VALUEFLO

Lean Foundations Guide

Getting Started with Value Stream Mapping

Introduction to Value Stream Mapping

Learning Objectives for this Guide

This guide will help you understand the Value Stream Mapping process, how it can help you, and will enable you to get started with mapping

- Understand what a Value Stream Map is
- Learn the purpose of Value Stream Mapping
- Know who should participate in Value Stream Mapping
- Learn the Value Stream Mapping Process.

The best way to learn mapping, like most things, is to practice it with the help of a coach.

What is a Value Stream?

A Value Stream is all of the steps that transform an input into a product or service. The Value Stream will include all steps – whether they are Value-Added or Non-Value-Added.

A Value-Added step must meet three criteria:

- The customer must care about it.
    - If you asked the customer whether they were willing to pay for a step, their answer must be, "yes".
    - The customer must notice if the step is done or not.
- The item must physically change, whether it is a material, a service, or information step, something must be done to alter it to progress towards the next step in the process.
- It must be done right the first time.

Non-Value-Added steps are all the rest of the things we do in the process to complete the production of a good or service. Non-Value-Added activities are divided into two categories:

1. Non-Value-Added but Necessary
2. Waste (Many people remember the seven wastes using the acronym "TIM WOOD": Transportation, Inventory, Motion, Waiting, Over-Processing, Over-Production, Defects).

In general, a very small percentage (normally under 10% of the lead time) of the overall time it takes to complete the production of a good or service is Value-Added. The rest of the time (~90%) is Non-Value-Added time.
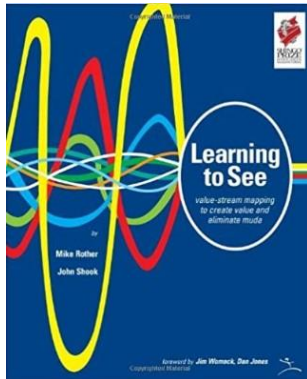
What is a Value Stream Map?

Figure 1 Cover of "Learning to See", a groundbreaking book on the Value Stream Mapping Process

Simply put, a Value Stream Map is a high-level representation of the Value-Added and Non-Value-Added steps of a process from beginning to end. More specifically, it is graphic representation that displays how two of the three major flows (Flows of Material and Flows of Information) fit together.

Value Stream Maps are unique in that they have a very specific set of mapping symbols or icons, and have a "circular nature" that provides a complete picture of these flows, where Material Flow goes from Supplier through the Organization to the Customer, and Information Flow goes from the Customer, through the Organization, to the Supplier in a "closed loop". This unique "circular" nature enables the organization to gain a "big picture" of how well it is using its resources in order to meet customer needs.

Value Stream Mapping is the method of documenting a Value Stream in order to help you reduce the lead times for completing services or processes, or making products. The technique will help you and others on your team "see" the process, including both Value-Added activity and waste, so that you know where to focus your improvement efforts first.

Value Stream Mapping is a Toyota Production System tool that was brought to life in the U.S. by two American teachers/consultants with deep knowledge and experience gained studying and working for the Toyota Manufacturing Company in Japan and their U.S. transplant locations. Mike Rother and John Shook described the tool in their 1998 Book, "Learning to See". While VSM is commonly applied to Manufacturing processes, it can be used on any product, process or service, independent of industry or application.

Incidentally, Toyota calls it "Material and Information Flow Mapping" and views it as a way to communicate information that they use to identify and target use of the TPS tool kit to make process improvements.

Why do we use Value Stream Mapping?

We use Value Stream Mapping in order to document the current state (or Current State Value Stream Map, CSVSM), enabling us to "see the waste".

Once we "see" the problems, we can change our mindset to think of these problems as opportunities. If we can change the current state, what would we do differently? The result is a Future State Value Stream Map (FSVSM).

Our goal is to look at the differences between the two maps, and identify the projects that need to be completed in order to achieve the FSVSM. This project list is known as the Kaizen Roadmap.

The whole point of Value Stream Mapping, is that we want to know what we can achieve (the Future State), and how we can get there (the Kaizen Roadmap), and to complete the improvement projects so that we can transform from the current state to the future state.

When we have completed our Kaizen Roadmap, we will "re-map" the Current State (which should look very close to the Future State Map we created when we first envisioned the future). The process will then start all over again, as depicted by the blue arrows in the diagram on the right.
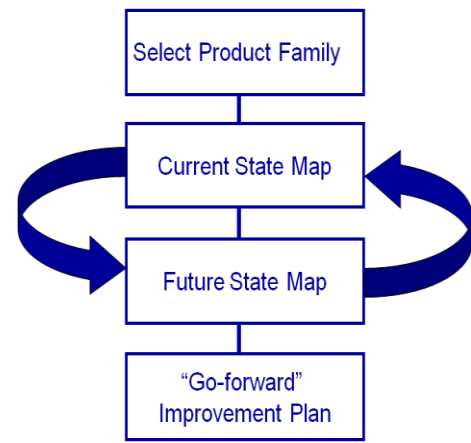

Figure 2 Model of the VSM Process, Showing the Continuous Improvement Nature of VSM

Current State VSM Example

Below is an example of a CSVSM:

The goal of mapping the CSVSM is:

- To "see" the current process
- To develop the baseline so we can create the future state
- To identify improvement opportunities

For now, don't worry about the various symbols and their meanings. Right now, we just want to familiarize you with the "look and feel" of VSMs. We will walk through the process of creating a CSVSM Step-by-Step in the next section.
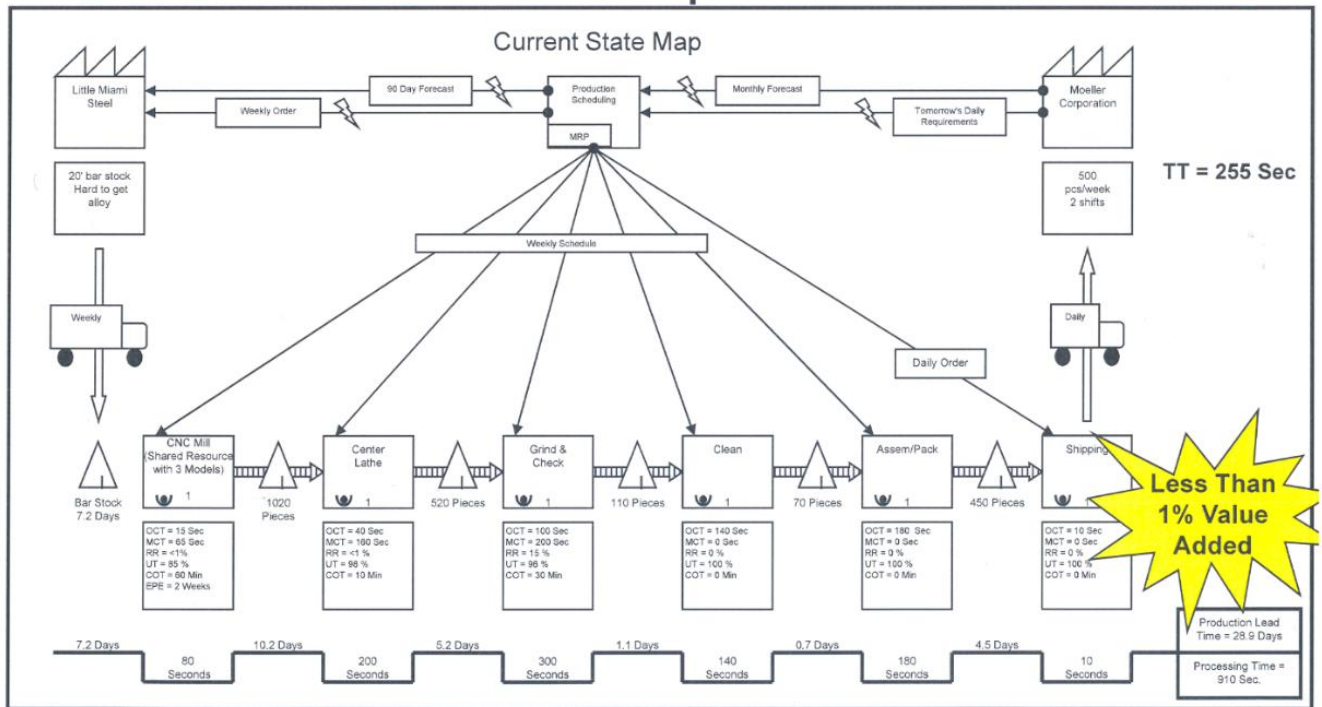

Figure 3 Current State VSM Example

Who Generally Participates in VSM?

Value Stream Mapping is sometimes referred to as, "System Kaizen". This is because the changes identified as opportunities to improve the Value Stream tend to be "big", such as changes in physical equipment and material flow layout, and structural and/or significant organizational changes.
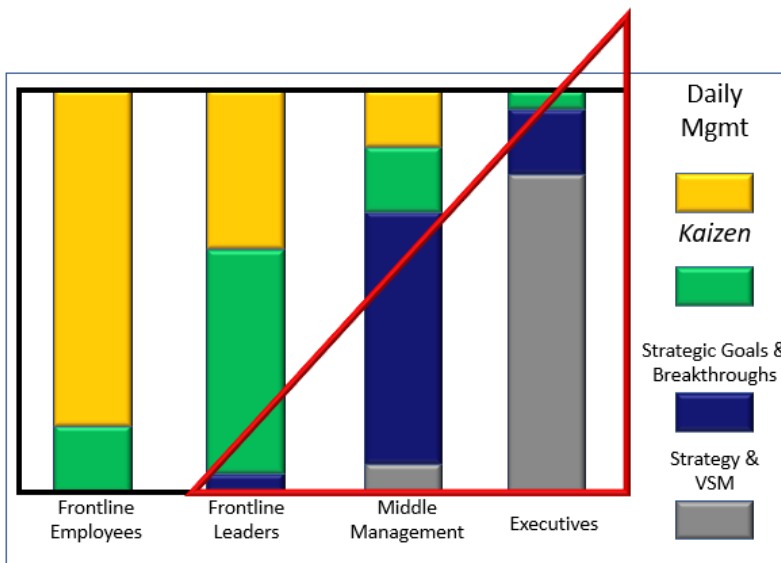

Figure 4 Model Showing the Participation of Employees by Managerial Level In Key Improvement Activities

Because of this, Value Stream Mapping should be completed by Executive level management led by an experienced Toyota Production System/Lean Practitioner, with support from middle management and frontline leaders to fill out the data and details. The Diagram at left shows the relative participation in Value Stream Mapping and other key activities by various levels of organizational leadership.

This is not to say that the VSM process cannot be used by other levels of the organization, but in order to for the large improvements and changes to the Value Stream to gain support and momentum, executive leaders must participate.

How to Create a Value Stream Map

Step 1: Identify the Target Product/Service Family

Start out by identifying Products or Services that are of strategic importance to your organization and to your customers. From here, it is normally helpful to create something called a "Product/Process Matrix". The idea, is to list all of the products you make. Then list all of the major production processes that are used to make them. List the Products in a column down the left side of your matrix. Then, list all the Processes across the top of the Matrix, roughly in order that they normally occur.

Go through each product, and place an "X" in each Process column corresponding to the processes required to make that product. Complete these steps for all products you make (eventually, you will want to do this for every product or service your organization provides, but organizations sometimes start this process with the top 80% of products by volume).

What you will notice is that some products will go through many of the same processes, often being processed over the same equipment or processing lines/cells. The products do not need to have 100% overlap in processes, but should have at least 80% commonality in the production paths they go through. These groups are known as, "Product Families" (or "Service Families" in service industries). An Example Product/Process Matrix is show below.

		PROCESSES								
		RAW MAT'L TEST	DRYING	EXTRUDE A	EXTRUDE B	TRIM1	FORM1	FORM2	WELD	FINAL TRIM	PACK
PRODUCTS	WALL1	X		X		X					X
	WALL2	X		X		X					X
	SHELVES	X	X		X	X	X			X	X
	BOXA	X	X		X			X	X	X	X
	BOXB	X	X		X			X	X	X	X
	COMBO	X	X	X	X	X	X		X	X	X

Figure 5 Product/Process Matrix

PRODUCTS	PROCESSES									
	RAW MAT'L TEST	DRYING	EXTRUDE A	EXTRUDE B	TRIM1	FORM1	FORM2	WELD	FINAL TRIM	PACK
WALL1	X		X		X					X
WALL2	X		X		X					X
SHELVES	X	X		X	X	X			X	X
BOXA	X	X		X			X	X	X	X
BOXB	X	X		X			X	X	X	X
COMBO	X	X	X	X	X	X		X	X	X

Figure 6 Product/Process Matrix with 4 Families Identified

Step 2: Select the Team

Next, select the team that will work together to develop your Value Stream Maps. Like most Continuous Improvement and lean methods, Value Stream Mapping works best when there is a cross-functional team collaborating together.

You will want to pick people who have experience with the product/service/process, as well as those who are less familiar with it for "fresh" perspectives. VSM Teams work best when there are around seven people included, but your team may be a bit smaller or larger.

Make sure that there is "executive" level representation (i.e., decision makers with responsibility and accountability for the value streams) on the team. You want to make certain that the team will have the authority to make decisions and act upon them.

Lastly, identify a Facilitator to lead the team through the Value Stream Mapping Process.

Step 3: Gather Supplies & Kick Off with Process Overview

Prior to your Mapping Event, you will want to gather the following supplies:

- White "butcher block" paper
- Multicolored "sticky" notes
- Fine tipped permanent markers
- Pencil, Paper, Clipboards
- Stop watches
- Calculators
- Safety PPE: ensure the whole team has the right gear – shoes, hard hats, safety glasses, safety vests, etc.

Gather the team together in the room. Conduct a Safety Overview prior to going to the work area. Review the Product/Process Matrix, and quickly review the process steps. It is often helpful to list these on a white board or flip chart to keep them "in front of" the team. It can be helpful to identify a person for each area of the Value Stream who can help lead the team through the process. This person should have familiarity with the process, and know where materials and information come from and go to in the process step. Gather your supplies – pencil, paper, clipboards, stop watches and all Safety PPE.

Step 4: Walk the Process

Staying together as a team, walk the process backwards, from the point closest to the customer, making notes about the process flows at each step. Sketch a rough map with pencil and paper. If you are not familiar with Value Stream Mapping symbols, just use a simple process box to identify each step in the process. Concentrate on gathering data about the process as you go, including quality data, cycle time, and inventory. It may be helpful to ask an area expert about where materials are stored, how they know what to work on next, and what happens to the materials (or service) after their step in the process.

After walking the process backwards, you may want to split into smaller teams, and re-walk the entire process going forwards, filling in missing details as you go.

Step 5: Start Your CSVSM with Material Flow

Return to the work area, and if you have not done so already, hang a length of butcher block paper along a long, plain wall. Collaborate as a team to map the flow of the material or service roughly halfway down on your butcher block paper using "sticky" notes. Start at the beginning of the process on the left side of the paper, and move across to the right side, adding process steps as you go. Leave plenty of space between each process step. Make sure everyone agrees on the general flow of material/services.

Now, between each step, make a note of any inventory that was between process steps. Note, there may be Inventory in several locations between processes. You should physically walk to each spot, and count the inventory on-hand. It may be tempting to use "system" data from your computerized ERP/MRP system. Resist the temptation to do this, and get the team to count inventory on-hand. It is often quite surprising to teams that "system" data does not always accurately reflect what is actually happening on the gemba. The Value Stream Mapping Icons in the appendix will help you as you create your map.

Step 6: Collect Data and Calculate the Takt Time

Add as much detail as you can to the materials portion of the map. Using sticky notes or pencil, "rough in" things like flow arrows, inventory, cycle time, downtime, and other key data corresponding to each process as you go. Determine Customer Demand and calculate Net Available Operating Time (total productive time per operating period, such as a day or a shift, in seconds. Subtract out any non-productive time, such as breaks). A reference for data you will want to collect follows after the Value Stream Mapping Icons in the Appendix.

Step 7: Map the Information Flow and Material Arrows

Next, add the Information flow. In the upper right-hand corner of your map, add your customer, with information such as Customer demand, by product in the product family, and in total. You may want to indicate the annual demand as well as the demand per operating time unit (day, shift, etc.). Calculate the Takt Time, and place this in a data box below the customer icon.

Next, in the center top of your map, place the appropriate icon for Production Control. If you use an MRP/ERP system, there may be a couple of icons here, one to indicate the MRP/ERP System, and one below it that indicates the "human" component of production planning and control.

In the upper left-hand corner of your map, list your suppliers using a separate Supplier Icon for each one. List pertinent data below each supplier (what they supply, how much, how often.

Once this structure is in place, document how customers place orders. Are their orders via email, fax, electronic means, telephone, or through a salesperson? Indicate this flow of information from your customer to your production control system, as well as the frequency of the information flow. Do they send you a forecast, or are your orders flowing in with no real pattern? Indicate this flow on your map.

Then, map the flow of information to each of your suppliers. Do you send them forecasts, order online, by phone or email? Indicate the frequency of communication from your
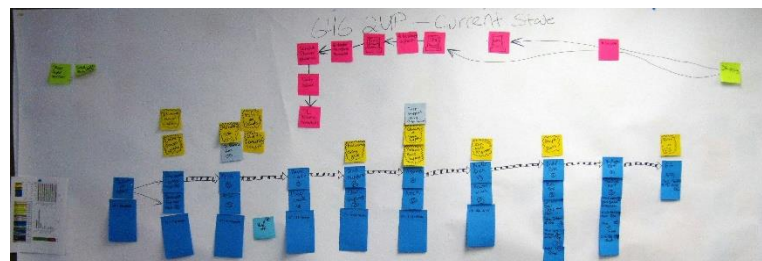

Figure 7 Example of a Value Stream Map Under Development

production control (a person – supply chain or purchasing, or a system – directly from your MRP/ERP system).

Finally, document the flow of information between Production Control and each process. Is each step in the process scheduled, which will indicate a "push" of material to the next process step, or is only one point in the process scheduled and materials are moved in first in, first out order through all downstream processes (FIFO), or pulled via Kanban and withdrawals from materials supermarkets?

Once you know how information moves from Production Control to each process, you can add Material Flow Arrows to the map. Finally, indicate how you ship to your customer, and how frequently, adding shipping arrows, and how often your supplier ships to you, and by what means, adding a shipping arrow from the suppliers into your Raw Materials. At this point you will have a map that shows the "circular" nature of the two flows of Materials and Information.

Step 8: Calculate the Value-Added Time, Non-Value-Added Time, and Lead Time, and % VA

Once you have completed the draft of the CSVSM, identify Non-Value-Added and Value-Added activities, and calculate the lead time across the bottom of the map. The Value-Added Time for each process will simply be the processing time through that process. The Non-Value-Added Time will equal the Number of Inventory Units upstream of a process, divided by the Cycle Time through the process.

The Value-Added/Non-Value-Added Timeline looks a bit like a "square sawtooth" pattern going across the bottom of the map. When you have added each of the times to the timeline, add up all of the Value-Added time, and add up all of the Non-Value-Added Time. To calculate the % VA, divide the Value-Added Total by the Total Non-Value-Added Total.

Total Value
Total Non-Value
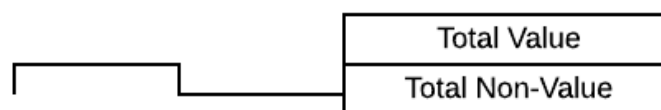
Step 9: Gain Consensus & Identify Problems with Kaizen Clouds

Once the team is satisfied with the map, it is a good idea to bring in a couple of "fresh eyes" to review the map and make sure that nothing significant has been missed. Generally, you

will want to seek out Subject Matter Experts, or SMEs, to review the map. After reviewing, the SMEs should depart so the team can continue its work. Be sure to thoroughly check out any SME-suggested changes as a team by the "go and see" method before adjusting the map.

Now, the team is ready to identify areas for improvement. Ask the team, "What's wrong with the current state?"

Normally, things that should be looked for include:

- Low % of Value-Added Time
- Long lead times
- Hidden problems
- Waste – (TIM WOOD) Transportation, Inventory, Motion, Waiting, Over-Processing, Over-Production, Defects
- Congested or unclear information flow
- Multiple scheduling points

Identify Problem areas – which are really your opportunities for improvement – with Kaizen Clouds. **Don't try to problem solve at this point – just note what is wrong and what could be improved!**

Many organizations don't use Kaizen Clouds at all, they just use one symbol, the Kaizen Burst, to indicate a problem identified and the ideas for improvement. The use of one or the other is not a "hard and fast" rule. Just be consistent in whichever method you choose.

Step 10: Envision a Future State & Identify Kaizen Bursts

Now that you have a CSVSM, and have identified opportunities for change, as the team, "What's a better way of operating?" This is where having someone with Toyota Production System or Lean knowledge becomes hugely helpful. It is helpful to keep in mind the five key principles of lean:

- **Specify Value** from the standpoint of the end consumer by product family
- **Identify all steps in the value stream** for each product family, eliminating every step, every action, and every practice that does not create value
- **Make the remaining value-creating steps** occur in a tight and integrated sequence so the product will **flow smoothly** toward the customer
- As flow is introduced, let customers **pull value from the next upstream activity**

- As these steps lead to greater transparency, enable managers and teams to eliminate further waste, **pursue perfection through continuous improvement**

Next, your team gets to be creative. It's a bit like looking into a crystal ball: review the Kaizen Clouds, and envision a Future State Value Stream Map (FSVSM) that eliminates or reduces waste, and incorporates the improvements. Map out the process with the improvements included. Re-calculate the process lead time, and the amount of % VA time.

Figure 8 Future State Value Stream Mapping requires your team to look into the future 12-18 months to determine what your team can accomplish

The timeframe you should consider for determining your Future State is 12-18 months. Much shorter, and not enough "big change" can happen. Much longer, and business conditions and other changes can shift priorities dramatically.

Another philosophy that should be maintained as we envision the Future State, is the concept of "Creativity Before Capital". The idea is to utilize existing resources and creativity to improve the process, before launching into more (expensive) advanced solutions.

Capture all improvement actions that will enable the FSVSM to become reality in "Kaizen Bursts".
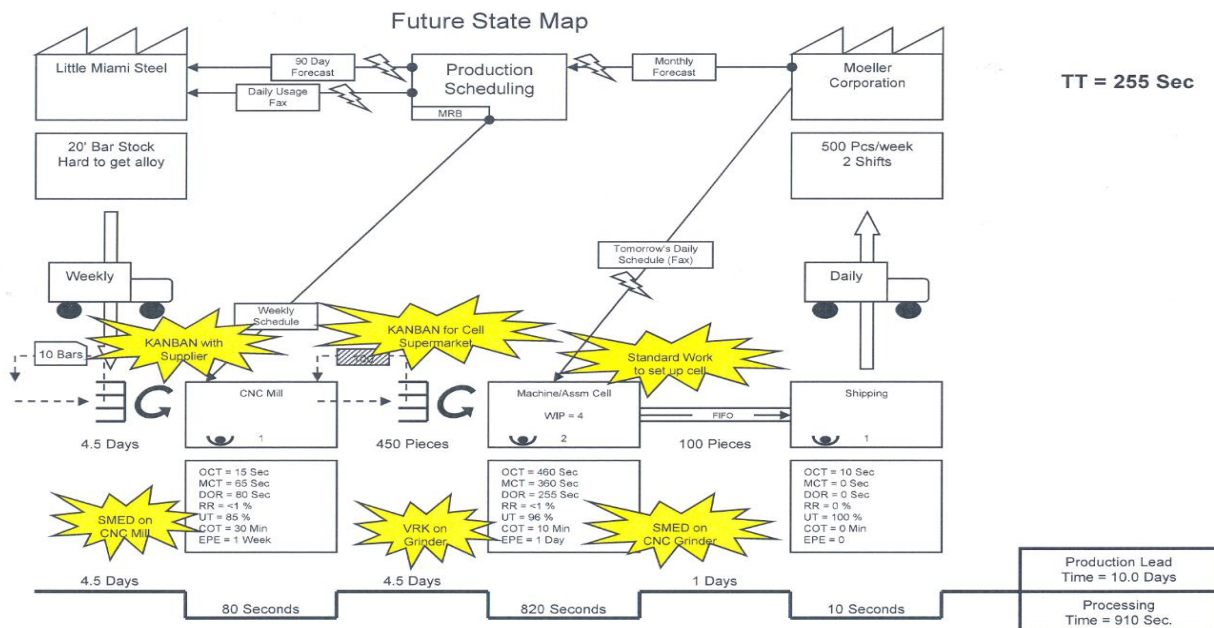
Figure 9 Future State VSM Example

Step 11: Create a Kaizen Road Map

The last step in the process is the creation of the Kaizen Roadmap.

To complete this, we compare the CSVSM and the FSVSM. Make certain that all of the Kaizen Clouds have been incorporated into Kaizen Bursts. It is often helpful to put the Kaizen Roadmap into an electronic spreadsheet format, as it will be shared and communicated during the transformation from Current State to Future State. Be sure when completing the Roadmap, to be very detailed about the Kaizen Burst topic, and the Expected Outcomes or goals of the improvement project for each burst. This is very important, because it could be several months before an improvement project is undertaken. You do not want to be "guessing" what the intent of the projects was months down the road. Take the time to fill out the Roadmap with a lot of detail. Some organizations create one-page project charters for each improvement project to capture the information in even more detail.

Priority	Kaizen Burst/ Topic	Expected Benefits	Activity Type	Start Date	Due Date	Who Is Responsible	Status	Comments
1								
2								
3								
4								
5								
6								

Figure 10 The Kaizen Roadmap above contains the crucial information for managing the transformation from the Current to Future State

Step 12: Manage the Improvement Projects

The last step in Value Stream Mapping, is completing the projects that will transition your Current State to the desired Future State. It may seem obvious, but it is not unusual to find organizations that have created excellent visions and plans for change, that sit on someone's computer or on a shelf and little to nothing happens with them. Complete the projects, and make updates to your Current State VSM. You should start to see the impacts of your projects accumulate in the performance results of the Value Stream over time.

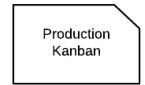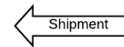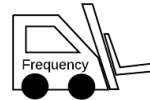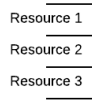In the words of Joseph M. Juran, "All improvement happens project by project and in no other way."
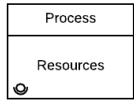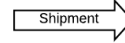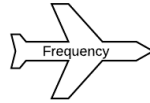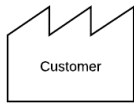
For More Help...

Please see our website, www.valueflo.solutions. Or, Contact Us at 734-657-1182, or email us at dawn@valueflo.solutions.
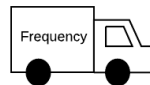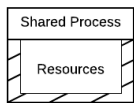
We offer One-on-One Coaching, Kaizen and VSM Facilitation, Management and Lean Consulting and Training services to meet all of your Continuous Improvement needs.
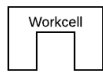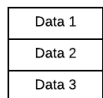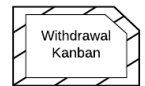
Appendix

Value Stream Mapping Useful Icons

Customer	Inventory	Frequency	Shipment	Kaizen Burst
Process / Resources	Resource 1 / Resource 2 / Resource 3 — Supermarket for Parts	Frequency	Shipment	Production Kanban
Shared Process / Resources	Withdrawal of Materials	Frequency	Push Arrow	Production Kanban Batch
Workcell	FIFO — FIFO flow	Frequency	Push Arrow	Withdrawal Kanban
Data 1 / Data 2 / Data 3 — Data Boxes for Processes, Inventory, Customers, Suppliers, etc.	Stock / Stock / Stock	Operator Symbol	Electronic Message	Batch Withdrawal
Supplier	Kaizen Cloud	Quality Problem	Electronic Message	Signal
Production Control / Resources	MRP/ERP	OXOX — Sequenced Flow	Go and See	Verbal Information
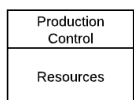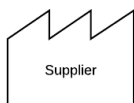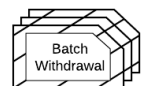
Information to Collect or Calculate

MEASURE	WHAT IT IS	HOW IT IS MEASURED/ CALCULATED
Cycle Time, C/T	How often a good or service comes off of a process	Measure the time from a good/service to the next one. Normally record ~10 cycles
Process Time	How long it takes for a part to go through a process from beginning to end. Note that Process Time does not always equal Cycle Time: look for whether the process is a "batch" process with significant inventory.	Measure from the time the part/service started the process to the time it comes out of the process
% Quality Yield	Is a measure of how many items make it through the process with good quality, normally measured over a period of time (Shift, Day, Week, Month)	(Number of Parts/Services that meet quality requirements)/(Total Number of Parts/Services produced by the process)
Changeover Time, C/O	How long it takes to change a machine from last good part to first good part	Measuring this during a VSM event may not be possible. You will need to look for records or ask the people who are responsible for completing changeovers for processes.
Uptime %	Uptime is a measure of how much a process is running versus how much it was expected or planned to run; Uptime % + Downtime % = 100%. Record the amount of downtime.	Subtract the amount of unscheduled downtime from the scheduled time, divide by scheduled time. Measuring this during a VSM event may not be possible. You will need to look for records or ask those who run the process how often it goes down.
Customer Demand	Quantity Demanded by the Customer(s) during the Operating Period	Add the Total Demand for the Product Family you are Mapping over the time period.
Net Available Operating Time, NAOT	The Amount of Productive Time in Seconds, per Operating Period (Normally a Shift).	(Total Time/ Shift)- (Breaks+Lunch+Cleanup). Normally converted to seconds.
Takt Time, T/T	The Rate at Which a Customer demands a good or service, normally in Seconds	NAOT/ Customer Demand. Note, the time periods of NAOT and Customer Demand must be equal.