Maximized Value Stream Mapping

Theory and practical application case study

Christopher Martin

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• Production planning supervisor at Case IH
  – Process improvement specialist with over 2 decades of exposure:
    • production operations planning, materials management and control, process improvement, database/systems design and development
  – Project activity in support of fabrication, welding, painting and assembly on several production lines.
• President – Central Nebraska APICS Chapter
Elements to Cover

- Value stream mapping – definition/theory
- Current state map
- Action plan to future state
- Future state map
- Case Study – VSM at the Case IH Grand Island facility
- Workshop – Video Console VSM

What is Value Stream Mapping

VSM: process of mapping the primary material and information flows in converting raw material to finished product or creating a service of value that a customer is willing to pay for.

Levels that can be mapped:
- Process
- Plant
- Multiple plants
- Cross company
Benefits of VSM

• Visualize entire process
• Common language
• Demonstrates links between operations
• Flow decisions easy to identify
• Waste identified
• Continuous improvement tool - iterations

VSM Primary Maps

• Current state map
  – How we are today including key measurement and communication flows

• Future state map
  – Where we plan to be a year or two from now based on proposed process improvement activity
Steps to a Current State Map

• Walk the process – start upstream
• Establish customer requirements
• Determine major product families
• Pick a primary flow and major product
• Walk again, measure key elements, count inventory
• Draw current state map

Establish Customer Requirements

• Define takt time – pieces per day, week, month, year – rate customer requires product
  – 21 units per day in 8 hours, 100% utilization
    • Factor 0.5 hr lunch, 2 - 15 min breaks
    • Available time => 7 hours => 420 mins
  – 420/21 => 20 min takt time

• Goal is to produce 1 unit every 20 mins
Determine Major Product and Flow

- Delineate major processes
  - Simplify but cover major steps in the flow

Measure Process Data

- Typical data to measure – varies with product
  - Cycle Time : Changeover time : Uptime : Lead time
  - EPE – 'leveled' production time : Scrap rate
  - # of Operators : Pack size : Available time

- Use smallest time measurement feasible for product – seconds, minutes, hours, days
Determine system triggers/ Info flow

• Examples of symbols used:

<table>
<thead>
<tr>
<th>Electronic Information</th>
<th>Push</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdraw Kanban</td>
<td></td>
</tr>
<tr>
<td>Production Kanban</td>
<td></td>
</tr>
<tr>
<td>Kanban Post</td>
<td></td>
</tr>
<tr>
<td>Supermarket</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td></td>
</tr>
<tr>
<td>Customer/Supplier</td>
<td></td>
</tr>
<tr>
<td>Shipping Truck</td>
<td></td>
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<tr>
<td>Data Table</td>
<td></td>
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</tbody>
</table>

Primary elements to consider

• VA - value added activity
  – impacts the fit, form or function of a product or service that a customer is willing to pay for – eg install gas cap on tank

• NVA - non value added activity
  – elements in the conversion process that adds no value to the product or service – eg move gas cap to point of installation
Draw Current State Map – eg: Pizza

Review map for process inefficiencies

- Waste – 7 primary symptoms of problems
  - Over-production : Waiting : Transportation
  - Inventory : Motion : Over-processing : Defects
- NVA vs VA time
- Over or under takt
- Push systems
- Line balance
Ask Primary Questions

- What is causing the waste?
- Where can we use continuous flow or pull?
- Where is best to trigger production?
- What is the bottleneck?
- How do we improve the bottleneck?
- How do we level production?

Determine Plan of Action

- Implement kanban
- Add kitting areas with kit carts
- Use standard packaging from suppliers
- Balance lines and reallocate resources
- Rearrange work stations for efficiency
- Mix model production where feasible
List opportunity to improve – eg Pizza

• Implement electronic signals
• Increase frequency of delivery
• Reduce raw material inventory value
• Improve efficiency of boxing operations
• Increase speed of delivery

Draw Future State Map – eg Pizza
Develop Project Plan/ Kaizen Journal

- Add key responsible persons
- Add timelines with milestone measurements
- Develop teams – include primary operators

Case Study: Case IH – Grand Island
Case Study – Case IH – Grand Island

- Case IH is a global leader in agricultural equipment. With headquarters in the United States, Case IH has a network of more than 4,900 dealers and distributors that operates in over 160 countries.
  — Corporate Website

The Challenge: Grand Island Plant

- 2 major product lines and 7 minor products
- Over 200,000 pieces installed daily
- Manufacturing in 4 buildings
- Warehousing 2 miles away
- Varying production shifts
- Suppliers from all over the globe
The Challenge – complex layout/pace

Fabrication
Weld
Main Spine for Assembly
Feeder Lines
Supermarkets
Sub-Areas etc
Main Paint – 1 of 3 systems

The Challenge – Product & Process

• **Major value product** – Axial Flow Combine
  – 3 major models, 20 model variations, thousands of option combinations

• **Major process flow**
  – Welding and assembly in multiple buildings using multiple paint systems. Several lines support major product with complex movement of parts.
The Decision

• Product
  – Pick high volume model
    • AFX High Capacity

• Process
  – Pick major component that travels major processes – fab, weld, paint, assemble, ship
    • Grain Tank

The Decision: Components
The Decision: Path

Measurements

- **Primary measurements taken**
  - Cycle time : Area lead time : Utilization
  - Takt time – different paces due to mixed model vs dedicated lines
  - Inventory : EPE : Changeover time
  - Number of shifts/associates
2009 observation highlights

- High inventory especially pre-assembly areas
- Delays across lines despite Andon system
- Imbalance/overtime /high cycle times
- Excessive transportation
- Complicated electronic signals difficult to match with physical movement
Challenges to Future State beyond 09

- Reduce inventory while doubling output
- Balance lines to reduce resource waste/takt
- Improve material delivery flow/reliability
- Link major lines for continuous flow
- Optimize fabrication operations
- Use world class manufacturing (WCM) as primary driver

Future State Map 2013 - increased vol
Overall results

- Almost doubled output with same shift plan
- Reduced lead time/inventory by 7.4 days
- Reduced cycle time by 40%
- Reduced assembly takt by 50%
- Millions saved due to improvement activity
- Changed overall culture of the plant

Challenges to the next Future State

- Continue expansion to all major components
- Reduce inventory between weld and fab
- Optimize paint and fabrication operations
- Continue line balancing and reduce cycle time
- Remove buffers, expand continuous flow
- Consistently include all associates in changes
Workshop

• VSM of a small video game console
  – Study current system and improve it
  – Increased demand to 100 units per day

Situation at a glance

• Weekly electronic requirements feed
• MRP system to control daily orders
• Plant ships daily to the customer with delays
• Suppliers ship daily to the plant
• High overtime including weekends
• Struggle to properly balance workforce
Plant Specification – 4 work cells

- Motherboard – C/T - 10 mins, Inv 50 completed, 100 pre-staged boards, 2 associates, 8 hour shift
- Console – C/T - 25 mins, Inv 25 completed, 3 associates, 8 hour shift
- Controller – C/T - 15 mins for controller and 5 mins to install to the body, Inv 25 completed, 2 associates, 8 hour shift
- Test – C/T - 5 mins testing and 5 mins to package, Inv 75 completed packages, 2 associates, 8 hour shift

Action Items

- Complete a current state map based on your plant observations
- Review this map and develop a proposed set of actions to improve the production system
- Complete a future state map based on your recommendations
Current State Map – Video Console

Actions to improve to Future State

- Reduce cycle times towards 4.8 min takt
- Reduce inventory
- Improve pace operation – console assembly
- Improve transportation to customer
- Balance lines to streamline and achieve pull
- Streamline raw material delivery
Future State Map: Video Console

Production Line

Tail Time
15 mins

Suppliers

NRE

Cycle Time: 10 mins
# of Employees: 2
Shift: 8 hours

2 stations

Cycle Time: cont
15 mins
# of Employees: 2
Shift: 8 hours

Cycle Time: test – 5 mins
pack – 5 mins
install – 5 mins
# of Employees: 3
Shift: 8 hours

Production Control

Motherboard
3

Console
2

Controller
3

Test

Milk run
10 mins
0.5 Days

20 mins
0.25 Days

15 mins
0.25 Days

15 mins
55 mins
0.25 Days

1.25 Days

Milk Run

Daily Requirements
25 pcs
Min – 10 pcs
Max – 25 pcs
50 pcs

Weekly Takt Time
8*60
100 = 4.8 mins

Add kanban triggered replenishment

Share employees

Restrict Supermarket

Cycle Time reduction

Continuous Flow

FIFO

Min – 10 pcs
Max – 25 pcs

Vary frequency to pace

Change trucking Co

Thank You

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