

A Practical Guide to  
**VALUE STREAM MAPPING (VSM)**

**IMEC** 

# A Practical Guide to Value Stream Mapping (VSM)

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I don't claim to know everything about Value Stream Mapping (VSM). However, I have used VSM extensively over the past 15 years in many different industries and situations. I believe strongly in the value of the tool and want to share some of my experience with the intention of helping novice Continuous Improvement leaders head in the right direction with VSM.

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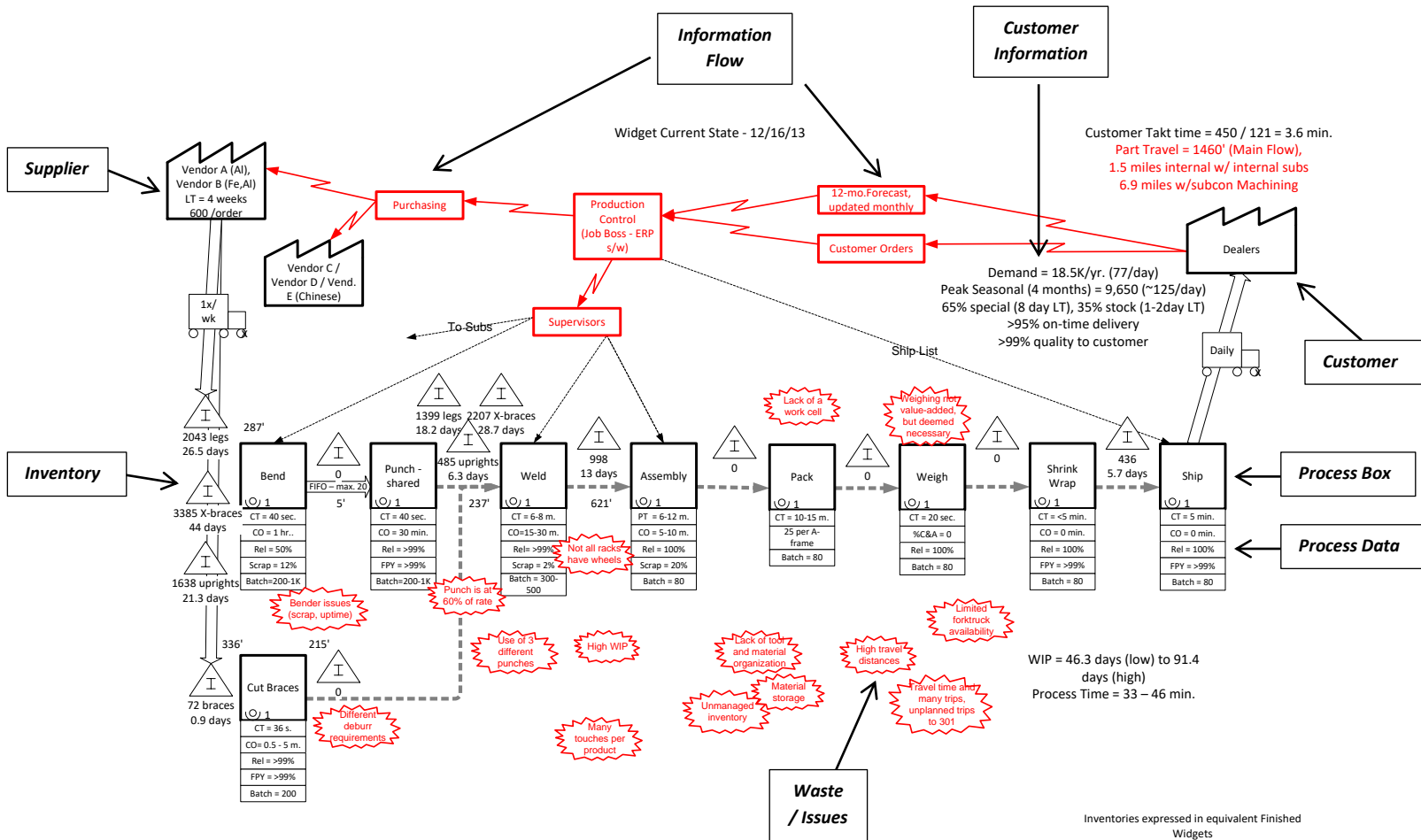
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## VALUE STREAM MAPPING BASICS

### What is Value Stream Mapping?

Value Stream Mapping is the graphical representation of material and information flows through a process or service. Here is an example:



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Getting started in VSM can be daunting. Learning to See was written by Rother and Shook in 1998 and even though it is a rather simplistic book on VSM, it is a great starting point. It does a good job explaining the mechanics of creating a VSM. However, it does not answer many of the questions I've had to figure out through all the variations of VSM I've encountered. I hope to share some of what I've learned through this forum.

**What VSM is not:** VSM is not observing and documenting an individual doing their work. A work study may result as an action from a VSM, but VSM is meant to span multiple functions / workstations.

**What VSM shouldn't be:** A VSM should not be a team of one collecting data to fill in the blanks. While it may technically be a VSM, there is little benefit from this. The benefit comes from the collaboration, discussion, arguments and sharing of ideas that can only come about in a team environment. VSM is the format that provides focus for this teamwork.



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## Why is it useful? Where does it fit in your Lean journey?

I have trouble imagining an organization not finding benefit in using VSM. It is a flexible, easy-to-use diagnostic tool that does a tremendous job of representing a process from start to finish. It's visual, easy for most people to follow and understand, and promotes focused discussion, brainstorming and problem solving among a diverse group of participants. It has been used successfully in manufacturing, healthcare, banking / financial services, insurance, education, non-profits and many more industries.

When starting a lean journey, VSM should be one of the first activities taken. Prior to VSM or any other lean initiative, it is a good idea to set up a Lean Steering Committee or another guidance entity for management support and direction. This will help focus lean efforts on issues and opportunities that will have the most impact the business. The Lean Steering Committee will help direct which product families to focus on first, allocate resources, set scope & boundaries and will be a sounding board for suggestions resulting from the VSM.

VSM allows a team to see the big picture and focus on what will have most impact on the entire value stream. For example, without VSM, a business may focus on improving productivity of a non-bottleneck machine. A more impactful solution would be to reduce setup time on a primary piece of equipment which currently drives a very large batch size and excess inventory (and lead time) throughout the process.

If a business has limited lean exposure, it is a good idea to precede VSM with an introduction to lean processes via educational workshops like [IMEC's Lean Overview with Simulation](#), a book club, tours of other lean businesses, etc. At minimum, you want to have the VSM core team familiar with Value-Add, Non-Value-Add, 8 wastes, and the lean tools (SMED, 5S, Cellular, etc.).

You don't have to start with VSM. 5S is also a good place to start a lean journey. It is easy for everyone to comprehend; it allows for mass participation and it's a foundation for many other lean tools. It drives discipline (if it's not already there), and the results are immediately noticeable and often dramatic. 5S and VSM can be done in parallel, but both should be tools used early in your lean journey. A VSM may help determine which areas to focus your 5S efforts on.

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## Why do companies do Value Stream Mapping?

In practice, I've found the reasons for conducting VSM fall into 3 categories: Critical Issue, See What Sticks and My Boss Said to Do It.

- 1) **Critical Issue (Goal or Opportunity):** When a business has a crisis or a tremendous opportunity that needs involvement from multiple functions / departments, VSM is a great tool to get everyone on the same page, focusing on solutions that will be of most net benefit to the entire organization. These VSMs usually get a lot of attention and a lot of management support. If it's a critical business issue / opportunity, management will allocate time and first class resources to get the project done. You generally get a great team fully engaged because they know the critical nature of the work we're doing and its visibility, great direction and goals. It's not just an exercise or the flavor of the day. The business is going to take action on the outcome of the VSM. Commitment, focus, urgency, awesomeness-I love it! It doesn't happen often enough.
- 2) **See What Sticks:** You don't know what your opportunities are-but you're sure you have some. Great! Let's see what you've got. VSM will help you identify your opportunities. There may be a lot, or you may find that your process is pretty good and you're just going to make some tweaks-perfectly good reason to use VSM, assuming you implement changes as the outcome.
- 3) **My Boss Said to Do It:** "Creating a VSM is part of my performance review" or "Corporate said we have to do it." That's fine if you do it with the intention to See What Sticks - with a team and a purpose. I've encountered many who have done VSM in a vacuum by themselves. Other times, it's done with a rag-tag team going through the motions (unfortunately, I've led some of these) and yes, technically, these are VSMs, but all too often these VSMs get filed on a shared drive never to be seen again. There is no resulting improvement, but the box got checked! This just gives VSM a bad name.

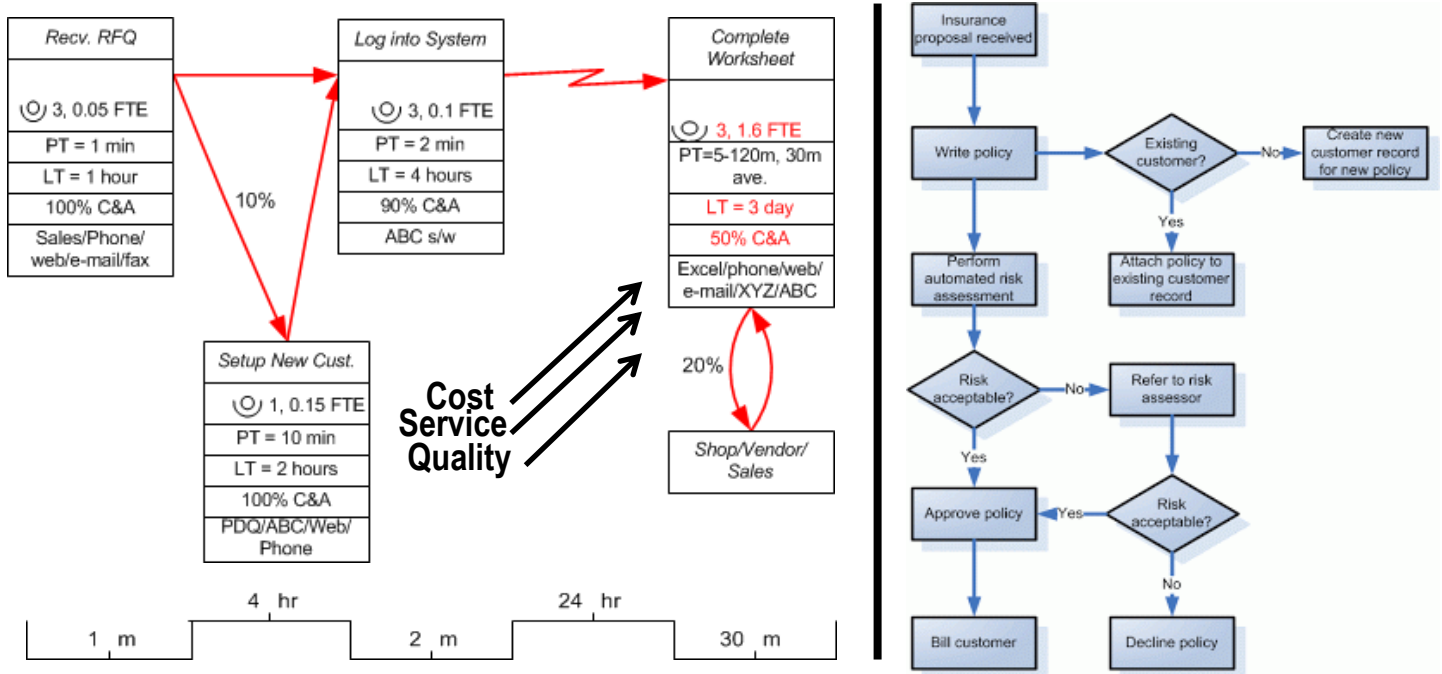
VSM itself does not improve anything; it is a diagnostic tool. The goal of VSM is to implement a Future State with less waste. VSM without implementation yields nothing. We need to use VSM to determine our roadmap and the projects / activities / policy changes that must be put in place to achieve our improvements. VSM is great for analyzing and planning, but it is simply that – putting a plan together. The benefit comes from being able to make changes through the understanding, vision, and consensus developed in the VSM.

## How is Value Stream Mapping different than Process Mapping?

VSM is similar to process mapping. I think of VSM as process mapping on steroids. Process mapping will show you the flow of a product or service, but it reveals little more than that. Is it a good or bad process? Where can we improve it? I can't glean that from a process map. VSM adds much richer information to the map...things such as process time, downtime, lead time, first pass yield, inventory, distance, number of operators, etc. These reflect delivery, quality and cost. VSM gives you a much better understanding of the process, its strengths, weaknesses and opportunities. Someone familiar with VSM,

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but unfamiliar with a particular value stream, can look at a map for the first time, and within minutes not only understand the flow, but also identify bottlenecks and their likely causes (long cycle time, downtime, quality, etc.), identify high inventories and lead times and most importantly, identify potential opportunities for improvement. VSM takes more time to develop, but it is well worth the investment.



## How does Transactional / Administrative VSM differ from Manufacturing-focused Value Stream Mapping?

I have found VSM to typically have one of two foci...either Manufacturing or Transactional. VSM was originally developed to support improvements in a manufacturing environment but expanded into transactional functions, and eventually many other industries.

If manufacturing is the core or your business, I'd start with VSM focused on manufacturing...this is where you make your money. This mapping may uncover issues in manufacturing caused by transactional functions such as quoting, scheduling/planning, logistics, etc. Subsequent VSMs can be focused on those problem areas. In a manufacturing VSM, I may include a box for order entry, scheduling and /or purchasing, but usually just input a minor amount of information, such as lead time, percentage complete and accurate. If these are both good numbers (short lead time, high quality of information), then we move on.

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Transactional VSMs can be more challenging than manufacturing VSMs because the VS is often less tangible. In manufacturing, you can walk through the process, see equipment and inventory, and observe various stages of transformation from raw material through finished goods. In an office environment, it's harder to "see" the process. Much of it occurs on a computer screen and inventory is often invisibly stored on a hard drive.

We also tend to not measure the transactional VSM. What is my lead time? How is quality? Amount of time spent on the item? Most don't track it - we tend to not improve what we don't measure.

In transactional VSM, we focus on some different items. Things like equipment reliability, setup time, etc. often don't apply. We tend to focus on work content (cost), lead time (service/delivery), % complete and accurate (quality of incoming information), and systems used.

Most often, resources are shared among many transactional value streams. If a high-dollar purchase order needs management approval, the touch time may be 2 minutes. If this occurs twice per week, there would seem to be a lot of capacity...no issues. However, our manager is busy dealing with other things, and it typically takes 1 -2 days to get the item approved. During this time, there are multiple follow-ups and fielding questions from others (end-user, vendor, etc.) with a vested interest in the result of the pending PO. This drives extra waste. We want to highlight the delays due to waiting or due to rework (incomplete or inaccurate items which require extra effort and delay).

In general, transactional VSMs have very low overall First-Time-Through yields. Multiplying the percentage complete and accurate at each step all the way through, will often yield numbers less than 10%. I have seen many zeros. This would never be accepted in the manufacturing world. Someone would put together a task force to address why we have 20% rework at a station. In the office, it's often just fixed or rerouted, and becomes an accepted part of the process. It's not uncommon for order entry staff to tell me that 20%, 40%, or more of orders received from customers or salespeople lack essential information. They then have to start a process to get the information. If you do a transactional VSM and fix nothing other than improving all the percentage complete and accuracy, you will see huge improvements to the flow and performance of your value stream.

Manufacturing processes are generally well-defined as to what is good vs. bad, how to determine what is acceptable and how to complete the work. There is also a definition of acceptable quality and work designed to achieve it. Manufacturing processes and flows are generally engineered and costed. In the office, processes tend to develop organically, often with different people who have different ways of doing things. Unlike on the shop floor, it is more difficult to standardize processes in the office, unless it can be mandated by a system such as ERP. This is nice in theory, but needs to be flexible enough to accommodate exceptions when needed and capable of changing with the business. In my experience, implementing changes to ERP rules, forms, etc. require an act of congress. There is a balance and limits to what your ERP system can do for you. Simplicity and organization is the best solution.



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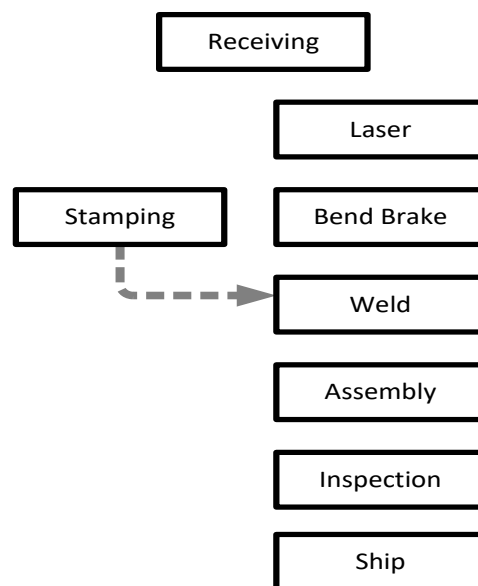
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## DETAILS OF A VALUE STREAM MAP (The Document)

### Where to start / Granularity

At what level should we map? I've done VSMs where an entire factory (a big one, making lawn tractors) was merely a box on the map. Our focus was on logistics and distribution- we included inventory, capacity and setup time in the factory box, but that was about it. On the other end of the spectrum, I've done VSMs for an Order Entry process. We got into much greater detail and discussed when/how credit approvals were done, etc. The level you go to really depends on your goals and scope of the VSM. If I were taking a first crack at VSM, I'd start door-to-door in a process, using major activities as my process boxes. If you find that one or more of these process boxes are real issues or need a better depth of understanding, you can complete a follow-up VSM on that process which includes more detail.

Prior to doing a walk-through, I like to list out the process steps we intend to put on our map. This is helpful for a couple reasons. First, it gives us solid start and stop points. We try to define this in the charter, but once we start listing it out, the team may have the desire to make minor adjustments. Second and more importantly, it gets us focused on the right level of detail for the VSM. This will help gauge the detail and depth we get into during the walk-through. If we start making the list of process steps, get 20 on the board and find we're only about 1/4 through, we need to bring it up to a higher level. We likely have time limitations and the map has to be something most people can comprehend. I've seen process flow maps with over 100 boxes on them (I like to count things). Too much! Very few people can absorb something like that. On the other extreme, I've made maps where there are only one or two boxes. It's hard to see any opportunities at that level...so we broke those boxes down further. Every map is different, but in general, I find perhaps 6 – 30 process boxes to be a good number to work with. I've occasionally done more or less, but it's a guideline. The goal is to get to a good amount of detail while still making the map manageable.



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## Creating the Value Stream Map

I've drawn maps on white boards. I've draw maps on paper. I've drawn maps directly into Visio. I've attempted using Excel before and I do not recommend. If you want electronic documentation, Visio is a nice product for that.

The most common practice my peers and I use is creating the VSM on a sheet of craft paper using Post-It notes. We hang the paper on the wall with tape or push pins, create the map and then preserve it by entering it into Visio. Some prefer to simply use pictures. My hope is that VSM continues to be used, and an electronic copy of the map can be modified and distributed easily. A VSM should really be a living document.

I was recently in a lab with no available wall space, so we laid the craft paper out on tables. It wasn't ideal, but it accomplished the job. Sometimes, you have to make do with what you have. I've also put the VSM directly into Visio. The direct input saves duplicate effort (first the wall, then the software) and is easier to read than most people's handwriting. I practiced this for a few years, but returned to creating VSM on the wall first. One of the criticisms of a direct-to-Visio map is that it is less tangible for the participants. It's something that I control on my hard drive. They can't touch or look at it before, afterwards or during break. They can't see the whole map if I'm focused on a small section of it. It's my map, not theirs. Creating it on a wall makes it more of "their" map and allows better interaction with the team. I know good things are happening when team members are getting out of their chairs and walking up to the map to point out things and generate good resulting conversations.

*Hint:* Refrain from writing directly on the craft paper. If you must, use a pencil. It's not uncommon for someone to suggest a change or add a process box. You'll wish you hadn't used permanent marker. If you want to use arrows to represent flow, you can purchase sticky arrows, although they are sometimes hard to find, or simply cut a 3x3Post-It note into 3 equal pieces, with adhesive on each. You can then draw an arrow and move it around on the map as needed.

## What to include in process boxes

There are no hard and fast rules here. Include whatever is of importance and value to your business, and what will help you see the opportunities to improve. The goal isn't to jam as much as possible into each process box, but rather include the best information. Common things to include in a process box are:

- Cycle Time
- Changeover Time
- Reliability (as a percentage or MTBF / MTTR)
  - If reliability is greater than 99%, then there isn't much need for a conversation. Unless you're putting together a cell with 10+ stations, 99% reliability usually isn't an issue. If reliability is 80%, then you need to have a conversation. How does the 20% downtime occur, and what is its effect? 12 minutes an hour is 20%. Perhaps there's a glitch and maintenance has to come out and bang the machine with a mallet once an hour. It's a quick fix. If it happens on a critical piece of equipment, then it's a big issue. If it happens

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on a machine you use a few hours a week...it's a nuisance, but not a big deal. If 20% downtime manifests itself as a workstation being unavailable for an entire day, once a week...that's a very different issue. Or it may run impeccably for 2 months and then go down for 2 weeks, requiring someone from Germany to fly in and fix it. Very different impacts on your ability to flow product. If downtime is impactful, you may wish to use MTBF & MTTR (mean time between failure and mean time to repair) on your map.

- Number of Operators
- First Pass Yield (or Scrap, or both)
- Batch Size
- Lead Time (if not calculated using inventory – discussed in the “Little’s Law” section)
- Distance (from operation / inventory location to operation / inventory location)
- Number of Shifts
  - If all operations run identical shifts, they are not included. However, if some operations run one shift while others run two, it has a material impact on understanding the operation, so it's identified. A difference in number of shifts (or extended hours) impacts your takt time calculation and generally mandates an accumulation of WIP. Example: Laser (first shift only operation) will cut 800 pieces for Brake Press (first and second shift operation). If you are using takt time in your VSM, the Laser's takt time will be approximately one half of the Brake Press (there may be differences for lunch / breaks). I would expect there to be WIP between the operations at the end of first shift. This is an opportunity to document the difference in shifts to help identify it.

Some companies have different terms for the same thing. Uptime may mean the entire time the machine isn't down for unplanned maintenance (100% - downtime); or it may mean the time the machine is running. As long as you're consistent and everyone understands your nomenclature, it's fine.

Distance and Inventory are represented between process boxes- I include inventory in a workstation as part of the WIP at the station. If there are multiple inventory locations involving multiple moves, include them separately on the map...it's an opportunity.

## **Less common items:**

- Utilization (discussed later regarding high-mix or job shop)
- OEE
- Safety
- Anything else you regard as important. It's your map!

## **Transactional VSMs often include:**

- Process Time (touch time)
- Lead Time

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- Percentage complete and accurate (a measure of incoming quality- the item is both complete and accurate with no questions or rework required)
- Systems used (Excel, ERP, e-mail, etc.)

On occasion, I'll include other items in transactional VSM process boxes such as a list of reports used or a list of required inputs and their sources, as well as outputs and their customers. If the team feels we need to go deeper after the first pass of the VSM, we'll discuss the value of adding SIPOC (Supplier, Input, Process, Output and Customer).

While mapping the new membership process at a local non-profit wellness facility, they chose to add a Relationship Value to each process box. They wanted their members to feel that their organization was a second home, and building relationships was very important to them. Entering data in a back room got a zero, but having a staff member asking how Johnny was enjoying swimming lessons was a 5. Where I usually want to possibly eliminate boxes, they wanted to keep them and increase the opportunity to build relationships. That was what was important to them, so they included it on their map.

## Value Stream Mapping data accuracy / integrity

In general, VSM is not a precise tool. Accuracy and precision may be required when working on subsequent projects such as line balancing, but don't overanalyze during your VSM. We need to be in the ballpark /right order of magnitude / directionally correct, but not precise. If someone tells me setup time is 2 hours, and it's really 1 hour 46 minutes with a 12 minute standard deviation, that's fine in most cases. In the Value Stream Map, we really want to know if it's a quick, medium, or long setup. Combined with the frequency of setups, this will help us better understand our current operation, and whether or not the changeover time is driving other things such as a large batch, lack of capacity, etc. This understanding will help us determine whether or not setup time is an issue or opportunity, and to what degree. If someone says they have a machine problem 5 times a day but it's really 4, that's fine because it won't significantly change our understanding of the impact. If the real number is once per day, then that is a material misrepresentation of the real condition and may lead the Value Stream Map to a less impactful solution.

You can use ranges for data as well. I often hear that a value (perhaps setup time) varies from product to product. I'll often represent that in a data box as an average and range: Setup = 45 min – 90 min, 60 min. average. Alternatively, we may want to define different categories: Setup = 2.5 – 3.5 hours (full die change), 15 – 20 minutes (insert).And, define frequency of category: full change: 40%, etc. This may or may not be of value to the VSM...but I tend to include this information when I can. As long as it isn't clutter, it may help the team understand the system better and drive improved solutions.

There are 3 types of truths: subjective, normative, and objective:

- Subjective is one person's opinion. It may be a very good and accurate opinion, or it may not be. There may be some bias or someone may not want to be honest about issues related to their operation- one data point.

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- Normative is group consensus. If someone suggests a number and the team agrees it's reasonable, then we have a better data point. I generally feel pretty good about these numbers.
- Objective is when we have real data.

If I'm doing a transactional VSM, and I ask "what percent of the time does 'X' happen?" An individual might tell me it happens 20% of the time. Are they right? I really don't know, but if that's the best information I have, it goes on the map. If it's deemed a critical value, we can always collect some data and update the map later. If the individual suggests 20%, and several others agree it's a reasonable number, then I feel pretty good about the number. Perhaps it's really 15% or 25%, but we'll likely arrive at the same conclusions if we are that close. If the individual presents data they've collected, or perhaps from an MRP / ERP system, then we can be very confident - assuming it was tracked well.

With VSM being a rough tool, it does not require precision. We don't need a 3-month study, at least not at this point, unless it's a resulting study if you're going to invest millions of dollars. We want close, directionally correct numbers. I may ask a machine operator how reliable her machine is and she may tell me 95%. I may then ask "so, over the course of a month, you collectively have 1 day or 8 hours of downtime?" She may agree; or put that way, she may respond that it's more like 2 hours per month, in which case we'll land on 99%. Other times, she may say "I don't know", in which case you can ask how many hours / days the machine has been down in the past 3 months. Always make sure employees know what you are doing, why you are doing it, and that it is not a personal evaluation of any sort.

## Representing Cells




Depending on the level of detail desired, several co-located operations can be represented in a singular box as a cell. Alternatively, you can break down the cell into its separate components, adding details about each step. This is driven by the purpose of the Value Stream Map and the necessary level of details to display in order to root out the information needed to understand and improve the process. When there is a cell with several operations and one-piece flow already in place, I represent this by placing the process boxes immediately next to each other.

|   |                        |              |                 |
|---|------------------------|--------------|-----------------|
| Anneal & Feed   | Wind                   | Zip Tie      | Assemble & Pack |
| ⊙ 0.3   | ⊙ 0                    | ⊙ 0.3        | ⊙ 0.4           |
| CT = 25 sec.  | CT = 68 sec. (240' SS) | CT = 24 sec. | CT = 40 sec.    |
| Overall CT = 90 sec. (demonstrated output = 200/day, 140/day stainless) |                        |              |                 |
| CO = 15m, 30-45m (size)   | Rel = 90%              | FPY = 99%    | Batch=300-1000+ |

In this example, there is one employee supporting the entire operation, with Wind being an automated process. I show individual cycle times for each operation, overall cell cycle time and overall cell metrics

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for changeover, reliability and first pass yield. If it's of value to the VSM, you can show these items for each operation within the cell.

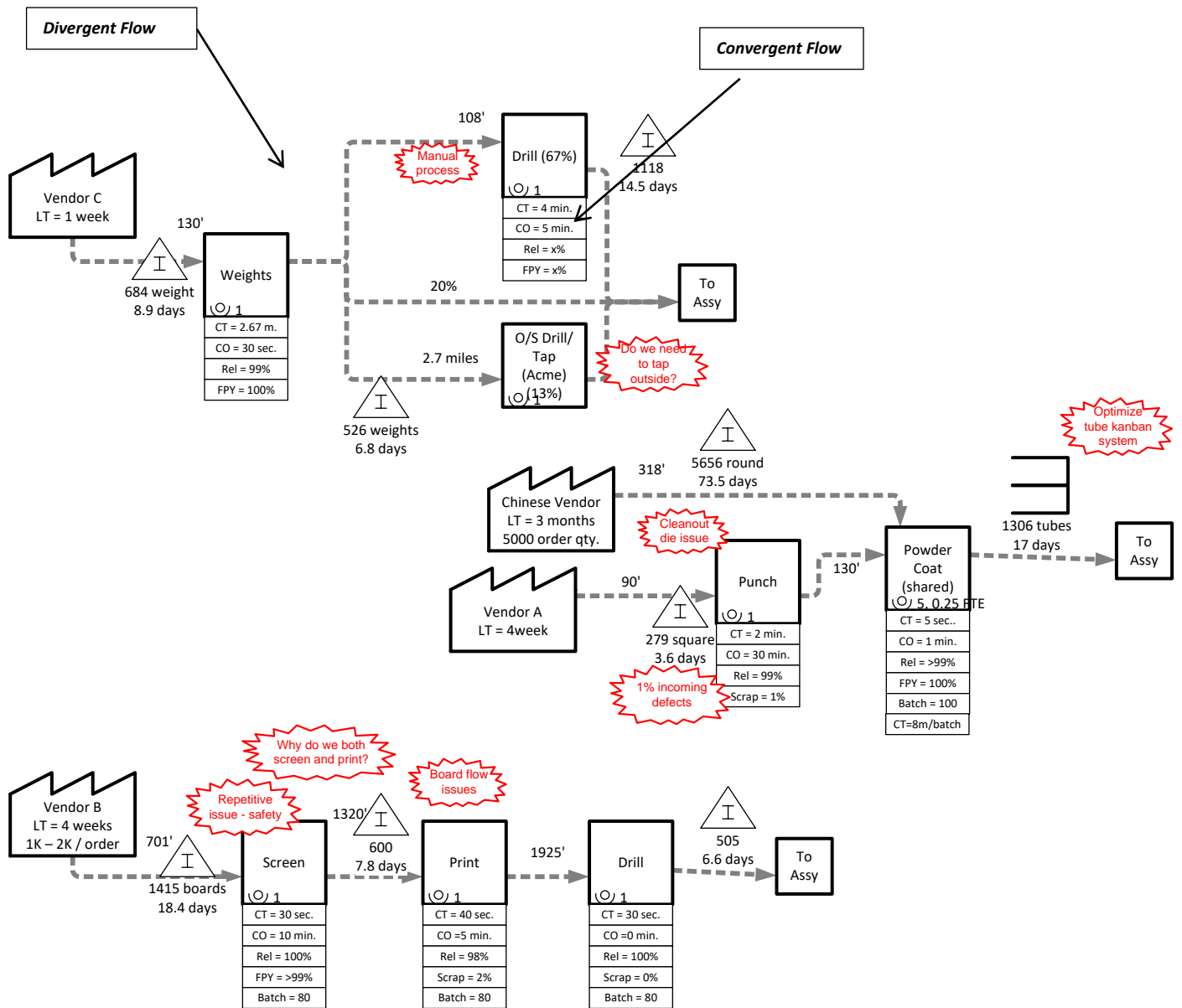
| Extrude  | Perforation   | Coiling  |
|--|---|--|
| 3 single wall extruders<br> | ~95% is perforated<br> |  |
| PT = 15K – 20K # / day   | PT = >20K # / day   | PT = 60 – 75 min / coil  |
| (all lines)  | C/O = 5 – 45 min  | C/O= 0, Line 1: 15 - 30 m  |
| C/O = 2 – 4 hours  | Reliability = 80%   | Reliability = 99%  |
| Reliability = 99%  | FPY = >99%  | FPY = >99%   |
| FPY = 98%  |   |  |
| Utilization = 75% - 100%   |   |  |
| Changeover 1X /wk/line   |   |  |
| Mix change 1X /day/line  |   |  |

## Representing Divergent / Convergent Flows and Sub-Processes / Assemblies

Sometimes a VSM will have a straightforward flow, where a product or product family all go through Op10, Op20, Op30, etc. Other times, the flows can diverge and / or converge throughout the process. Try to represent this on the map with straightforward boxes and arrows. I like to include percentages or volumes for diverging flows. For example, 80% get a machining operation done internally, while 20% need to be sent to an outside service for special machining, and perhaps an inspection upon their return).

Sub-processes and sub-assemblies can be shown on the map also. When there are many, I may create them on a separate sheet of paper with an icon showing their internal customer (perhaps welding or assembly).

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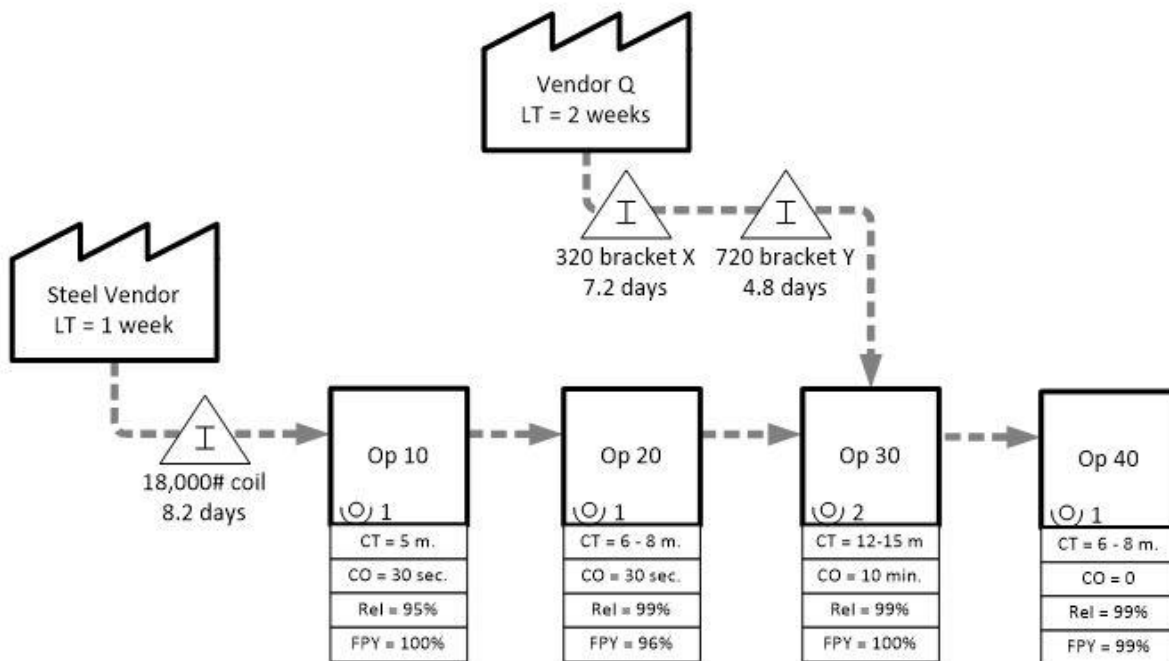
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## Suppliers and Customers

Most Value Stream Maps have multiple suppliers and customers. Some have several hundred. You generally can't put them all on a map, so you want to focus on the most important few.

I once worked with an aerospace supplier who could count their customers on one hand; in this case they were included individually on the VSM. Sometimes the scope is such that we have a single, internal customer. Other times, we have many customers which can be represented as a generic "Customers" or perhaps we consider the Warehouse or Distributors to be the customer...or a combination of these.

With suppliers, try to focus on the suppliers of items which are either: high cost, large (lots of floor space and / or difficult to move / manage), long or inconsistent lead times representative of the product's "chassis" - something that everything else in the process gets attached to. Sometimes a VSM will have one supplier process box, other times it will have several. I'd suggest a maximum of 10, and most often less than 5 is appropriate. You don't want to include commodity items like nuts, bolts, grease, etc. For example you may not want to include casters for a machine, but you may want to include \$14,000 tires for heavy equipment. The supplier box on the VSM will generally flow to a raw material inventory icon which feeds a process. Some of the material used may not be at the beginning of the process flow, such as mounting wheels / tires toward the end of a process, and should be represented on the VSM as entering the flow at the process which consumes them.





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I like to add some information about suppliers and customers to the map. The following can add a lot of richness to our understanding of the performance of the VSM and current challenges / limitations we may have. For example, if I have 40 days of raw inventory whose supplier is in China and has a 16-week lead time, I understand why. Perhaps this could be changed or improved, but I understand the likely drivers behind the extra inventory. If my supplier is within 50 miles of my facility and has a 2-week lead time, good quality and reliable shipments, then 40 days of inventory raises other questions and highlights other opportunities.

Therefore, consider including the following Customer / Supplier information on your map:

## **Customer**

**Lead Time** – I usually put their expected or required lead time as soon as a firm order is placed. Sometimes, this is a negotiated amount of time. Other times, I'll hear "they usually want it tomorrow." If your competitors can do that, then that should be the customer lead time used. If not, use the low end of what the industry can consistently do. This will guide us in the Future State to the right service level. If the customer would like a one-week lead time, but our best competitors can't do less than 4 weeks, then 4 weeks will be a good target for the Future State. Less is better, but at what cost / trade-off? This information is good to have for that discussion. If they have a lot of rush orders (say 20%), you can note that.

**On-Time Delivery** – Is our on-time performance impeccable, great, good, mediocre, or poor? This may be a focus for the VSM. Do we measure on-time to their request or our promise date? We have to consider reasonableness of request dates and industry expectations.

**Quality** – Is quality to the customer 95%, 99% or 50 PPM? Although we'd always like our quality to be 100%, there are trade-offs to get there -more expensive materials, slower machine rates, more highly skilled employees, more mistake-proofing / inspection, etc. These things can raise costs, so we need to understand our current performance on quality vs. our customers' expectations. Some customers are very happy with 99% quality. Others are looking for <100 PPM (>99.99%). If quality is an issue, then it will be a focus during the VSM exercise.

**Order Pattern (Quantity, Frequency, Variability)** – What quantities do they order and how frequently do they place orders (you may include this on the map)? What quantities and frequency would they like to have...or would we like to see (perhaps a discussion for Future State)? On the map, you may include the quantities they order and the frequency at which they order. This can lead to a Future State discussion around the quantity and frequency they'd like to have, or what we'd like to see.

## **Supplier**

**Lead Time** – What is their lead time? Is it consistent, or does it vary? I've seen paint suppliers vary from next day to several weeks based on whether they had product in stock.

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On-Time Delivery – Do they reliably meet their promised lead time?

Quality – Is it consistently excellent? Are there habitual issues -regular, relatively minor issues, which are accommodated without great pain? Or sporadic issues, such as getting in an entire shipment of non-conforming product, which either impacts production or requires a prohibitively high inventory to be held for such circumstances.

Order Pattern (Quantity, Frequency, Variability) – Can we order an individual piece, at a competitive price, or do we need to order a larger quantity? A case? Pallet? Truckload?

All these things help us understand why we have the raw material inventory we do (or don't at times, but wish we had), and perhaps opportunities to improve it.

## Shared vs. Dedicated Resources

It is important to understand whether or not resources are dedicated to a value stream or are shared. I generally like to note this on a VSM. The VSM team has a lot of influence over a resource dedicated to the value stream. Shared resources can be more challenging. What is the utilization of the equipment? Can I run smaller batches more frequently? Who gets priority for scheduling? If we want to make a change, how does this impact other parts of the business? I like to include a "utilization" number for shared equipment. This is discussed further under the 'Mapping a High-Mix Process' section

## Representing Inventory on the Map

Inventory is an important part of a VSM. In addition to highlighting the evils of excessive and uncontrolled inventory, VSM allows us to translate inventory into lead time. Time is the "currency" of VSM and is generally a primary focus. If inventory is high, lead times are long, and flow is poor.

During your VSM walk-through, collect inventory data for your product or product family. Choose the critical few items to collect data on, like high value or lots of floor space. Don't worry about commodity items. Actual data is best, but I won't ask anyone to count thousands of items in tubs. If you somewhat trust your ERP system, and it says you have 1,932 pieces in 2 tubs, I'll ask the team to locate the tubs and eyeball it for reasonableness. There are times the counts are obviously off (10 items in a tub that should have 200) and times when it takes too long to locate inventory, in which case you'd put a limit on search time. When this happens, it tells us more about daily activities in the plant. How much time is wasted each day locating and managing inventory? It may be an important point of discussion.

Most inventory doesn't have a sign on it telling us that it's 2.4 days' worth of inventory. It is generally identified as:

- Items (800 housings)
- Weight (18,000 lbs. of steel)
- Value (\$450,000 of Finished Goods)
- Length (288 feet of bar stock)
- Volume (600 gallons of paint)

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We represent inventory on the map as a triangle with a brief description and data:



## Little's Law

Little's law is a handy relationship between Inventory, Lead Time, and Demand Rate. I find it useful in most VSM applications...and occasionally during a visit to a post office or other location where there may be a long queue. Little's Law is:

- $\text{Inventory} = \text{Demand Rate} \times \text{Lead Time}$
- $\text{Lead Time} = \text{Inventory} / \text{Demand Rate}$
- $\text{Demand Rate} = \text{Inventory} / \text{Lead Time}$

When mapping, if a process has 800 units of inventory and demand is 160 units / day, then there are 5 equivalent days of demand there. This is also equivalent to 5 days of lead time. If you add an 801<sup>st</sup> unit to the inventory and process the items first-in-first-out, it will take 5 days to consume the 800 units prior to the 801<sup>st</sup>, at the rate of 160 units / day.

Perhaps the machine can process 400 units / day. Does this make the lead time 2 days? No. If you processed 400 in one day, then you'll just have a pile of inventory waiting for the next machine. If the parts are going out the door at a rate of 160 / day, then that's your denominator.

*The milk analogy* (I use this when presenting Little's Law in VSM workshops). When presenting Little's Law in VSM workshops, I like to use the milk analogy: if my family consumes on average 1 quart of milk a day, and we have 2 quarts in the refrigerator, how many days' worth of milk do we have? What if I told you my sons and I could chug that 2 quarts in 5 minutes? It's still 2 days' worth of milk it's not how fast my family could consume the milk, but rather what the typical demand (consumption) rate is.

*Note:* There have been times when the true / end customer demand is lower than what is requested of the factory; usually because a business has made a strategic decision to build inventory due to seasonality. In this case, I have considered the warehouse or distribution center to be the customer for the VSM. You may consider the opportunity to build more closely to true demand in the Future State, but some operations, such as tractor assembly, require tremendous space and capital, so there is often a balance to be struck. I've also represented different demand rates, and corresponding takt times, for seasonal businesses - perhaps peak and trough values. If it helps represent and understand the VSM, include it.

## Shared inventory

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You may find there is inventory which is shared among products or value streams. Perhaps the product I am mapping (Widget X) uses 10 lbs. of coiled steel per part. Customer demand for Widget X is 40 per day, so Widget X's raw steel consumption rate is 400 lbs. / day. If I have 40,000 lbs. of coiled steel in raw material, this would imply I have 100 days of inventory. This would be correct if the 40,000 lbs. were used only by Widget X. However, if other products also consume this material, we have to allocate material to them in their proportion of usage. I may determine that Widget X typically consumes ~20% of the coil steel in question. We then estimate 20% of 40,000 lbs. will ultimately support Widget X while the balance will support other products. Using this, we estimate Widget X's raw material to be 8,000 lbs., which is equal to 20 days of demand.

In the example above, we estimated. Don't spend too much time trying to find exact numbers. If Widgets X's real raw inventory should have been 16 days or 25 days, we're close enough, and that will generally lead us to the same conclusions. Remember, immediate improvement trumps postponed perfection.

If a finished product requires 4 of Item X and you have 800 of Item X in raw material, this is equivalent to 200 sales units. If demand is 25 / day, it's 8 days' worth.



I've been asked if one should use a universal time unit for all time data throughout the VSM: minutes vs. hours vs. days. I've been mandated to use a universal time unit before, and I find it clumsy. Process times tend to be quick - minutes or perhaps seconds, while translated inventory (lead times) tend to be long - days or perhaps hours. You want the map to be understandable. If I tell you the process takes 0.001736 days, what do you make of that? If I tell you the process time is 2.5 minutes, it's much better. I like to use a scale that is easy to understand. If most process times are 1 – 60 minutes, use minutes as the common unit for process times. Use seconds if the processes are typically less than 1 minute. Inventory (lead time) is generally best represented using days - 3.6 days mean more to most people than 5,184 minutes does. So, different units are fine for the categories of process time vs. lead time vs. setup time, but it is helpful to keep them consistent within category.

## Mapping a High-Mix Process

Years ago, I had a debate with a young OSU engineering grad. In college, he was taught that VSM was not applicable to a high-mix environment, and I disagreed. VSM has its limits. It's not the end-all-be-all solution for a high-mix, low volume, or job shop environment, but it is still valuable and will move you forward in the right direction. Remember, lean is about continuous improvement. Don't focus on the perfect solution; it's only perfect until something changes. VSM will guide improvements to all systems.

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If the products in your VSM have similar setup time, processing time, changeover, etc., I'd group them together and treat them as one product type. For example, there may be a product line that is sold with four color variations and 6 length variations, but they are processed nearly identically. These can be combined and represented as one product group in the VSM. Be aware of inventories -combined - you may have 5 days of inventory in finished goods, but there may be 6 months' worth of a low-volume product. Perhaps not a big deal, but worthy of a discussion regarding forecasting, order points, and batch size.

Most of the companies I've worked with have mixed-model value streams. Many have dozens or even hundreds of products running through the same equipment, some shared with other value streams. This makes VSM less straightforward, but it is the reality of many businesses. After many repetitions and long drives home thinking about how I could have done the map better / differently, I've arrived at the following suggestions for handling high-mix VSMs.

One map won't address everything for every product. That's OK. Let's focus on a map, which when improved, positively impacts the majority of the products in the product family. I mapped one such process at a company that had dozens of process flow options for a product family. Some were more complex than others, but they had many similarities. They manufactured a lot of single-run products - never to be seen again and had some repeats. Since volumes would range from 1 to a few dozen per order, we chose to map one of the more complex process flows. Doing so allowed us to touch more workstations with the VSM.

We chose a "tracer part" to map. A tracer part is a product that is representative of many other products. It had one of the most complex flows in the business and we created our VSM based on it. Just mapping one part doesn't capture everything, but it can capture a lot. As we created the map, we saw the places where this part flows quickly and where it experiences long delays. We identified long changeovers, equipment reliability issues, staffing limitations, etc. Many of these issues (or opportunities, if you're an optimist!) likely affect the majority of the other parts in this value stream. Fixing an issue for the tracer part will also fix that issue for many other parts.

When you have high mix and shared resources, takt time loses its value. If my tracer part has demand of 20 per month, takt time is 1 day; and it would look like I have tremendous capacity. We have to consider all the other parts running through the jumble of equipment and flows in the value stream. What I have found more useful in this case is to try to estimate a "utilization" number for equipment that is shared or in a high-mix value stream. After all, one of the purposes of takt time is to determine whether or not our system has the required capacity to support demand.

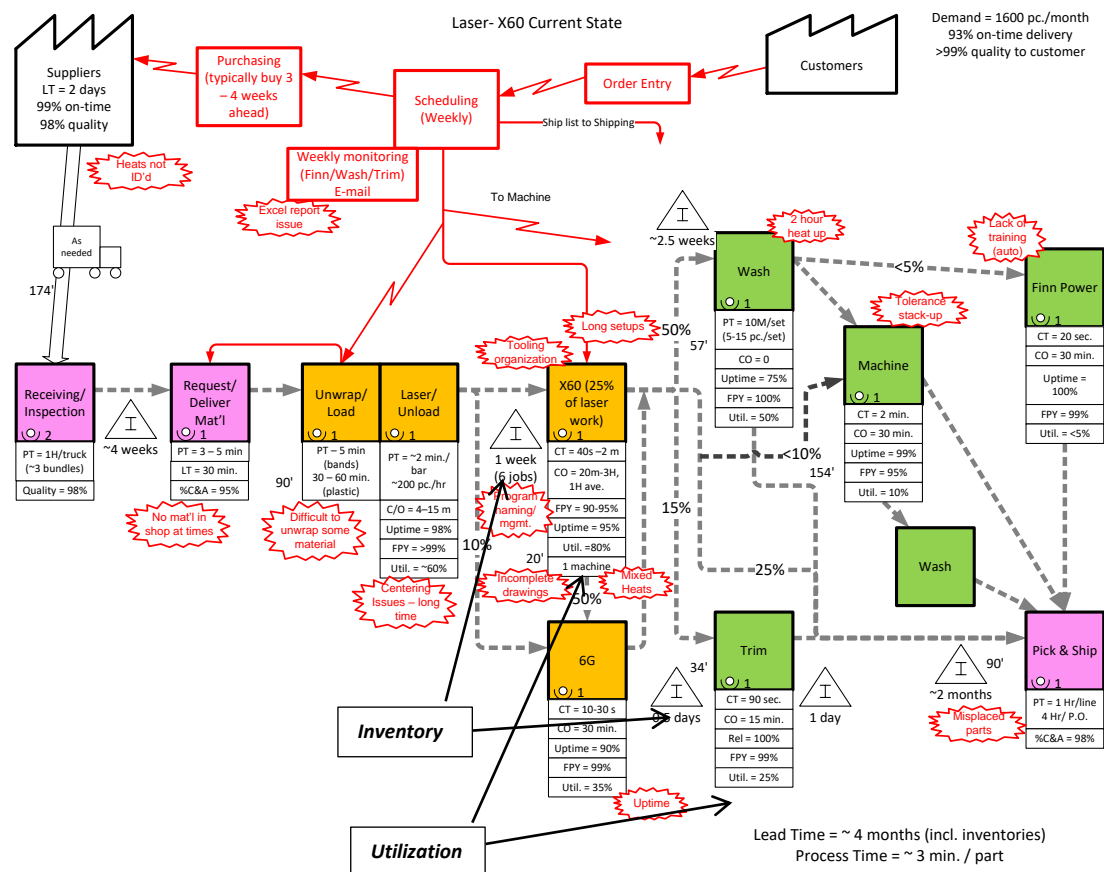
If a machine always has a backlog and / or overtime is required, our utilization is 100% or more. Utilization isn't efficiency; utilization = 100% - Idle Time. Thus, if I'm at 75% utilization, I could possibly squeeze 33% more volume out of that work center if needed. It's sometimes difficult to get honest answers on this because no one wants to tell you "My machine sits idle one-third of the day." I keep pushing the question "Could you get 10% more out if you needed to? 20% more?" Etc. It's not very

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scientific, but you're really just trying to identify whether or not a workstation is a bottleneck - rarely, occasionally, or frequently, and if capacity on the workstation should be a focus of improvement.

When it comes to lead time, the traditional VSM approach would have you convert inventory to time using the demand rate. Doing so on a tracer part will often show a big clump of product somewhere in the value stream. I use the analogy of a "pig in a python" - slowly making its way through the system. While this is a component of overall lead time, this isn't a good representation of lead time at the process level. I may have 20 parts at Op 20 today. If demand is 20 / month, the conventional approach would tell me I have a 20-day delay through Op 20. In actuality, that's just where the batch happens to be today. Tomorrow, it will be at Op 30. Here's where we want to ask about lead time / delay time during the walk through. When we get to Op 20, there may be a mix of product waiting in a queue. We want to know how long it will take the operator to work through the queue, or how long until they process a newly arrived job if they are working First-In-First-Out. We do not need precision or tremendous accuracy. If they look at the queue and estimate 2.5 days, and it's really 2 days or 3 days, that's close enough. It gives us the right order of magnitude and relative impact to flow.

A high-mix VSM might look like this:



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Note the inclusion of Utilization and Inventory. For high-mix value streams, this is useful to help identify capacity bottlenecks. In the example above, Trim is 25% utilized while X60 is 80% utilized.

Unsurprisingly, Trim has 0.5 days of inventory in queue, while X60 has a week's worth. The back end of the process has many different potential routings which got captured on the map. Note: this business installed an additional X60 and now has two.

Many of the issues identified (centering issues, program naming, long setups, tolerance stack-up) aren't exclusive to an individual product, but may impact many products. Often times, identifying and improving an issue for one product are improvements for many.

## Identifying Waste

Once the Current State map is complete, I like to do an exercise where the team identifies waste in the process. I'll use Post-It shapes (such as yellow stars) to place the wastes on the map near the offending process box. It provides a nice visual and serves to remind us of opportunities to address in the Future State. A waste might be "required tools frequently missing from shared tool board". In the Future State, this may drive a discussion of 5-S discipline or the need for dedicated tools.

## DETAILS OF A VALUE STREAM MAPPING EFFORT (the event)

### Can I facilitate the VSM myself, or should I use an outside resource?

Short answer: Sure. You probably can facilitate it yourself; and should if you're comfortable with it. VSM isn't rocket science. But, depending on your level of experience with lean / VSM and company dynamics, there may be advantages to using an outside resource.

Long answer: When I worked in the industry, I didn't like consultants. I never felt like they knew our business as well as we did, yet they were giving us advice. In hindsight, sometimes that was a good thing, as we would be stuck on a paradigm, or couldn't see the forest through the trees, and a different perspective was helpful. I am now one of those consultants (university-affiliated, non-profit), and I see the role of a consultant differently.

*Unbiased facilitation:* Sometimes the value of an outside resource is their specific knowledge, skill, or collective experience. However, I've often seen the value of my work come from being an unbiased third party. Internal politics can often be an obstacle to improvement, and an unbiased outside resource can help mitigate some of those issues. I don't have an agenda. I can ask questions about the elephant in the room, sometimes not realizing there is an elephant in the room. The process of mapping requires the facilitator to learn the details about the value stream. In many ways, being unfamiliar with the value stream is an advantage for a facilitator. I will ask questions that may not otherwise be asked if a facilitator who is familiar with the process thinks they are common knowledge, and that may not be the case. I can ask "why...why...why" many times without it being a dumb question -being foreign to the process, I'm not expected to know the answer - and I can ask without prejudice or personal bias.

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I was facilitating a transactional VSM for a local manufacturing company years ago. The guy that brought us in was an engineer with a Continuous Improvement background. As we went through the VSM process with their team, it was obvious that this guy knew VSM well. At lunch, I suggested that he probably could have facilitated the VSM instead of bringing in IMEC. He replied something like “Yeah, I would have been comfortable leading this...but my boss is Fred, and he doesn’t get along so well with George, the other engineering manager. If I were leading the VSM, there would be the perception that I will lead the team to do what Fred wants to do.” I’ve also heard from others “The guys respond differently to you than to the plant manager. You’re just a friend trying to help.”

*External perspective:* I’ve also seen many cases where my advice as a consultant is given much more weight / credence than identical advice from an internal source. A prophet has no honor in his own land! “What does he know? He works here.” I suppose my advice is considered good and credible because I’ve been to many places and have seen many things, but also because I don’t have a vested interest or agenda, other than helping the business move forward toward continued success.

*Efficient use of resources:* Another thing to consider whether or not to use an external resource is the overall cost and impact of the project. An outside consultant may seem like a significant cost, but consider the cost of your personnel in the VSM: 6 - 8 salaries for 1 – 3 days is a bigger investment. You want to use their time well. I had a client who had started doing VSM on their own. They told me they spent 4 hours arguing about how to do the first process box, and never finished the VSM. Also, if an experienced resource can get the team to a place where an implemented Future State will yield 10%, 20%, or more benefit than an internal resource could, then the investment in the external resource is well worth it.

I’m not suggesting you need an outside resource to get started; I’m merely listing some things to think about. I promote companies doing their own VSMs whenever possible; I am writing this guide for that very purpose. IMEC’s model is to share knowledge and teach others how to fish. If you are going to be a lean company, VSM should be a core practice. Ideally, you’ll have one or more internal resources that can facilitate mapping in manufacturing, logistics, planning, quoting, customer service, accounting, and other aspects of your business. If you don’t have this resource internally, work on identifying and developing one or more. The first few VSMs your business conduct may be a little clunky -mine were, too; but you’ll learn and improve as you go. If you need help getting started, or an outside, unbiased perspective, look to an experienced external resource to get you moving forward.

## Characteristics of a Good Facilitator

- Comfortable in the front of the room – presenting and leading a team
- Fair and unbiased
- Open-minded
- Good listener
- Inquisitive, with a desire to fully understand – they will need to ask a lot of probing questions
- Good business sense -what may / may not be important to the business



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- Organized
- Excellent attention to detail

## **Not required:**

- Special VSM training / education (but it can be helpful)
- Expertise in the process being mapped. The experts are on the team!

## **Planning for a VSM**

Once a value stream is chosen, it's a good idea to fill out a project charter for your VSM. It doesn't have to be elaborate. A one-page document is fine. Please distribute it to the team prior to the start of the VSM, so everyone is on the same page and has a chance to ask questions or challenge the goals / scope. It should include:

- Location
- Dates, start & end times
- Participants and other resources, with VS manager identified (if possible)
- Goals of the VSM (tangible / measurable when possible)
- Scope / boundaries (start, finish, inclusions, exclusions)

Ideally, a VSM is conducted near the process it relates to. This applies to both manufacturing and transactional VSMs. You always want to "walk the process" when doing a manufacturing VSM, and often times, we also do this for a transactional VSM. During the creation of the VSM, you may find that there is something you missed, or you wish to see again, or a disagreement over a data point. If you are physically near the value stream, then someone from the team, or the entire team, can quickly verify. Other resources needed for input to the VSM tend to be local as well. The one downside to performing a VSM locally is the potential for distractions like shop floor issues and other interruptions. I've done VSMs both on-site and off-site, and onsite is greatly preferred.

**The VSM workspace:** Conduct your VSM in a flexible, generously sized space, because you will need ample wall space to place the map. We use 4-foot wide white craft paper with Post-It notes (buy Post-It brand - generic brands don't stick well or they'll curl up). Every value stream is different. Some maps need 6 feet of paper, others 20+ feet, sometimes wrapping around to a second wall. A table and chairs for participants is helpful as well as a space for projection: action items, perhaps looking up information or demonstrating something in the ERP system, etc. A quiet space away from distractions, but not too far from the physical VSM is ideal.

## **Picking a Product Family**

A product family is a group of parts that have similar flows, using similar resources. They don't need to be perfectly aligned, but ideally would be perhaps 80% similar or more. There are times however, that I've mapped value streams based around the product running through a critical piece of equipment. In the transactional world, quoting families may fall out as: Repeat Business (pricing updates), Simple

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Quotes, Configured Quotes, and quotes requiring Engineering work. Alternatively, they may break out based on dollar value and approvals needed. It's not uncommon to create a map with all of these families on the map; a quote comes in, and based on its characteristics, follows one of several flows - I mention multiple flows later on.

Choose a product family that is important to your business. VSM takes time and effort and is only beneficial when improvements are implemented as a result. Mapping a trivial process will likely not get the commitment and buy-in that you'll get working on a value stream that represents 20% of your revenue. Here generally lies the most opportunity for impact.

## Who should be on the team?



You'll want to have a cross-functional team that represents many aspects of the value stream. In most cases, a core team of 6 – 8 is ideal. A team size of 4 – 10 is also manageable. A team smaller than 4 typically doesn't offer enough perspectives and intimate process knowledge, whereas more than 10 can be difficult to manage and keep everyone engaged. I've worked with teams of as few as 2 and as many as 29 - at the insistence of the client...it was like herding cats.

A manufacturing VSM might include some of the following roles / functions:

- Manufacturing Engineer
- Sales / Customer Service
- Quality
- Production Lead / Supervisor(s)

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- Purchasing
- Material Handler
- Production Planner / Scheduler
- Shipping / Receiving
- Direct Labor employees

There is tremendous value in including some of the employees that actually do the work in the VSM. First, they know the process best. They know what really happens - what works, what doesn't, what causes them heartache. Sometimes there are biases, but good questions can help sort that out. Secondly, it helps bridge gaps between the shop and the office / management. If a group of exempt employees make decisions about changes on the shop floor without direct employee input, it is generally not well accepted. I believe this is often the case even when the changes are very good ones. If you are looking to get good information when creating the Current State map, a VSM team member who works in the shop can get more honest answers from their peers than the plant manager often can. Remember, we're looking for what really happens, not what is supposed to happen. When you go to implement changes, you will have a plan that has shop floor ideas and input. It will have a much better chance of being implemented.

Less frequent participants:

- Maintenance
- Accounting
- EHS
- IT
- HR
- Design Engineering

These may be used as an outside perspective, or perhaps to help achieve a specific outcome. For example, if labor tracking is an issue you want to work on through VSM, Accounting, IT, and HR may all have a vested interest and valuable input.

I know. You counted. I have more than 10 roles listed. We generally don't have all these roles on the core team of the VSM. You have to pick and choose as to who you think will contribute best. Availability of personnel may also be an issue. You'd like to have a core team of participants dedicated to the project. Others can serve as resources, which are pulled into the VSM as needed. For example, I might have a CSR as a resource. During the development of the Current State map, the team may invite the CSR to participate for 20 minutes to explain the customer process (order entry, order frequency, quantities, lead time, on-time delivery, seasonality, etc.). They then return to their regular job, but are "on-call" if other questions arise.

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I've done some maps where individuals come in one-at-a-time and explain their process to me so I can map it. Please try to avoid this. Having a dedicated core group is so important. At the end of the Current State, this core team will develop the Future State. All the conversations, questions, concerns, etc. that get flushed out during the Current State development are gold. A lot of learning can happen here, and it's important that everyone on the core team understands the Current State well.

I have done many maps where individuals join the core team to cover their part(s) of a process and then leave. This is perfectly fine as long as the core team is there to listen, ask questions, and digest the information shared. Perhaps the most comprehensive VSM I've done involved a core team of 6 with input from an additional 20+ employees. This was done over the course of about 12 days. 3 transactional value streams (RFQ to Invoice for 3 different transactional product families) were combined into one in the Future State. The 6-person core team was present during the entirety, with subject matter experts joining us, individually or in pairs, to help create the map.

Have a balanced team. In choosing your VSM team, you'd like to have a balance of personalities. It's good to have some outspoken, probing participants and it's OK to have some quiet thinkers. But we need to have people who can be dedicated and engaged in the process. Having an owner or top management on the team can be good or bad. It's good in that they can lend a high level perspective, and perhaps provide guidance towards goals during the Future State development. It's bad if they will dominate the discussion, or if the rest of the team will be reserved with a high-profile figure in the room. A lot has to do with the relationship management has with the staff -formal vs. informal. It's also OK to have a nay-sayer or two on the team. They can offer an alternative perspective, and there have been times they've had an epiphany during the project and become an advocate for change. However, you don't want a room full of nay-sayers. In over 200 VSMs, only once have I asked that a team member be removed from the project. He was being intentionally difficult and was holding the team back. The company's project leader was in complete agreement with my request.

It's helpful to have an advocate on the team. This might be a supervisor, manager, engineer, etc. who is supportive of VSM and familiar with the process being mapped. They will serve as a voice of reason if the team goes off the rails. I've done maps without an advocate, and at times felt like the team was sandbagging or making up excuses for things. Not being familiar with the process, aside from a walk-through, I couldn't keep them honest. An advocate can help with that. They can also help direct us to, and acquire, the appropriate support resources we may need during the mapping process. For example, if we think it would be of value to visit an affected customer of the VSM in Plant 2, the advocate may be able to make the arrangements for that to happen.

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## The Walk-Through



The walk-through process is very important - I consider it mandatory - for a manufacturing VSM. It gives us the opportunity to observe the process and ask questions of those involved in the process, with the goal of understanding how things currently work. It also allows VSM team members to better understand the process first-hand. Sometimes, this is the first time people see the process beyond their own four walls.

I've done transactional VSMs with and without a walk-through. A walk-through often reveals things that would not come up during a conference room exercise or discussion. Things such as ergonomics, safety, difficulty with a process, distance and other issues often evidenced by WIP (Work-in Piles), such as overproduction, quality problems, limited human resources / training, etc.

These things are less evident in the transactional walk-through, perhaps why I see less value in it. I've had times during a transactional walk-through when employees would be intimidated and not very open due to proximity of their peers, and working through the details in a conference room was more productive. Sometimes, you can demonstrate a process in the conference room – i.e. data entry in the ERP system. There is nothing wrong with trying one method and switching if you find you're not getting the right information for your map.

When doing the walk-through, remember to focus on the process, not the people. I suggest informing employees about the VSM prior to the event. The rumor mill can be swift and often inaccurate. As I meet employees during the walk-through, I explain briefly that we are tracking a product's flow from start to finish and have a few questions about their process. I reinforce that we aren't evaluating them as an individual and are looking for real and honest answers. I'd say more than 95% of people are very cooperative. Occasionally, someone isn't. I've even had people swear at me before (it's not me, something else is going on that has made them bitter). I like to ask employees what is their biggest headache with their job, or what one thing would they like to see changed. It's an open-ended question

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that can reveal an issue that our standard list of items like changeover time, downtime, etc., may not otherwise reveal. It also gives them a voice in the process and shows that the team is interested in improving the VSM for their benefit.

Assign roles to your team; one person may have a measuring wheel to collect distances between operations, another can be in charge of identifying and recording inventory, another can be scribe, etc. I will lead the interaction at the first couple of processes. If there is someone who is willing to take over that role as we go, that's great, especially if it's a shop-floor team member. They are often able to get better "real" information. A shop floor employee is more likely to share his / her problems, issues, shortcomings with a peer than with a supervisor / manager who may be the one that evaluates their performance: "Everything is great. No problems here, move along." Remember, we are looking for what is actually happening - good or bad -not what is supposed to be happening.

## Current State vs. Future State VSM

Current State is intended to represent conditions that are present today. Not ideal conditions or how it is supposed to be, but as close to reality as possible. Future State should be your goal, your blueprint, your roadmap; this is your destination. It should be optimistic, but not unrealistic. We generally plan for a timeframe of 6 – 12 months to get to Future State. There are times an interim map is drawn, which I often call "Current State with kaizens." Kaizen is the Japanese translation for 'good change'. The interim map with the kaizens can be a bit messy, but it helps represent the transition from Current State to Future State. There are times when the Future State isn't structurally different than the Current State, and the Future State is the Current State with kaizens.

Encourage the team to push the Future State ideas a bit. Big changes only come about through big ideas. The team needs to challenge the status quo. Change is hard. It's hard for me - I now recognize it more than I used to, but I often find myself resisting change. Most people do. In my early days of learning VSM, my mentor would often say "If you're asking questions that make people uncomfortable, you're asking the right questions." Future State VSM generally doesn't focus on high-cost solutions, it's creativity over capital. I've seen most improvements come from changes in mindset, policy, and procedure - not in capital investments.

Pitfall to avoid: While creating the Current State map, refrain from working on Future State map improvements until the Current State map is complete. Teams often want to jump to solutions for an issue as soon as it is placed on the map. Please wait. There are times that what may initially seem like a good solution locally, may not be the best solution globally; or there is a Future State vision that eliminates the need for a change at the local level altogether. We want to first map and understand the entire process to help us arrive at the best overall solutions. That doesn't mean you can't suggest things as you map. I encourage team members to bring up improvement ideas as we map, but we don't develop or dwell on the ideas. Simply write them down as something to come back to during the Future State conversation - we don't want to forget them. Doing this is also an efficient use of time, as many Future State idea discussions can be time consuming.

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## How to Create the Future State

The focus of the Future State should be dependent on the goals created in the charter. That's not to say we should ignore other opportunities; we certainly want to include them as well. If the focus is lead time reduction, but someone observes an opportunity to mitigate an ergonomic risk, by all means, include it in the Future State discussion. However, lead time should take the main stage and the conversations should frequently return to it.

Much like suggested in "Learning to See," I find it best to start the Future State focused on the customer with questions like: "What is the takt time?" and "Will we make to order or make to stock? Or, some of both?" This gets us focused on our ability to satisfy the customer: how much capacity do we need to meet customer demand (whether using takt time or machine utilization in the case of high mix) and how quickly do we need to respond to a customer order? This will drive our inventory and scheduling strategy.

After this, turn your eyes inward and start discussing opportunities for improving flow internally. This may be through combining operations, relocating equipment, reducing batch sizes, utilizing transfer lots (splitting a large lot into smaller lots so you don't have to wait for the entire lot to finish), reducing or eliminating delays (material handling, quality checks, etc.), as well as a myriad of other opportunities. During these discussions, we review the wastes and opportunities we identified in the Current State map. Be sure to visit / develop the improvement ideas you recorded while making the Current State map.

Here is a list of things to look for to help guide your Future State discussions:

- Where is inventory piling up? How can this be reduced?
- How many times is the product picked up, moved, and put down? How can this be minimized?
- If there are paper-intense processes can they be simplified, made more visual (schedule boards, etc.), or automated?
- How is information communicated to and from the customer? Could this be improved / simplified?
- Are there duplicate processes, duplicate inspections? Can some be eliminated?
- Are things taking long because of sequential processing? Could some parts of the process be happening in parallel?
- Is it easy to see ahead or behind status? Could it be made more visual?
- Does every piece of the process have someone who is responsible for it? Or, are there some "orphan" processes? Every step in the VSM needs to be owned by someone.
- Are things organized in "silos" (departments), rather than value streams or product lines?
- How are products scheduled? Is machine capacity taken into account? It should be.

## Follow-up:

As I mentioned before, VSM is of little value unless you do something as a result of it. It's such a good format for getting ideas and input from everyone. You should leave a VSM exercise with consensus and

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a plan for the future. What a waste to let this fade away! Everyone on the VSM has regular jobs that they have to go back to, and after a couple days devoted to VSM, there is catch-up to do. It's important to keep the Future State VSM and action items on a front burner. The VS manager should be responsible for calling the team together on a regular basis to review progress of the action items and their success / impact, discuss challenges to implementation, and keep the ball rolling. When I have action items, I often get them completed the day before I have to report out on them. With no report out, other things get in the way, and action items get ignored.

The frequency of follow-up meetings will vary based on the timeline for implementing changes. Often times, many action items can be completed within a few weeks (changing forms, training, policy changes, etc.). There are usually some items that take months to put in place. Occasionally, it's the other way around with most items being long-term. If a lot of activity is happening near-term, consider having bi-weekly meetings to review progress. Monthly meetings should be considered when the majority of the improvements are longer term.

The VS manager should communicate regularly with the team members and update the VS as improvements get implemented.

## Conclusion

I don't know that there are any strict rules about VSM. If you find representing a process in a unique manner works well for your business, do it. I do recommend consistency, though. The point isn't to make a beautiful or critically acclaimed product, it is to communicate, share, and focus the efforts of a team with a purpose. So, make it your own -figure out what works as you go, replicate and share.

I hope you found this guide to be of value to your continuous improvement efforts. I welcome suggestions for improvements or additional topics to include in this guide. If you have any specific questions about VSM, please feel free to contact me or one of my colleagues at IMEC. Good luck on your lean journey!

## About the author:

Greg Thompson has provided business outreach solutions as a Technical Specialist at IMEC since 2002. He has facilitated the creation of over 250 Value Stream Maps in over 100 different businesses, ranging from screws to tractors / combines and childcare centers to colleges. He worked in private industry for ten years prior to joining IMEC. He holds a BS & MS in Industrial Engineering and an MBA from the University of Illinois Urbana -Champaign.

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