Lecture 4: Overview

1. Value Stream Mapping
2. Present State Map
3. Process Improvement Strategies
4. Takt Time
5. Future State Value Stream Map
Value Stream Mapping

Helps us see where value is created, and where waste exists:

• Developed by ‘product family’
• Shows flow of both material & information.
• Helps us ‘see’ where/how specific Lean tools can be used to improve flow and eliminate waste
• Consists of two types of maps:
  Present State (“how it is”)  
  Future State (“how it should be”)
Present State Value Stream Map

Value Stream Mapping
The Process Box

• Indicates basic production process.
• One box for each major material flow, not for each processing step.
• Process disconnection and inventory accumulation are indicators of where processes are separated.

Value Stream Mapping
The Data Box

- **Cycle Time (C/T)**. Rate at which a part or product is completed by a process.
- **Changeover Time (C/O)**. Amount of time to switch from one product type to another.
- **Uptime**. Measure of machine use (100% = Always running).
- **Every Part Every (EPE)**. Measure of batch sizes and changeover cycles.
- **Available Work Time**. Per shift of a process (in seconds, minus break, meeting, and cleanup times.)
- **Quality Level**. % First time yield.
- **Number of Operators**. Required personnel for a process.

<table>
<thead>
<tr>
<th>C/O</th>
<th>Uptime</th>
<th>EPE</th>
<th>C/T</th>
<th>Available Work Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour</td>
<td>85%</td>
<td>2 weeks</td>
<td>1 second</td>
<td>6000 sec. avail.</td>
</tr>
<tr>
<td>10 minutes</td>
<td>100%</td>
<td></td>
<td>38 seconds</td>
<td>27,000 sec. avail.</td>
</tr>
<tr>
<td>10 minutes</td>
<td>60%</td>
<td></td>
<td>45 seconds</td>
<td>27,000 sec. avail.</td>
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<tr>
<td>61 seconds</td>
<td>100%</td>
<td></td>
<td>2 shifts</td>
<td>27,000 sec. avail.</td>
</tr>
<tr>
<td>39 seconds</td>
<td>100%</td>
<td></td>
<td>2 shifts</td>
<td>27,000 sec. avail.</td>
</tr>
</tbody>
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Value Stream Mapping
Inventory Triangle and Push Movement Arrow

- An Inventory Triangle captures the location and amount of inventory
- A striped arrow indicates a Push movement of inventory according to a predefined schedule

Value Stream Mapping
Lead Time Bars

- Lead time indicates total time for a process or series of process.
  - Production/Manufacturing Lead Time (MLT). Lead time through entire production.
  - Process Lead Time. Lead time through each process, including time in inventory. Calculated as inventory quantity divided by daily customer requirement.
  - Processing Time = Value Added Time. Actual time spent processing the part or product.
  - Used to highlight inefficiencies

(7000 pcs)/(28400 pcs/month)x(20 workdays/month)
Map Features

1: Document customer demand
2: Define processes w/operation data
3: Show material flow
4: Show information flow
5: Compute lead times
Questions – Part 1

1. Are there any symbols on the map that you don’t recognize?
2. What determines the work schedule at each station?
3. How is ‘time’ data in the map acquired?
4. What is the bottleneck in the ACME manufacturing process?
5. Where is the biggest changeover time? What does this mean for downstream processes?
Questions – Part 2

1. What is the manufacturing lead time for a product (definition and value)? How does that compare to the value added time?

2. What is the impact of 1 truck a day leaving with finished goods and trucks arriving on Tuesday and Thursday with coils of steel?
Questions – Part 3

1. Where do you see waste in this process and what types of waste from the mnemonic CLOSED MITT do you see?

2. What countermeasures could be taken to reduce the most significant forms of waste?
Mapping Methodology

• Focus on a product family within single plant.
• Seek leadership from the value stream manager.
• Go and see. Conduct door-to-door process walk.
• Work backwards, starting at the shipping door.
• Capture and quantify basic operations involved.
• Encourage participation of all stakeholders.
• Use pencil & paper rather than CAD.
Investigation Etiquette

- Get management approval
- Communicate to all areas before visit
- Make introductions when you get there
- Remember, the workers are the experts for their tasks!
- Respect people’s work space
- Explain your purpose
Strategies for Process Improvement

#1: Produce to your Takt Time.

#2: Develop continuous flow where possible to reduce inventory. Eliminate isolated islands of production.

#3: Use supermarkets to control production where continuous flow does not extend upstream (often outside the plant).

#4: Try to send customer schedule to only one production process (pacemaker).

#5: Load-level production at pacemaker.

#6: Release/withdraw small, consistent increments of work to pacemaker (pitch).
**Establish Takt Time**

- Synchronizes pace of production to match pace of sales.

\[
\text{Takt Time} = \frac{\text{Demand Rate}}{\text{Work Time Available}} = \frac{\text{Number of Units Sold}}{	ext{Work Time Available}}
\]

**Example Calculation**

\[
\text{Takt Time} = \frac{900 \text{ Seconds}}{85 \text{ Boards}} = 10.6 \text{ Sec/Board}
\]

\[
\text{Cycle Time} = \frac{\text{Takt Time}}{\text{Takt Time}} = \text{Minimum # of People}
\]

**GOAL: Produce to Demand**
Supermarket Pull System

- Used to control production where continuous flow does not extend upstream.

Example Reasons for Supermarkets:
- Process that operate at very fast or slow cycle times and need to change over to serve multiple product families
- Some processes, such as those at suppliers, are far away and shipping one piece at a time does not make sense.
- Some processes have too much lead time or are too unreliable to couple directly to other processes in a continuous flow.
Pacemaker Process

- A pacemaker process is single point in the manufacturing value stream that sets the production pace for the entire process.
- The pacemaker process is frequently the most downstream continuous-flow process.
- On the future-state map, the pacemaker process is the production process that is controlled by the outside customer’s orders.

Load-leveling means distributing the production of different products evenly over a time period, creating a product “mix”.
- The schedule should create an “initial pull” by releasing and withdrawing a small, consistent increment of work, called the “Pitch”.

Value Stream Mapping

TECHHELP
Load Leveling and Paced Withdrawal

- Load-leveling means distributing the production of different products evenly over a time period, creating a product “mix”.

- The schedule should create an “initial pull” by releasing and withdrawing a small, consistent increment of work, called the “Pitch”.

Value Stream Mapping
1. What is the company’s Takt time if the demand is 460 parts per 8 hour shift (with two 10 minute breaks)?

2. Where is it not practical to achieve continuous flow? How could a supermarket be used to overcome this?

3. How can the welding and assembly operations be configured to Takt time?

4. What should be the pacemaker process?

5. What other improvements are possible?