16.660 / 16.853 / ESD.62J Introduction to Lean Six Sigma Methods
January (IAP) 2008

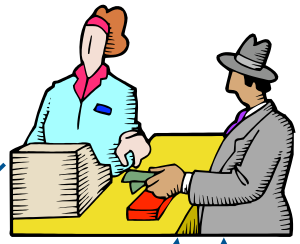
Value Stream Mapping Fundamentals

Learning Objectives

At the end of this module, you will be able to:

- **Sketch a basic value stream map**
- **Demonstrate basic value stream analysis**
- **Recognize steps for process improvement using value stream mapping and analysis**

Hot Dog Stand Process Map



11 - Clean up

1- Take order

9 - Deliver to Customer

8 - Add beverage

Yes

7 Order OK ?

6 Out Order

No

Yes

10 - Set up

2 In Order

3 - Cook Hot Dog

4 - Put in bun, wrap, add fruit

5 Another dog ?

No

How can Sasha and Andy improve their productivity to meet growing customer demand?

Five Lean Thinking Fundamentals

- **Specify *value*: Value is defined by customer in terms of specific products and services**
- **Identify the *value stream*: Map out all end-to-end linked actions, processes and functions necessary for transforming inputs to outputs to identify and eliminate waste**
- **Make value *flow* continuously: Having eliminated waste, make remaining value-creating steps "flow"**
- **Let customers *pull* value: Customer's "pull" cascades all the way back to the lowest level supplier, enabling just-in-time production**
- **Pursue *perfection*: Pursue continuous process of improvement striving for perfection**

Ref: James Womack and Daniel T. Jones, Lean Thinking (New York: Simon & Schuster, 1996).

Value Stream Map (VSM)

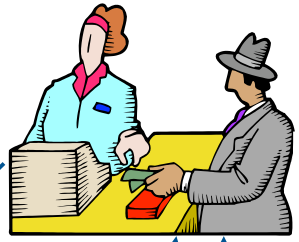
- A tool used to improve a process by identifying added value and eliminating waste
- A process map with process data added
- Some examples of process data
  - Times: processing, wait, cycle
  - Quality: number of rejects
  - Inventory
  - Resources
    - Number of people
    - Space
    - Distance traveled
  - Whatever else is useful for analyzing the process

Only value-added data and graphics should be used!

Steps for Creating a VSM

1. Define customer value
2. Create a "current state" map
   - "Walk" the process to identify tasks and flows
   - Gather data on resources, time, quality for each
3. Analyze map to determine opportunities for improvement
   - Identify value-added and waste
   - Brainstorm actions to eliminate waste and add value
4. Create "future-state" map to visualize the desired state
5. Create action plans to move towards future-state

S&A Customer Value



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Yes

7 Order OK ?

6 Out Order

No

Yes

10 - Set up

2 In Order

3 - Cook Hot Dog

4 - Put in bun, wrap, add fruit

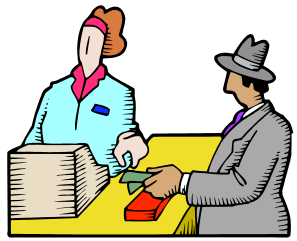
5 Another dog ?

No

Current Demand
50 customers
100 hot dogs

Customer Value
Good food
Faster service

S&A VSM



T = 48 sec
Qual = 100%

11 - Clean up

T = 11 sec
Qual = 90%

T = 10 sec
Qual = 100%

T = 30 sec
Qual = 100%

T = 60 sec
Qual = 100%

T = 33 sec

1- Take order

9 - Deliver to Customer

8 - Add beverage

7 Order OK ?

6 Out Order

Yes

No

Yes

10 - Set up

2 In Order

3 - Cook Hot Dog

4 - Put in bun, wrap, add fruit

5 Another dog ?

No

T = 48 sec
Qual = 100%

T = 30 sec

T = 110 sec
Qual = 100%

T = 44 sec
Qual = 100%

T = 22 sec

Display of data collected during Lean Thinking

Value Stream Analysis

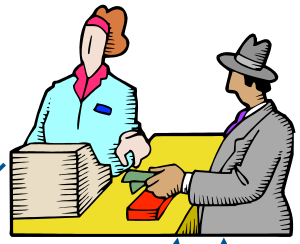
Sasha

Andy

- With your team, take 10 minutes to
  - Identify with colored dots the VAT (green), NVAT (yellow) and WT(red) value stream activities
  - Calculate the total
    - Value added time
    - Non value added time
    - Wait time
  - Calculate the total time Sasha and Andy spend on a single order
- Be ready to report your answers to the class

S&A VSA Using “Castle Wall” VSM

S&A Takt And Cycle Times



50 customers
100 hot dogs

Open from
10AM - 2PM

11 - Clean up

1- Take order

9 - Deliver to Customer

8 - Add beverage

Yes

7 Order OK ?

6 Out Order

No

Yes

10 - Set up

2 In Order

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$$\text{Takt time} = \frac{\text{Available time}}{\text{Customer demand}} = \frac{4\text{hrs} \times 60\text{min/hr}}{50\ \text{Customers}} = 4.8\text{min} = 288\ \text{sec}$$

Cycle time = 446 sec = 7.43 min

Summary - S&A Value Stream Analysis (VSA)

- Current production (50 customers) is a little below current capacity (64 customers) of Andy and Sasha
  - Process improvement needed to meet growing demand
- Andy and Sasha are both underutilized
  - But utilization is not balanced between them
- Cycle time of 7.43 min per customer too long
  - Should be able to shorten cycle time to meet demands of customers for faster service

Bottom Line

Sasha and Andy should implement process improvement for week 3 to meet growing demand!

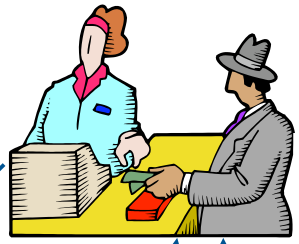
Improvement Brainstorm

Sasha

Andy

- **Help Sasha and Andy figure what to improve**
  - **How can utilization be improved?**
  - **How can cycle time be reduced?**
  - **What has to be done to serve 75 customers?**
  - **What has to be done to serve 100 customers?**
- **Spend 10 minutes with teams and then discuss with class**

Brainstorm Bursts



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Why is VSM a Useful Tool?

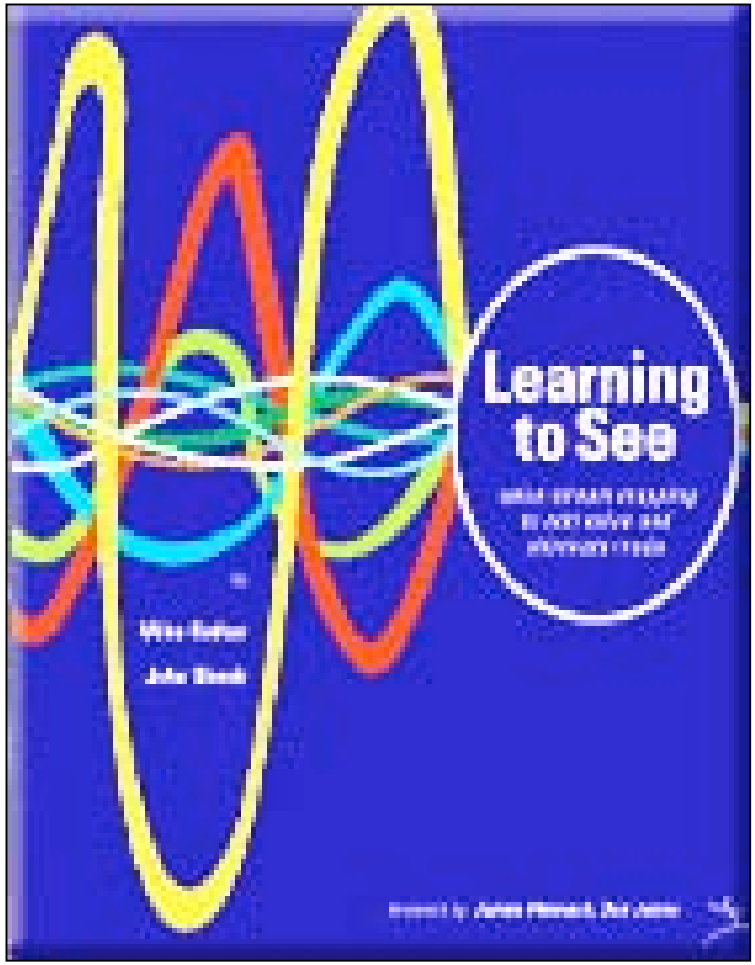
- Helps visualize interactions and flows
- Shows linkages between information and product flows
- Provides a common language for talking about a process
- Helps to identify:
  - the constraint(s) - any resource whose capacity is less than customer demand;
  - wastes as well as their sources

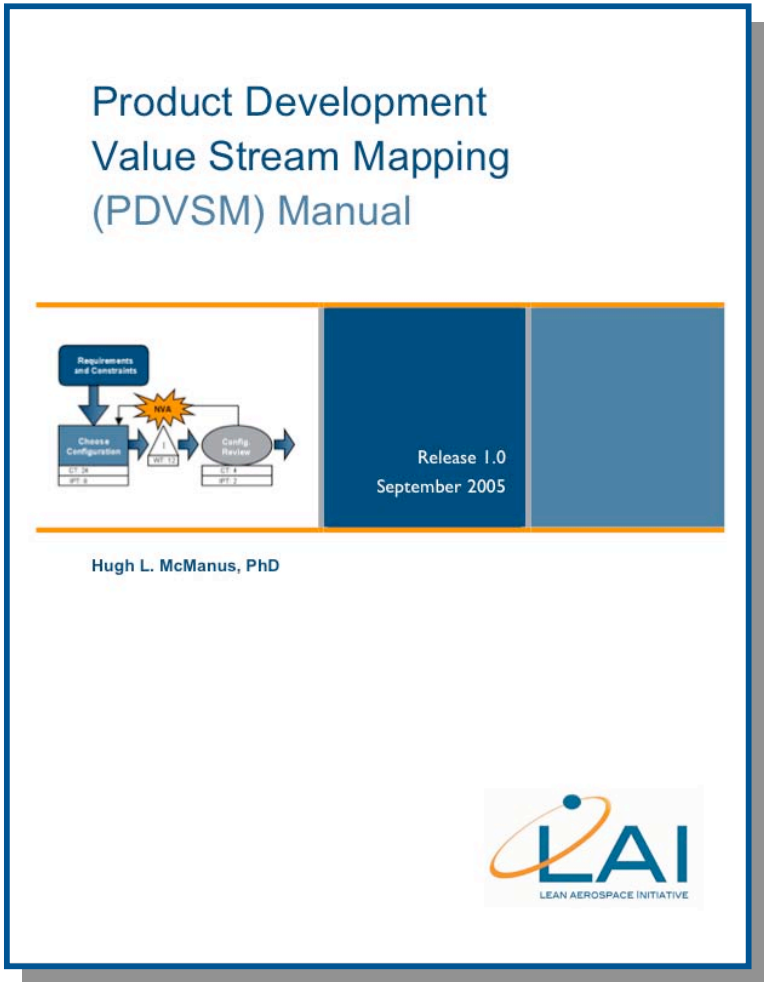
Adapted from: M. Rother and J. Shook, Learning to See, Lean Enterprise Institute, 1998

Tips for Creating a VSM

- Involve entire team
- Actually walk the process - follow the material and information through the process, starting at the beginning
- Use Post-it notes and butcher paper
- Use symbols or icons that are meaningful to the process but common enough to be understood by all involved

More Information





Courtesy of Lean Enterprise Institute. Used with permission.

Reading List

McManus, H., “Product Development Value Stream Mapping (PDVSM Manual)”, Release 1.0, Sept 2005. Lean Advancement Initiative.

Rother, M. and Shook, J. Learning to See, v1.2, The Lean Enterprise Institute, Cambridge, MA June 1999

Acknowledgements

- Sharon Johnson – Worcester Polytechnic Inst.
- Jose Macedo – Cal Poly San Luis Obispo
- Ted Mayeshiba – USC
- Earll Murman – MIT