Lean Systems

Mustafa Shraim
Principal Consultant

SQPS, Ltd.
PO Box 218132 . Columbus . Ohio 43221
Tel. 614-245-0503
Fax. 614-573-7238
www.shraimqps.com
sqps@shraimqps.com

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True or False

Question	T	F
1. Lean initiatives focus on product and its needs rather than Organizations or Equipment	✓	
2. The worst form of waste is probably overproduction	✓	
3. Lean principles involve extensive statistical analysis		✗
4. An organization must have an MRP-like system for Lean initiatives		✗
5. The critical starting point in Lean thinking is to define value as perceived by the customer	✓	
6. Value stream maps require physical layout sketch of the organization		✗
7. It is unusual to cut lead time by as much 75% or more in some organizations		✗

Outline

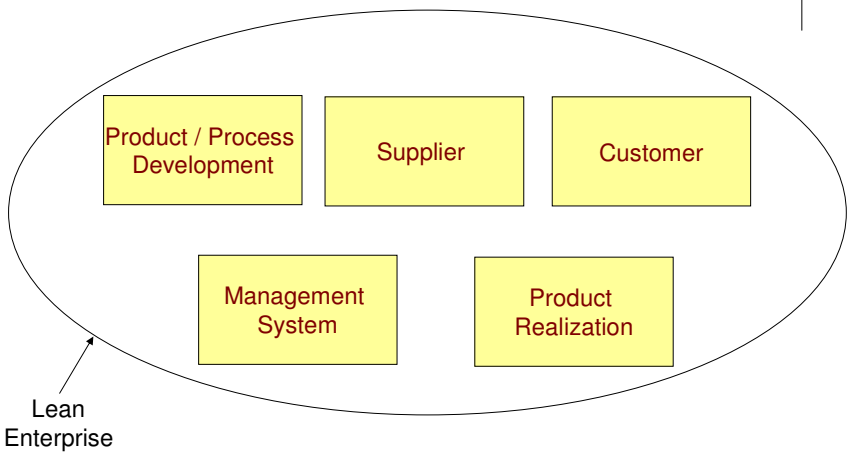
- Forms of Waste
- Waste-Free Cost
- Characteristics of Lean Systems
- Value Stream Mapping
- Case Study (in-progress)

Typical Results of *Lean* Applications

(Lean Enterprise Institute)

- Throughput time for a given activity reduced by 50 – 90 %
- Number of defects reduced by more than 90%
- Number of injuries / sick days reduced by up to 90%
- Cost of a given activity reduced by 30 – 50 %
- Significant reductions in employee turnover and dissatisfaction

Value Streams



What is a Lean System?

- A lean system emphasizes the prevention of waste
- Waste (*Muda*) refers to activities that absorb resources but create no value
- The seven modes of waste as identified by Taiichi Ohno, the Toyota Executive (1912-1990), are:
  - Overproduction (*often the biggest area of waste*)
  - Waiting
  - Transportation
  - Unnecessary Processing
  - Inventory
  - Extra Motion
  - Defects

Waste 1: Overproduction

- Producing more than the customer wants
- Probably the worst form of waste
- Possible reasons for overproduction:
  - Changeover time is high
  - Unreliable equipment
  - Unpredictable process (produces defects)
  - Use of standard cost accounting metrics (utilization ratio, etc.)
  - Poor communication between facilities

Waste 1: Overproduction

Examples

- Extra inventory on hand
- Producing reports no one needs
- Entering repetitive information
- Sending unnecessary e-mails to everyone

Waste 2: Waiting

- Waiting refers to the time a process is idle waiting for an upstream processing to be completed.
- Waiting is usually caused by an upstream bottleneck process that could be plagued with:
  - Defects
  - Extra motions
  - Extra processing --- making larger batches

Waste 2: Waiting

Examples

- Missing items
- Worker absent with no backup
- Untrained backup
- Kanban numbers are not calculated correctly
- People late for meetings
- Not responding to sales leads in a timely manner
- Dependency on others to complete tasks

Waste 3: Transportation

- Transportation refers to moving the product within a facility or between facilities (internal or external).
- Taking product (in-process) back and forth to the warehouse
- Transportation can be caused by:
  - Poor layout design
  - Overproduction
  - Poor supplier selection system (based on price given for buying large quantities)

Waste 3: Transportation

Examples

- Excessive filing of hardcopies in storage
- Moving product to intermediate storage
- Sending documents by metered mail instead of e-mail
- Not utilizing free deposit pick-up service that banks offer businesses

Waste 4: Extra Processing

- Usually refers to using more than necessary to accomplish a task

  "*A sledgehammer to crack a nut*".
- Using expensive, high precision, or high-energy-consumption equipment when all is needed could be a simple tool
- Such situations may result in
  - Increased complexity – *PM, expensive parts, etc.*
  - Overproduction
  - Longer changeover time

Waste 4: Extra Processing

Examples

- Issuing statements for inactive accounts
- Setting up complex software for simple computer work
- Sending out several statements instead of a consolidated one
- Conducting unnecessary tests of more frequent inspections
- Too much lighting in vacant areas

Waste 5: Inventory

- Inventory can be:
  - Raw material
  - Work in process (WIP)
  - Finished goods.
- Excess Inventory
  - Can be the result of overproduction, equipment failure, and/or supplier order details, among others.
  - Requires more space
  - Can hide problems
  - Can increase lead time

Waste 5: Inventory

Examples

- Excessive number of parts on hand
- Excessive amounts of office supplies
- Presence of old and outdated manuals and books on shelves
- Unused / Unneeded electronic files on hard drive

Waste 6: Extra Motion

- Extra motion refers to any bending, stretching, overreaching, or any extra steps taken by employees to accommodate an inefficient process.
- Like transport, motion takes time but adds no value.

Waste 6: Extra Motion

Examples

- Computer files not organized
- Too many icons on desktop space
- Looking for a tool to use
- Paperwork in one stack
- Reviewing a manual for one piece of information
- Printer/fax machines are all in one isolated room
- An assembly operator turning around to get a component for processing

Waste 7: Defects

- Defects are the result of a product or service not conforming to requirements
- Defects can be very costly as they move towards the customer
- In addition to sorting, scrap, and rework costs, there are costs associated with customer dissatisfaction which cannot be immediately measured.

Waste 7: Defects

Examples

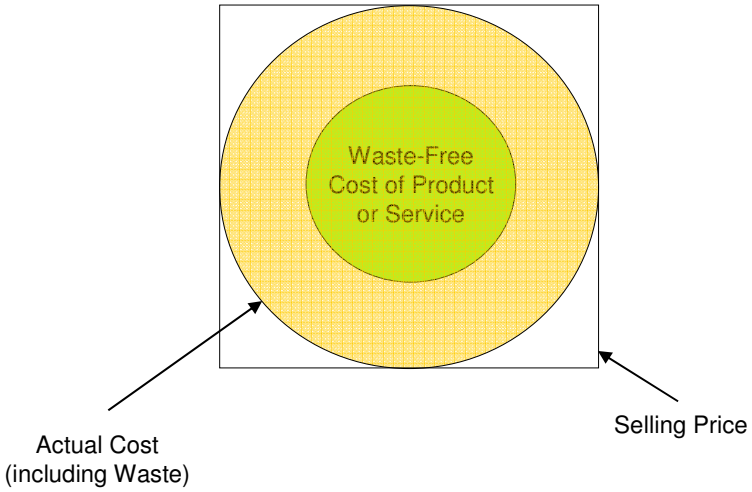
- Re-submitting application
- Online connection not reliable
- Customer complaints
- Customer returns
- Wrong merchandise shipped
- Product missing installation manual
- Lost data
- Lost luggage

The Eighth Waste

- In 1996, James Womack, a Lean Thinking Expert, and founder of Lean Enterprise Institute, identified “Underutilized Employees” regarding their ideas / minds, as another form of waste

Visa Commercial

Waste-Free Cost



Lean vs. Traditional Enterprise

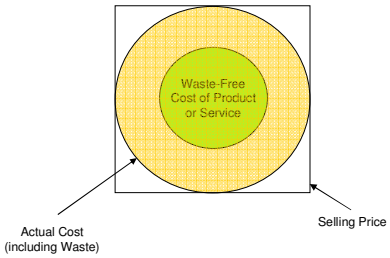
Traditional enterprise

Cost + Profit = Price

Lean enterprise

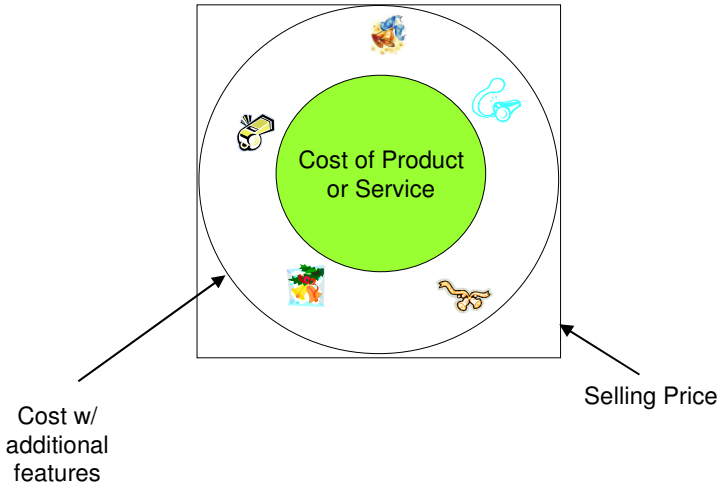
Price – Cost = Profit

Identifies waste-free cost of product / service using *lean tools*



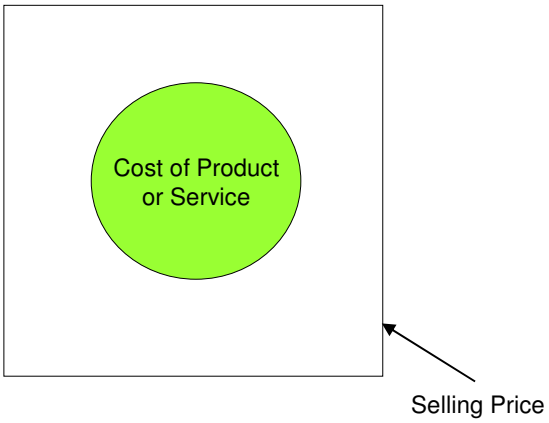
Choices for Lean Organizations

(1) Additional Features >> More Market Share



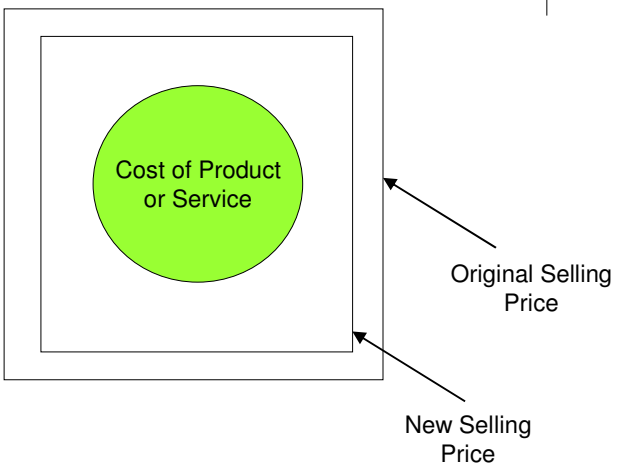
Choices for Lean Organizations

(2) More Profit



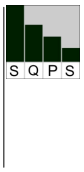
Choices for Lean Organizations

(3) Lower Selling Price >> More Market Share



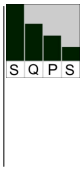
Lean

Some Examples of Lean Applications in Service



- Processing
  - Claims
  - Applications
  - Proposals
- Handling customer complaints / returns
- Conducting meetings
- Leading projects
- Handling sales orders
- Hiring new employees
- Orientation of new employees

General Guidelines for Getting Started



- Everyone must understand why lean initiatives are being introduced
- Three principles must be understood by all:
  - Continuous flow
  - Involvement of all
  - Root Cause Analysis / Continuous Improvement
- Metrics must be establish early
- 5-S can be started NOW

General Guidelines for Getting Started – Cont'd

- Organize project documents and create folders for best practices
- Use visual controls where possible

Value Stream Mapping

- A Value Stream (VS) includes all actions currently required to bring a product through the main flows
- Mapping of the value stream is a method to visualize how product and information flow throughout the organization

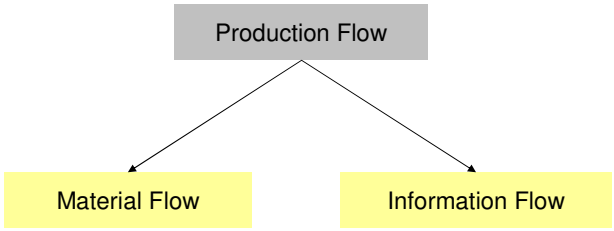
Value Stream Mapping – Cont'd

- Value Stream Mapping:
  - Helps us visualize flow throughout the facility
  - Helps us identify sources of waste
  - Is a standard (common) communication tool for improvement
  - Shows relationship between material flow and product flow
  - Reflects the big picture in terms of opportunities for improvement

Objective of VS Mapping

- To highlight sources of waste (bring them to the surface)
- Eliminate these sources of waste by implementing *Future State Value Stream*
- The focus will be on root causes of sources of waste (not the symptoms)

Overall Production Flow



- Production Flow is a function of both material and information flows
- In many cases, the information flow is what distinguishes lean organizations from others
- Example: Toyota – A lean automaker uses the same basic processes as other auto makers. However, Toyota regulates production flow **through an efficient information flow**

Critical Starting Point: Value

- "Value" is the critical starting point in lean thinking
- "Value" is always specified by the ultimate customer
- "Value" is created by the producer
- The problem is that value is hard to define for producers
- Once "Value" is defined, points where such "Value" is created can be identified

Product Family

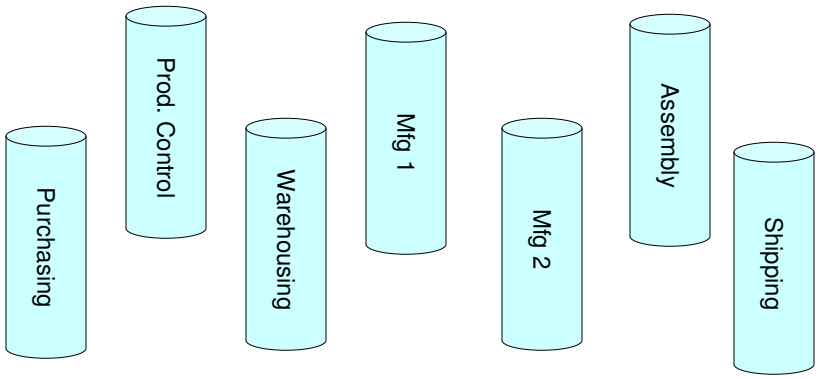
- Value Stream Mapping should be done for each product family
- A product family is a group of product variants passing through similar processing steps and/or using common equipment prior to delivery to the customer
  - Example: Cars using the same platform / Chassis
  - Example: Injection molding (No Mixing, Drying, Using 50% regrind, etc)
  - Example: Grocery shoppers with few items
  - Example: Business travelers not going to major airport hubs

Selecting A Product Family

Process Activities

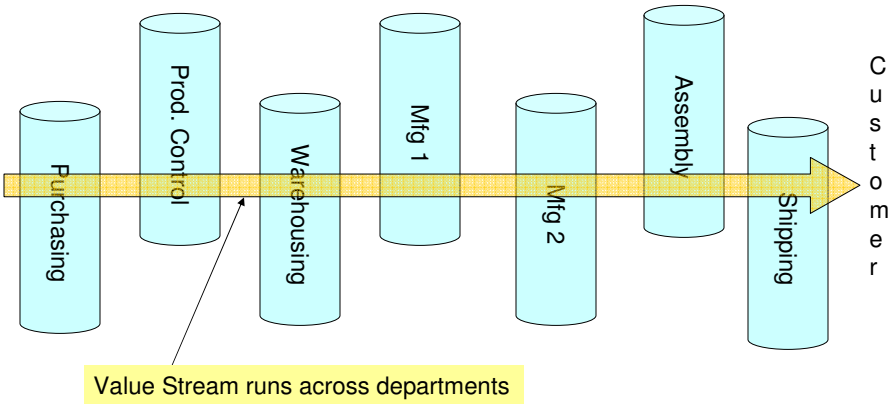
Product Variants	A	B	C	D	E	F
1	x	x		x		
2		x	x	x		x
3	x	x	x	x		x
4			x		x	
5	x				x	x
6						

Traditional Structure (Silo)



Little communication among departments (Silos)

Traditional Structure & The Value Stream



Steps for Lean Systems – Cont'd

4. Identify waste and potential waste on the value stream and:
   - Remove steps and tasks that are deemed "Not Important" and "Non-Value Adding"
   - Study those steps that are deemed important but add no value for possible removal or improvement

	Important	Not Important
Value Adding Task	Keep	
Non-Value Adding Task	Study Further, May Be Waste	Absolute Waste: Remove Immediately

Case Study – Cont'd

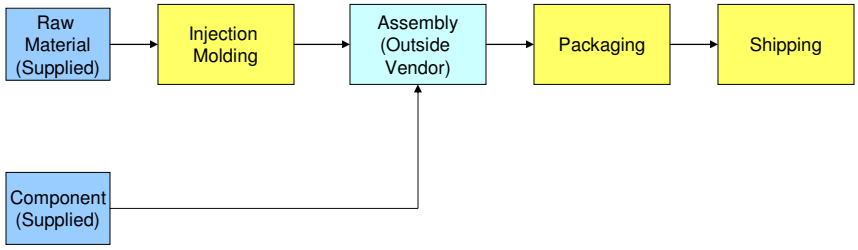
- Value Stream Mapping Data for XYZ Plastics
  - Customer Requirements
    - Average of 16,000 assembled parts per week
    - Customer expects shipments on Wednesdays and Fridays
    - Parts are placed in corrugated boxes (200 pieces per box)
    - Customer places order one week out through their supplier network website
    - Customer uses the same system to inform XYZ about the 30-day forecast
    - Adjustments are possible within the week

Case Study – Cont'd

- Value Stream Mapping Data
  - Production Processes (See diagram)
    - XYZ Plastics receives resins using manual order system one week out with minimum order of 2,200 lbs.
    - XYZ Plastics receives component for assembly
      - Order quantity of component = 65,000
      - Each bag has 2,500 pieces (total of 26 bags)
      - Must manually place order 2 weeks out
    - XYZ Plastics visually checks raw materials and components and enters information into large spreadsheet to update orders and existing inventory
    - XYZ Plastics updates the production schedule

Case Study – Cont'd

XYZ Plastics: Production Processes



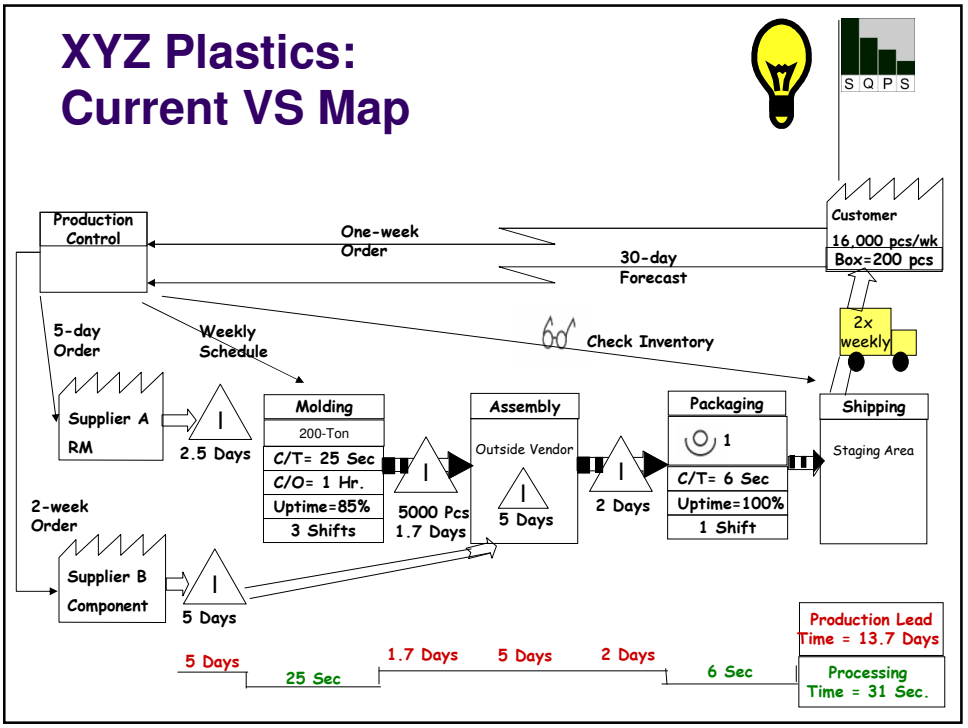
Case Study – Cont'd

- Value Stream Mapping Data
  - Production Processes
    - Injection Molding:
      - Cavities = 2
      - Uptime = 85% (based on observation)
      - Cycle time (C/T) = 50 Seconds (per a two-cavity output)
      - Changeover time = 1 hour
    - Assembly:
      - Outside vendor is used
      - Picks up inventory daily
      - turnaround time = 5 days

Case Study – Cont'd

- Value Stream Mapping Data
  - Production Processes
    - Packaging / Labeling:
      - Each box contains 200 pieces
      - On the average, it takes 20 minutes to obtain finished parts from their assigned location, package and label each box
      - Boxes are then moved to finished inventory
      - On shipping day, boxes are placed on pallets and shrink-wrapped according to order requirements

XYZ Plastics: Current VS Map



Inventory / Delays Calculations

- WIP (Inventory) Supplier A (RM)
  - Shared material / Observed based on consumptions of other products
- WIP (Inventory) Supplier B (Component)
  - Order 2 weeks out. 65,000 per box. Each box has 26 bags of 2,500 pieces
  - Customer demand= 2 per finished product or 32,000 per week so each box roughly covers 2 weeks. To be sure XYZ carries about 5 days worth of inventory
- WIP (delay) at Outside Assembly Vendor
  - Observed: 5 days turnaround time
- WIP (Inventory) Coming from Outside Assembly
  - Observed: 2 days worth of customer weekly demand

Inventory / Delays Calculations – Cont'd

- WIP (Inventory) after molding
  - 24 hrs/day, 5 days per week, 85% uptime
  - Available time in seconds = 5x24x60x60x.85
    =367,000 seconds
  - Observed an average of 5000 units in front of the molding process with 25 sec. cycle time per unit

    5,000 x 25sec = 125,000 seconds

    125,000 / 367,000 = 0.34

    0.34 x 5 days = 1.7 days

Evaluating the VSM

- What is Takt time for this value stream?
  - Takt time is the pace of production based on the available working time of the down stream process that is closest to the customer. In this case, it is Packaging
  - 8 hrs / day minus 2 breaks @15-min each = 7.5 hrs /day
    = 27,000 Sec.
  - Takt Time = $\frac{\text{Available Working Time in a day}}{\text{Avg. Daily Customer Demand}}$
  - Daily Customer Demand = 3,200 pieces
  - Takt Time = 8.4 Sec
  - So every 8.4 seconds, XYZ Plastics needs to produce one unit to satisfy customer demand

Studying The Current VS Map

- Inventories?
- Long Delays?
- Lead Time vs. Processing Time?

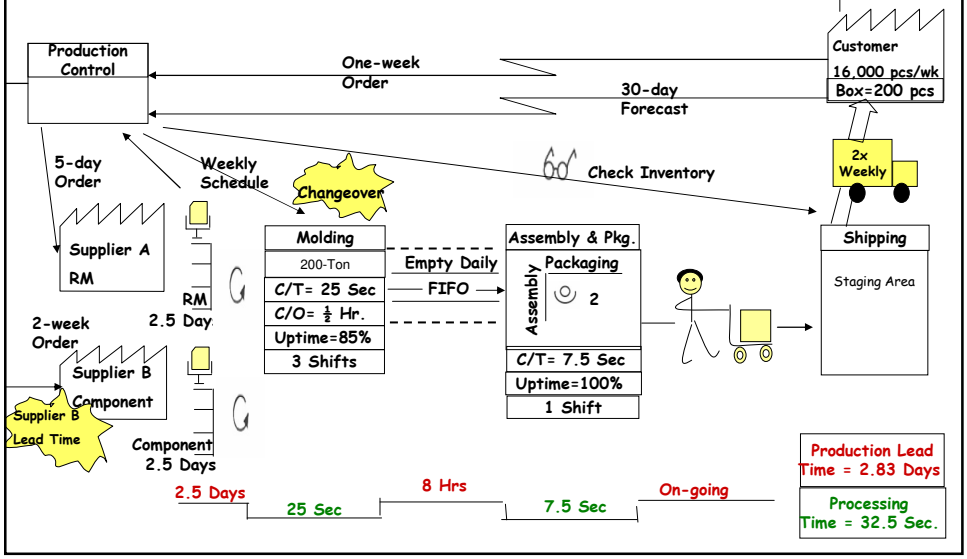
Where can XYZ Improve?

- Continuous Flow
  - If feasible, assembly can be brought in-house by adding one operator
  - It takes 10 second to assemble a part according to vendor's estimation
  - Time study revealed that it takes 7.5 sec to assemble and package one part (2 operators) when the 2 operations are next to one another
  - L shaped process for assembly and packaging can be introduced
  - Each box finished can be moved to shipping

Where can XYZ Improve? – Cont'd

- Continuous Flow – FIFO Lane -
  - Molding is done on 3 shifts while assembly and packaging is only on one shift. Therefore, there are two shifts that molding is accumulating products.
  - This will accumulate inventory over two shifts which can be channeled through a FIFO lane to be emptied daily

XYZ Plastics: Future VS Map



Implementation of Future State

- Divide into segments:
  1. The Suppliers Segment
  2. The Molding segment
  3. The Pacemaker segment (Assembly / packaging)
- For each segment, establish objectives and specific goals to achieve
- Based on the goals established, develop a value stream plan:
  - Use Gantt Chart
  - Step by step with measurable goals
  - Checkpoints / deadlines with identified responsibilities

Implementation of Future State

– Cont'd

- Which segment do you start with?
  - The one that everyone agrees on
  - Probability of success is high
  - Shows highest yield (biggest bang for the buck)
  - Usually downstream pacemaker then move up.
- Which pattern do you follow?
  - Highest priority: Continuous flow
  - Next: Pull system (Through Kanban or FIFO)
  - Next: Leveling of Mix and Volume
  - Next: Kaizen to continually and incrementally improved

Thank you!

Questions?

Some References

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- Rother, M, and Shook, J. *Learning to See*, The Lean Enterprise Institute, 2003
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