Value Stream Mapping
Basics & Beyond

Prepared by
Anthony Manos
Catalyst
Profero, Inc.

Developer

Anthony Manos
Tony Manos is a Catalyst with Profero, Inc., "Leaders in Lean," where he provides professional consulting services to organizations focusing on implementing Lean Enterprise. Mr. Manos has extensive knowledge of Lean and quality in a wide range of work environments. Tony is trained and certified by the National Institute for Standards and Technology (NIST) U.S. Department of Commerce in all elements of Lean manufacturing.

As a member of American Society for Quality’s (ASQ) faculty, he teaches a two-day course in Lean Enterprise and a one-day course on Kaizen. Tony is the past Chair of the Lean Enterprise Forum of ASQ. He is a Senior Member of the Society of Manufacturing Engineers (SME) and a member of the Association for Manufacturing Excellence (AME). He is part of the team that developed the Lean Certification for AME, SME and the Shingo Prize. Manos also is a Shingo Prize Examiner for Manufacturing Excellence.

Mr. Manos served in the United States Navy nuclear propulsion program and holds an MBA from the University of Illinois at Chicago.

Contact information:
Anthony Manos
Catalyst
Profero, Inc
124 W. Polk Street, Suite 101
Chicago, IL 60605
O 312.294.9900
F 312.294.9911
C 312.718.0078
anthony.manos@proferoinc.com
www.proferoinc.com
Agenda

- Introduction to VSM
- History of VSM
- Value Stream Scope
- How to hold a VSM Event
- Process Families
- Current State Map
- Future State Map
- Plan and Deploy
- Role of VS Manager
- VSM and Business Planning
- Future State 2 and Beyond
- Conclusion

Introduction to VSM

- What is VSM?
- Common Errors
- 4 Step Process
Lean Journey & VSM

- One of the ways to start your Lean journey is to create a Value Stream Map
- Using VSM will help discover and determine the best path for your Lean efforts
- This will help you focus on what is important
- Using VSM everyday will give you continuous improvement

Building Blocks of Lean

- Continuous Improvement & Kaizen Events
  - TPM
  - Cellular & Flow
  - Pull System & Kanban
  - JIT
  - Poka-yoke
  - Self Inspection
  - Autonomation
  - Batch Size Reduction
  - Quick Changeover
  - Layout
  - V
  - S
  - M
  - Standardize Work
  - POUS
  - Visual
  - 5S
  - Change Management
  - Teams
What is VSM?

• A Value Stream Map is a pictorial representation of the information and process flow
• It is simple and easy to learn
• It creates our roadmap for Lean improvements
• It is more powerful than flowcharts because it includes so much more information in a concise way
• Using the VSM symbols or icons are kind of like playing “Pictionary”. If people can understand your simple symbols, then you were able to effectively communicate your point
• It helps reduce the fear of change and of the unknown by allowing an organization show the way things will be in the future

VSM Is/Is not

Is
• Allows everyone to see the whole picture
• Based on current data
• A roadmap for improvement
• Used for continuous improvement

Is not
• A flowchart
• Based on engineering standards or old information
• a once a year planning session
Most Common VSM Errors

1. Not determining the Process Family correctly
2. Not appointing a Value Stream Manager or VS Manager not performing their duties effectively
3. Maps created by a “team of one”
4. Not considering items that don’t necessarily show up on the map (Change Management, training, communication, Teams, 5S, etc.)
5. Not frequently updating the map

6. Trying to jump to a higher level Building Block (i.e., cells, TPM, Kanban) before the basic Building Blocks in place
7. No following the plan
8. Not having an expert lead the first few events
9. Not communicating the Value Stream Maps
10. Calling other tools VSM (“butcher paper”, flowcharts, etc.)
11. Using software to create maps
12. Trying to collect too much data or not enough data
4 Steps for VSM

1. Process Family
2. Current State Map
3. Future State Map
4. Plan

Brief History of VSM

Material and Information Flow
Before VSM

- Too micro focused or
- Too macro focused = not focused

With VSM

- Focused on a Process Family
**Origins of VSM**

- “Material and Information Flow Diagrams” were originally developed by Taiichi Ohno and the Operations Management Consulting Division of Toyota to help suppliers learn TPS
  - Visual communication tool
  - Able to identify & eliminate waste
- Mike Rother and John Shook (1999) adapted Toyota’s techniques and refined this technique into what we now call “Value Stream Mapping”
- After learning how to apply VSM at the facility level, it was apparent that extending it out to the Supply Chain or Value Chain was important to continue to make improvements
- Drew Locher & Beau Keyte wrote about VSM in the office and support function areas

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**How to Perform a VSM Event**

8-Week Kaizen Cycle with a three day VSM Event
Items to Help Prepare for a Facility Level VSM

- 8 Week Kaizen Cycle
- How to prepare for a VSM Event
- The VSM Team, supplies, materials, communication, measures and metrics
- 3-day VSM Event

8 Week Kaizen Cycle

- Week 1: Brief team meeting and basic information on Value Stream Mapping
- Week 2: Short meeting to verify supplies, scope, measures and metrics
- Week 3: Quick meeting to go over anything before the event
- Week 4: Value Stream Mapping 3-day event
- Week 5-7: Continue to refine the Plan
- Week 8: Final report out to management and beginning of plan implementation
How to Setup the VSM Team Structure

- Value Stream Manager
- VSM Champion
- Team Members

VS Manager

VSM Champion

Participants
- People from area
- Customer/Suppliers
- Experts
- “Outsider”

VSM Team

- 7-10 cross-functional people from the managerial level including the Value Stream Manager
  - Having a larger group makes it difficult to have everyone walk the flow and gather data
  - Having a smaller group tends to limit the ability to create a meaningful future state
- Have an experience person lead the team and facilitate the first few events – VSM Champion
- Choose people that are knowledgeable enough about the inner workings of your organization
- Also having an outsider or new person may be helpful
VSM Team Members

- Production control/scheduling
- Operations management
- Key floor leaders/supervisors
- Information Technology.
- Materials/logistics/warehousing material handlers

- Marketing/sales/customer service
- Accounting/finance
- Human resources
- Purchasing/receiving
- Process/design engineering/engineering
- Quality
- Supplier/vendors

Recommended VSM Supplies

Training area
- Comfortable training room with tables and chairs
- LCD projector, screen, and computer
- Two large (4’ x 8’) dry erase boards (one for the Current State Map and one for the Future State Map)
- Medium-point dry erase markers (black, blue, green, red)
- Training material on VSM (PowerPoint presentation, VSM video/DVD, VSM workbooks, etc.)
- Flipchart and markers

VSM materials for participants
- Clipboards
- Pencils and large erasers
- 11” x17” paper
- Rulers or VSM templates
- Data collection sheets
- A calculator
- VSM software (optional)
Value Stream Scopes

Facility
Process
Extended

Field to Fork

• The concept of “Field to fork” shows an example of an entire value stream
Levels of Value Stream Maps

- **Extended Value Stream Map** – include suppliers, customers, other facilities, corporate, etc.
- **Facility Value Stream Map** – focus on a single Process Family first
- **Process or Inter-departmental Value Stream Map** – focus on specific aspects of the Facility Value Stream
Warning! Warning!

- Many organizations want to start by drawing Value Stream Maps at the individual departmental level – **DO NOT DO THIS!**
- If you do not see the *entire flow* you may be optimizing one area and sub-optimizing others!
- See the “Big Picture” first before drilling down into specific areas

Process Families

- What is a Process Family, the Process Family Matrix
- How to choose which Process Family to map first
  - Multiple Process Families
Process Family

- Process Family are groups of products or services that go through the same or similar processing steps (a.k.a. “Product Families”)
- Many companies want to skip this step or take shortcuts – **DON’T**
- Take the time to complete this step (even if you have many SKUs) and continue to update as necessary
Focus on One Process Family

Determine process families by:
- Look for similar processing steps, departments and equipment,
- By process, not product
- Quantities or volumes may help in the decision of which SKUs to include
- Many organizations fall into the trap that they think customers or products are process families
- You eventually will have Value Stream Maps for each process family

Reasons Why This Step is Skipped

- It is hard to determine when processing steps need to be included, omitted, split apart, etc.
- Your VSM Team knows your company the best, you will be able to figure out at what level this needs to be performed at
- The process will become easier with more experience
# Process Family for Goodenuff, Inc.

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<th>Process Steps</th>
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<td>X</td>
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<td>BL-99</td>
<td>X</td>
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**Products**

Let's rearrange for convenience.
Process Family Selection

There may be many reasons to choose which Process Family to focus on first, each organization will have its own reason:
- “Biggest bang for the buck”
- Largest reduction in Lead-time or inventory
- Biggest impact to the customer
- Highest probability for success
- Most visible to stakeholders
- New product line
- Volume or quantity

Current State Map

- Walk the flow
- Data and information collection
- VSM symbols
- How to draw a Current State Map
Walk the Flow

• You have to have the team ‘walk the flow’ to gather the data and information for the Current State Map and to look for the 8 Wastes of Lean
• It does no good to sit around in a conference room trying to come up with the data
• You will learn more by going to ‘gemba’ (Japanese for “the place”) than you will by just sitting there
• Have a team member draw a spaghetti diagram of your travels and document the distance walked

8 Wastes of Lean

“OMIT What U DO”

• Overproduction
• Motion
• Inventory
• Transportation
• Waiting
• Underutilized People
• Defects
• Over-processing
Information Gathering

- Don’t rely on engineering standard times, get real numbers
- 80% accurate data is enough to get started, as long as it gets us “in the ballpark”, fill in the gaps A.S.A.P
- Interview techniques
  - Explain the exercise
  - Be ready for the “It depends” answer

What Type of Information to Collect

Office/Support
- Processing time (P/T) or Task Time (T/T)
- Batch time (B/T)
- Accurate & Complete (A&C)
- Priority (PRI)
- External contacts (ExC)
- Late Information (LInfo)
- Quantity (QTY)
- Difficulty (Diff)
- Lead-time, Queue-time

Manufacturing
- Cycle time (C/T)
- Machine time (M/T)
- Changeover (C/O)
- Number of Changeovers (#C/O)
- Reliability (Rel)
- First Pass Yield (FYP), Scrap, Yield
- Quantity (QTY)
- Inventory
What Type of Information to Collect

Information
- Hardcopy
- Electronic – EDI, fax, email, phone
- Software

Transportation
- Trucks, planes, trains, Express Service
- Distance traveled (DIST)
- Expediting costs (Expd)
- On-time delivery (OTD)

More Data Collection

Customer/Suppliers
- Names
- material/service types
- Quantity (QTY)
- Service level (Serv)

Miscellaneous
- Number of operators (trained or per shift)
- Push or Pull/Kanban, Supermarkets
Interviews

• It is important to have good interviewing skills
• Everyone on the team should have the opportunity to perform interviews
• Stick together rather than splitting into smaller groups so that you can all hear the same answers
• If you are the manager of the area, be quiet and listen - do not interrupt the interviewee, answer for them or lead the answer

Conducting Interviews

• There are 5 things to remember when conducting the interview:
  1. There are no wrong answers
  2. Put the interviewee at ease
  3. Explain to them what you are doing
  4. Do not read directly off the data collection sheet
  5. Listen for the answers
Data Collection Sheet

- Experienced VSM’ers can draw the Current State Map as they collect data
- In the beginning, it is easier to collect the data and then go back and draw the amp
- It is usually easier to write additional data even if you don’t think you’re going to use it

Data Collection Sheet Example

<table>
<thead>
<tr>
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<th>Support</th>
<th>Name</th>
<th>Queue</th>
<th>P/T</th>
<th>Diff</th>
<th>Priority</th>
<th>Rel. D/T</th>
<th>OEE</th>
<th>A&amp;C</th>
<th>Qty</th>
<th># of People/Shift</th>
<th>Shared/Dedicated</th>
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<td>Inventory</td>
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<td>C/O</td>
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VSM Symbols

- Standard VSM symbols
- Simple, easy to understand
- Add others if needed to fit your organization
- Made up examples:

Office/Manufacturing/Supplier

<table>
<thead>
<tr>
<th>Office/Support Data Box</th>
<th>Manufacturing/Shop</th>
<th>Supplier/Outside Processing</th>
<th>Office</th>
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<td>Process Box</td>
<td>Main Customers or Suppliers</td>
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</tr>
<tr>
<td>Department</td>
<td>Work Center/Machine Numbers or Name</td>
<td></td>
<td></td>
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<tr>
<td>Software</td>
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<td></td>
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<td>P/T = Processing time</td>
<td>Q/T = Cycle Time</td>
<td>L/T = Lead Time</td>
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<tr>
<td>Diff = Difficulty (S-E)</td>
<td>W/T = Machine Time</td>
<td>P/T = Processing Time</td>
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</tr>
<tr>
<td>ACC = Accurate &amp; Complete</td>
<td>Q/O = Changeover</td>
<td>Dist = Distance</td>
<td></td>
</tr>
<tr>
<td>Pri = Prioritize</td>
<td>FFY = First Pass Yield</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rel = Reliability</td>
<td>Qty = Quantity</td>
<td>Qty = Quantity</td>
<td></td>
</tr>
<tr>
<td>Qty = Quantity per _____</td>
<td>Takt = Takt Time</td>
<td>Qty = Quantity per</td>
<td></td>
</tr>
<tr>
<td>(Q) = No. of people/shift</td>
<td></td>
<td>Qty = Quantity per</td>
<td></td>
</tr>
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</table>

At = Queue/waiting

△ = Inventory

△ = Inventory

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How to Draw the Map

• A key concept of drawing the map is that no two maps will look the same
• Even if you drew the same map on different days, it may look different
• Remember, the map is about communicating and creating an awareness so that we can achieve a better Future State
• Don’t get too lost in the details

Preparation

• 11” x 17” paper, landscape
• Pencil and big eraser
  1. Customer
  2. Supplier
  3. Material
  4. Information
  5. Time calculations
Case Study - Goodenuff, Inc.

- Goodenuff is a traditional manufacturer
- They have been in business for over 40 years
- Make and sell different types of airplanes
- Lately they have been having problems with:
  - customer complaints
  - quality
  - cost
  - on-time delivery
- Read the case study and prepare to draw their Current State Map
Future State vs. Ideal State

- It is not uncommon to see companies try to be overly aggressive in the amount of work they can complete on their first map – they try to reach and "Ideal" state
- It all depends on resources: time, people, budgets
- Ideal states are usually longer term outlooks, like 3-6 years
- Focus on that you can get down in 6-12 months
Future State Questions

1. What is the Takt time?
2. Are there bottlenecks or constraints?
3. Where can inventory be reduced or supermarkets used?
4. Where can you improve flow?
5. What other improvements are required?

1. What is the Takt Time?

Takt Time = \( \frac{\text{Time available per shift}}{\text{Demand}} \)

For Goodenuff

\[
\text{Time available} = 480 \text{ min (8 hours)} - 20 \text{ min (breaks)} - 30 \text{ min (changeover)} - 5 \text{ min (clean up)} = 425 \text{ min} = 25,500 \text{ sec}
\]
Takt Time Calculation

Time available = 25,500 sec
Demand = 1,200 planes per day

Takt Time = \( \frac{25,500 \text{ sec}}{1,200 \text{ planes per shift}} \)
= 21 sec (per plane)

2. Are there bottlenecks or constraints?

- Any cycle times or process times greater than Takt Time
- Bottleneck – Any resource whose capacity is less than the demand placed on it
- Constraint – Anything that limits a system from achieving higher performance, or throughput

Alternate definition: that bottleneck which most severely limits the organization’s ability to achieve higher performance relative to its purpose or goal.
3. Where can inventory be reduced or supermarkets used?

Types of inventory:
- Raw materials
- Buffer stock
- Work in process (WIP)
- Finished goods
- Safety stock

Look at:
- Raw materials
- Dedicated resources
- Between processes
- Finished goods
- Long cycle times or changeovers
- Outsourcing
When to use Supermarkets

- Use Supermarkets when the lead time for materials exceeds the customer’s requirements for on-time delivery
- When you can’t flow, pull
  - When large batches are still required (e.g., heat treat, out sourcing, long changeovers, etc.)
  - When shared equipment is used
FIFO Lanes

- FIFO = First in, first out
- Set a maximum amount of material for the FIFO lanes
- Requires Quick Changeover, flexible manufacturing or dedicated lines
- It doesn’t matter what item is next queue
- FIFO example: Constant WIP or CONWIP

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4. Where can you improve flow?

- Reduce or eliminate non-value added processes
- Use the Building Blocks of Lean
- Don’t forget office or support functions
- Create a cell or dedicated support equipment
- Use Pull/Kanban systems

---

**National Airlines**

**Sales**

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**Paper**

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**Change 1x per shift**
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- Change 1x per shift
- Cell

**Additional Information:**
- Monthly Scheduling
- Weekly MRP
- Change 1x per shift
- Each order
- 30/60/90
- 1 day
- 20 sec
- 20 days
- 95 sec

**Daily:**
- 1 day
- 1 hr
- Diff=1/4
- Rel.=99%
- A&C=50%
- ~24,000/mo
- ~1,200/day

**Weekly:**
- 3 days
- 1 day
- 1 day
- 1 day
- 1 day
- 2 days
- 1 day
- 1 day

**Monthly:**
- 1 day
- 1 day
- 1 day
- 20 sec
- 20 days
- 95 sec

**W.O.**
- Change 1x per shift

**Scheduling**
- Monthly
- Weekly

**National Airlines**
- Daily
- ~24,000/mo
- ~1,200/day

**Kostalott Paper**
- Monthly
- Weekly

**Notes:**
- FIFO
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
- 1 day
5. What other improvements are required?

- Any changeovers greater than 10 minutes
- Reducing or eliminating waste or non-value added processes
- Low quality (A&C) or First Pass Yield (FPY)
- Low reliability of equipment
### Before & After

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead-time</td>
<td>23 days</td>
<td>7.3 days</td>
</tr>
<tr>
<td>Processing time</td>
<td>91 min 35 sec</td>
<td>30 min 45 sec</td>
</tr>
<tr>
<td>Inventory</td>
<td>21,000</td>
<td>6,300</td>
</tr>
<tr>
<td>Changeover</td>
<td>20 min</td>
<td>5 min</td>
</tr>
<tr>
<td>Reliability</td>
<td>90%</td>
<td>100%</td>
</tr>
<tr>
<td>First Pass Yield and Accurate &amp; Complete</td>
<td>75%</td>
<td>99%</td>
</tr>
<tr>
<td>Difficulty</td>
<td>1/3</td>
<td>1/1</td>
</tr>
<tr>
<td>Scheduling</td>
<td>Weekly</td>
<td>Daily</td>
</tr>
</tbody>
</table>
Loops

• Once you have your map marked up, divide it into loops
• Loops are an easy way to break up the projects into smaller pieces

Q. How do you eat an elephant?
A. One bite at a time.
• Typically there are 3-7 loops
• Not magical, just look for natural breaks
Plan and Deploy

- Creating the Plan
- Prioritizing your plan

Muda

- If you don’t do anything with the maps and more importantly with the Plan, then all you did was create more muda (waste)
- The process of creating Value Stream Maps can be very eye opening, but the power in this tool is following through with the Plan
- Use the Plan!
Draft Plan

• Gather the information from the Future State Map and put it into the plan
• Assign:
  – Project Leaders
  – Support people or functions
  – Goals
  – Metrics
• Additional information is needed before the final Plan can be presented

Communicating with Maps

Map phases
1. Current State – Base State
2. Current State – with Kaizen bursts
4. Future State
5. Ideal State
Key Elements of the Plan

- Project or task name
- Dates: start, end, milestones
- Leader and team members
- Impact or measurable goals
- Status or progress
- Priority
- Resources needed: people, time, budgets, etc.

VSM Plan Example

<table>
<thead>
<tr>
<th>ID</th>
<th>Date</th>
<th>ID</th>
<th>Status</th>
<th>Progress</th>
<th>Loop</th>
<th>Priority</th>
<th>Resources Needed</th>
<th>Team</th>
<th>Impact/Goal</th>
<th>Comments</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>O</td>
<td>/barb2down</td>
<td>1</td>
<td>C</td>
<td>Reduce Inv R.M. Kanban</td>
<td>Cindy, Steve</td>
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<td>0%</td>
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<td>1</td>
<td>A</td>
<td>Decrease L/T F.G. Kanban</td>
<td>George, Fred</td>
<td>$$$$$$</td>
<td>-40%</td>
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<td></td>
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<td>Reduce costs POUS</td>
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<td>20%</td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td>O</td>
<td>/barb2right</td>
<td>1</td>
<td>C</td>
<td>Improve OTD Cell</td>
<td>Bob, Ralph</td>
<td>-40%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>A</td>
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<td>$ $$</td>
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<td>O</td>
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<td>Reduce Inv F.G. Kanban</td>
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<td>26%</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td></td>
<td>C</td>
<td>/barb2up</td>
<td>2</td>
<td>A</td>
<td>Emp. Involve POUS</td>
<td>Cathy, Bob</td>
<td>$$$$$$</td>
<td>-40%</td>
<td></td>
<td></td>
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<tr>
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<td></td>
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<td>3</td>
<td>B</td>
<td>Reduce costs Cell</td>
<td>Laurie, Homer</td>
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<td></td>
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<tr>
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<td>4</td>
<td>D</td>
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<td>C</td>
<td>Improve OTD Cell</td>
<td>Ralph, Mike</td>
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<td>Emp. Involve POUS</td>
<td>Bob, Laurie</td>
<td>$$$$$$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Effort & Impact

- To prioritize your implementation plan a simple tool like “Effort & Impact” matrix can be used.
- Have the team determine the E&I levels.
- Select top ideas/projects.

<table>
<thead>
<tr>
<th>Effort</th>
<th>High</th>
<th>No!</th>
<th>Med</th>
<th>Low</th>
<th>Yes!</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
<td>Low</td>
<td>Med</td>
<td>High</td>
<td>Low</td>
<td>Med</td>
<td>High</td>
</tr>
</tbody>
</table>

Role of the VS Manager
Definition of a Value Stream Manager

• The person assigned clear responsibility for success of a value stream
• Identify value from the customer’s perception, creating value and flow
• Aligns activities and resources
• Achieve the Future State Vision
• Similar to a *Shusa*

Value Stream Manager Musts

• Remove *all* barriers to achieving the Future State
• Review the plan at least every week
• Continually communicate the progress towards the Future State
• Ensure that the Value Stream Maps are keep up to date
Traditional View

• Departmental Managers focus on their area
• They have “blinders” on

VS Manager View

• Focus on the whole value stream

I see the whole!
VSM and Business Planning

- Operational Planning
- VSM versus Current Business Plan

Business Planning

- Your first VSM will probably occur while you already have a business plan or operational plan in place
- You have to determine which items to keep off of each of the plan
- Chances are you don’t have enough resources to do both
Next Year

• Before you roll into your business planning for your next fiscal year, do your Value Stream Maps first.
• The VSM will show you what’s most important for your value stream and not an individual or department.
• If you use Hoshin Kanri or Policy Deployment your Value Stream Maps will fit in well to help develop your plan.

Future State 2 and Beyond

"Obstacles are those frightful things you see when you take your eyes off your goal." – Henry Ford
What to do next?

• The first Future State is usually the easiest
• Subsequent Future States become more difficult, but the rewards are definitely worth it!
• The goal is to reach an Ideal State (continuous improvement)

What’s After FS1?

• Typically at this juncture (or before) the team has a decision to make
  – Do we have enough resources to start a new VSM on a different Process Family?
    • If the answer is yes, start a new VSM
  – Do we continue on with the next future state with our current Process Family?
FS2 on Same Process Family

- Review of FS1
- Lessons Learned – what worked, what didn’t work, how to improve for FS2
- Walk the flow (again) – look for waste
- Future State 2 – review FS questions and go through them again
- Brainstorm ideas for improvement in FS2
- Create the (draft) Plan for the next period

Conclusion

Wrap-up
Q&A
Evaluations
Thank you

Feel free to contact me if you have any comments or questions

Tony Manos
Catalyst
Profero, Inc.
124 W. Polk Street, Suite 101
Chicago, IL 60605-1770
USA
Office: 312.294.9900
Cell: 312.718.0078
Fax: 312.294.9911
Email: anthony.manos@proferoinc.com
Website: www.proferoinc.com