

Lean Manufacturing

Bob Johnson, CSSBB, CQM, PMP
ASQ Section-1302 Chair



Overview

- The Why and What of Lean Thinking
- 8 Categories of Waste
- The Tools of Lean Thinking



Where did Lean Thinking originate?

- Originally started by Henry Ford (1911)
- Developed by Taiichi Ohno, Toyota (1942)
 - Developed in Textile Industry not Automotive
 - Developed as a response to “slow growth” economic theory
 - Goal: Produce variety cheaply



Lean Thinking Benefits

- Cost Reduction
- Cycle Time Reduction
- “Waste” Minimization (Waste Killer)
- Elimination of Non-Value Added Activities

Resulting in a more “lean”, agile, quick-response and competitive company



Why the Emphasis on Lean Now

- Global/Internet Economy
- Pressure from customers for price reduction
- Fast-paced technological changes
- Increased expectations of customers
- Continued focus on Quality, Cost and Delivery
- Quality Standards like ISO 9000:2000



Definition

Lean thinking is aimed at the elimination of waste in every area of production or service including customer relations, service design, supplier networks, service delivery and factory management. Its goal is to incorporate less human effort, less inventory, less time to develop products and services, and less space to become highly responsive to customer demand while producing top quality products and services in the most efficient and economical manner possible.

Adapted from ***Production System Design Laboratory***
Massachusetts Institute of Technology



Definition

A systematic approach to identifying and **eliminating waste** (non-value-added-activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection

Manufacturing Extension Partnership (MEP) Definition



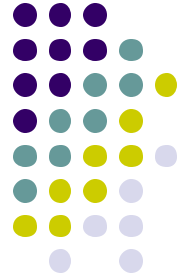
Definition of Value Added

Value Added

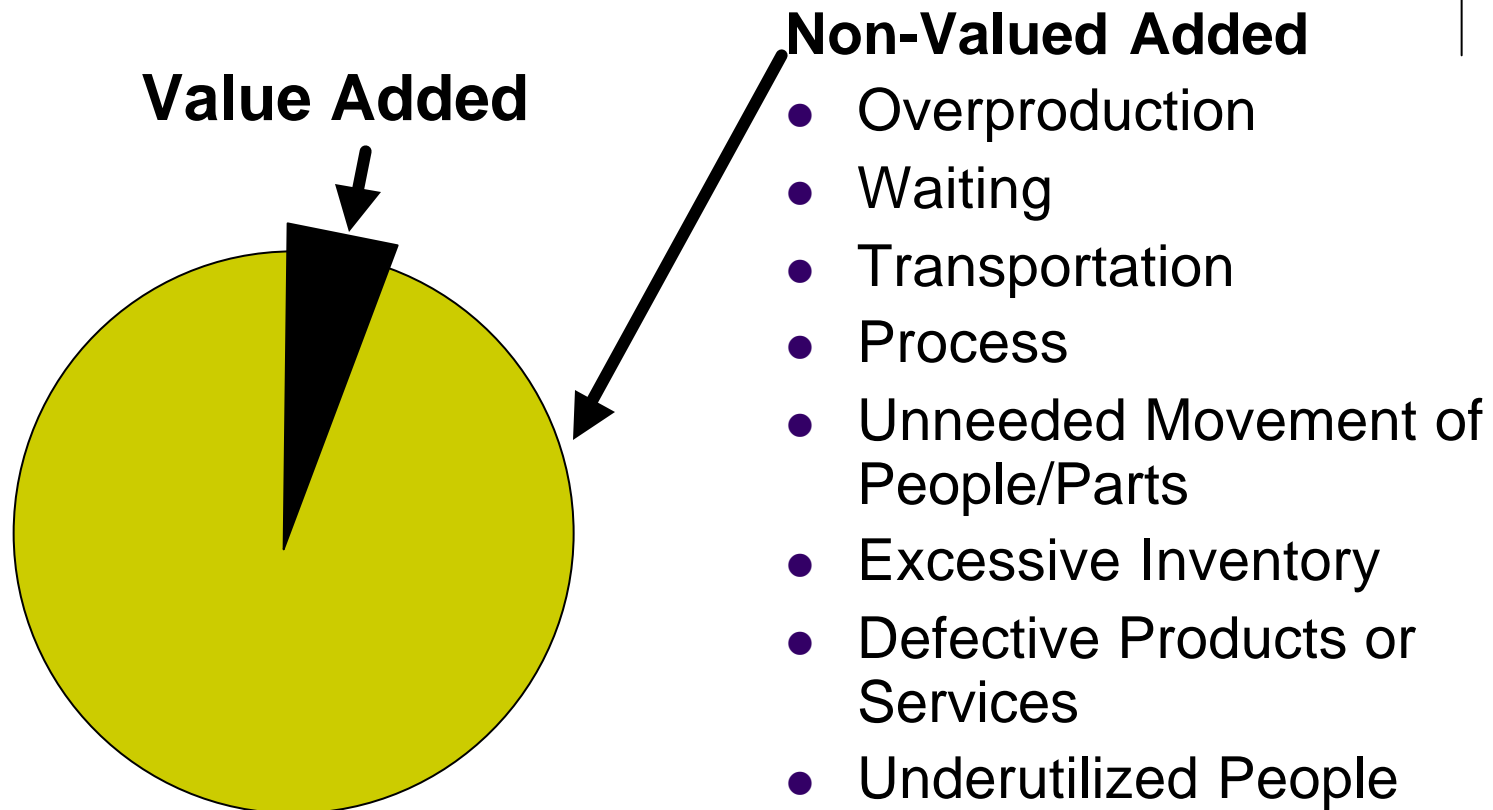
Any activity that increases the fit, form or function of the product or service. (These are things the customer is willing to pay for.)

Non-value added

Any activity that does not add to the fit, form or function or is not necessary. (These activities should be eliminated, simplified, reduced or integrated.)



Value vs Non-Value Breakout



Typically 95% of all lead time is non-value added



Typical Process

Service

- Long Cycle Times
- Process not flexible
- Lots of Wait Time

Manufacturing

- Batch Processing
- Inventory - Safety Stocks
- Lots of Wait Time
- Material inspected at the end

Categories of Waste

(7 Muda plus one)



- Overproduction
- Waiting
- Transportation
- Process
- Unneeded Movement of People/Machines
- Excessive Inventory
- Defective Products or Services
- Underutilized People



Overproduction

Making more/earlier/faster than is required by the next process

Causes of Overproduction

- Just in case logic
- Misuse of automation
- Long Process Setup
- Un-level Scheduling
- Unbalanced workload
- Over Engineering
- Redundant Inspections



Waiting

Idle Time Created by Waiting For ...

Causes of Waiting Waste

- Unbalanced workload
- Unplanned Maintenance/Computer Downtime
- Misuse of automation
- Long Process Setup Times
- Un-level Scheduling
- Upstream Quality Problems



Transportation

Transporting parts and materials around the plant

Causes of Transportation Waste

- Poor Plant Layout
- Poor Understanding of the Process Flow for Production or Service
- Large Batch Sizes
- Long Lead Times
- Large Storage Areas



Process Waste

Efforts that add no value to the product or service from the customers' viewpoint

Causes of Process Waste

- Product Changes Without Process Changes
- Just-in-Case Logic
- True Customer Requirements not Clearly Defined
- Over-Processing to Accommodate Downtime
- Redundant approvals
- Extra Copies/Excessive Information
- Lack of communication



Unneeded Movement

Any movement of people, parts, or machines that does not add value to the product or service

Causes of Motion Waste

- Poor People/Machine Effectiveness
- Inconsistent Work Methods
- Unfavorable Facility or Work Center Layout
- Poor Workplace Organization and Housekeeping
- Extra “Busy” Movements While Waiting



Excessive Inventory

Any supply in excess of a one-piece flow through your process

Causes of Excess Inventory

- Just-in-Case Logic
- Poor Market Forecast
- Unbalanced Workload
- Misunderstood Communications
- Wrong Reward System
- Unreliable shipments by suppliers



Defective Products/Services

Inspection, Rework, Scrap of material, process or product

Causes of defects

- Weak Process Control
- Poor Quality
- Unbalanced Inventory Levels
- Poor Education/Training/Work Instructions
- Wrong Reward System
- Product/Process Design
- Misunderstood customer requirements



Underutilized People

Not using people's mental, creative, and physical abilities

Causes of People Waste

- Old Guard Thinking, Politics, Culture
- Poor Hiring Practices
- Unbalanced Inventory Levels
- Low or no investment in Education/Training
- Wrong Reward System
- Low pay, High Turn-Over Strategy



Value Stream Mapping

What are the steps that add value to the process?

- Map the Current State
- Identify Non Value Added (NVA) Steps
- Reduce or eliminate NVA
- Map the Future State



Value Stream Mapping Vs Process Mapping

Helps you visualize the material and information flow

- Simple
- Visual
- Adds Takt Time (available production time divided by rate of customer demand) to Process Map
- Adds Information Flow



Theory of Constraints

Helps you visualize the bottle necks in the process and information flow

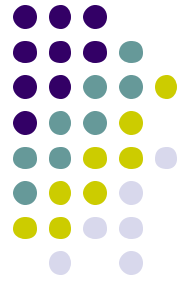
- Demand on a resource greater than capacity (backlogs throughout system)
- Subsequent event depend on prior ones
- Identify system constraints, use non-constrained resources, increase capacity, subordinate other resources to constraint, or improve process of constrained resource



5S-Workplace

A System for workplace organization and standardization

- Seiri – (Sort) Separate needed from the unneeded, get rid of unneeded
- Seiton – (Set in order) Neatly arrange and identify parts for ease of use
- Seiso – (Shine) Clean working environment (house keeping)
- Seiketsu – (Standardize) Make all work simple and uniform
- Shitsuke – (Sustain) Make it easy to follow the standard work flow



Visual Workplace

Placing all parts, production activities and performance indicators out in plain view

- Self-Explaining
- Self-Ordering
- Self-Regulating
- Self-Improving
- Where what is supposed to happen – does happen every time



Batch Size Reduction

A System for making one and moving one for continuous flow

- Best Batch Size is One
- Flexible
- Detect Defects Earlier
- Shorter Lead Times



Quality at the Source

A System for making operators responsible and empowered to ensure quality

- Inspection by Operators
- Doesn't move unless acceptable quality
- Visible samples/standards used
- Need quality inspection requirements defined for each work station



Point of Use Storage

System for storing raw materials where they are needed

- Stored are workstation where used
- Supplier relationship permits frequent, on-time, small shipments
- Simplifies Physical Inventory Tracking
- Simplifies storage and handling



Single Minute Exchange of Dies

System for quick changeover to a different product or service

- SMED is changing a process to produce a different product in the most efficiently
- The amount of time between last good part to first good part of next set-up
- Try for under 10 minutes (Bob's Tire vs Pit Crew)



Cellular Flow

System for moving equipment or processes in most efficient way

- Physically linking of manual and machine operations
- Looking for most efficient combination
- Maximize value added and minimizing waste



Total Productive Maintenance

System to maximize equipment effectiveness and machine life

- Everyone participates in TPM from top executives to shop floor operator
- Involves all departments
- Eliminate breakdowns, defects and accidents
- Maximize production system efficiency



Poka-Yoke (Mistake Proofing)

System to make it more difficult to make mistakes or defects

- Right part goes in on only one way
- Part can only be positioned correctly
- Machine/System controlled (laser eye)
- Color coding/buzzer/lights as signals
- Automatic vision system inspection



Kaizen

System of continual incremental improvement of an activity

- Improve Value
- Reduce Waste
- Kaizen Blitz – dedicated process to find process improvements
- Gemba Kaizen – Close to the action improvements



Kanban

System of tickets or signals to order or stage inventory

- Reduces inventory
- Ensures inventory is ordered as needed
- Can be used for all resources; materials equipment, information, reports, etc.
- Supplier managed or consignment inventory is not Kanban

QUESTIONS

