batch replenishment systems
- Works best if vendor or material handling permits frequent, on-time, small shipments

Why Point of Use Storage?

- Reduces non-value-added sorting, transporting of parts and tooling
- Gives the sense of a beginning and an end to the work
- Allows identification of quality issues in a timely fashion
- Simplifies physical inventory tracking, storage, and handling

Inspection at the Source

- Operators inspect product before passing it to the next workstation
- Visual Tools: samples or established standards
- Supporting Documentation: clear checklists& established quality disciplines
- Effective training on quality standards& inspection process

Why Quality at the Source?

- Eliminate or reduce final inspections
- Reduce passed on defects
- Eliminate non-value-added processing
- Increase throughput
- Increase employee satisfaction

Design and Construct Cell

- Flexible layout
- Lot size=1
- Point of storage
- Visual management- Kanbans
- Operators stand for flexibility

Refining the Cell: Five step Process

- Group Products
- Measure demands
- Review work sequence
- Combine work to balance process
- Design cell layout

5 Step Cell Design Process

- Observe Sequence of tasks each worker performs
- Break operations into Elements
- Use time observation to study process
- Identify Value added vs. non Value added
- Study machine capacity, cycle times, and changeover times

Pull vs. Push(Kanban)

- Push system- produces product, using forecasts or schedules without regard for what is needed by the next operation.

- Pull system- is a method of controlling the flow of resources by indirectly linking dissimilar functions using visual what h controls (kanbans), replacing what has been by the customer.

Key Success Factors

- Prepare and motivate people
- Involve employees at all levels
- Share information and manage expectations
- Identify and empower Champions
- Create an atmosphere of experimentation
- Install realistic performance measures, evaluations systems, and reward systems
- Execute pilot projects

Elements of 6S

- SORT-eliminate clutter
- SET IN ORDER-organize and label
- SHINE-clean everything
- STANDARDIZE-Keep maintenance checklist make visible
- SUSTAIN-maintain discipline with visible checklists
- SAFETY-provide a safe work environment

Identify the Project

- Define the target area
- Identify the operations that occur in the area
- Communicate Activity to Area personnel

Perform a Workplace Scan

- Gather information-(take before and after photos) start with a map
- Create workplace Scan display-visually report conditions and encourage interaction with area employees
- Measure your progress

Identify Red Tag Targets

- Does it have a function in this area?
- Is it needed? How often? By whom?
- If we remove it will it really matter?
- Is it in the way? Does it take up too much space?
- Make a red tag holding area

Definition of Standardize

- Create rules to maintain the first 3 S's
  - Red tag procedures
  - Holding area rules and responsibilities
  - Location, number, position of items
  - Cleaning schedules and procedures
  - Storage, retrieval, and archival systems
- Share information through visual controls(create and use checklists)

5 Necessary Conditions for Sustain

- Development of new awareness and skills
- Support from Management
- Ongoing communication
- 6S is part of daily work
  - 5 minute 6S & 6S weekly
  - Part of job descriptions
  - Measure and display
- Total Employment Involvement (TEI)

Benefits of 6S

- Machine efficiency
- Less scrap
- Production increased
- Visual control
- Quality
- Cleaner environment
- Safety
- Inventory (FG/WIP)

Definition of
Changeover time

Time between the **last good** piece off
the current run and the **first good**
piece off the next run

Waste in Changeover

- **Overproduction: making** too much, too soon
- **Excess Inventory:** anything in excess of one-piece **flow**
- **Defects:** Inspection an repair of material in inventory
- **Underutilizing people:** utilize skills and abilities
- **Excess Motion:** movement adds no value

Benefits of quick Changeover

- Shorter lead time
- Less material waste
- Fewer defects
- Less inventory
- Lower space requirements
- Higher productivity
- Greater flexibility

SMED (Single Minute of Exchange of Dies)

- Develop checklists of everything needed to be perform changeovers (tools, parts, materials, procedures, people)
- Function checks of parts, tools, fixtures we in before changeover to make sure everything is in good working order
- Transportation: move all new parts, tools and materials to machine before shutdown and put away old tools after machine is running good product.

Keys to Success

- Atmosphere of Experimentation: tolerating mistakes and willingness to take risks (safety nets)
- Instill realistic performance measures, evaluate and reward systems during implementation.
- Use pilot projects before redoing the whole organization.

TPM (Total Productive Maintenance)

- TPM is the process that maximizes the productivity of equipment for its life cycle and will extend the life of the equipment.
- Goals of TPM:
- Develop people who are equipment knowledgeable
- Perform preventative maintenance

Supply Chain Management (the Lean Way)

- 1 or few source per item
- Partnership (JIT)
- Long term, stable
- On-site audits & visits
- Exclusive contracts
- Low prices (large orders)
- Frequent, small lots
- Delivery to point of use

Managing the Supply Chain

- Establish lines of credit for suppliers
- Reducing bank "float"
- Coordinating production and shipping schedules with suppliers and distributors
- Sharing market research
- Making optimal use of warehouse space

Examples of Waste

- Watching a machine run
- Wait for parts
- Counting parts work Making more parts than can be sold
- Moving parts over long distances
- Storing work In Process Inventory
- Looking for tools
- Machine breakdown
- Rework
- Redundant Inspections

Keys to Success

- Keep it simple!
- Be flexible, work around constraints
- Apply only where appropriate
- Break old paradigms
- Challenge, question everything- find "root causes" for "why it has to be that way"

The Goal: Making Money

- Increase throughput-the rate at which money is generated through sales

- Decrease inventory- the money invested by purchasing things for sale

- Decrease operating expense-the money spent to convert inventory into throughput