
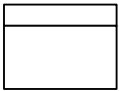

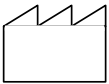





PART I – GETTING STARTED	
Value Stream	<ul style="list-style-type: none"> ➤ <i>Value Stream</i> is all the actions (both value added and non-value added) required to bring a product or service to the customer <ul style="list-style-type: none"> • “a product’s production path from customer to supplier, ... a visual representation of every process in the material and information flow.” ➤ A Value Stream Map consists of: <ul style="list-style-type: none"> • The production flow from raw material into the arms of the customer • The design flow from concept to launch ➤ Value Stream perspective means working on the big picture and improving the whole
Material and Info Flow	<ul style="list-style-type: none"> ➤ <i>Material Flow</i> is the movement of material through the factory ➤ <i>Information Flow</i> is the flow that tells each process what to make or do next
Product Family	<ul style="list-style-type: none"> ➤ Focus on one product family at a time when value stream mapping. ➤ Walk and draw both the material and information processing steps from door to door in your facility. ➤ Identify your product families from the customer’s perspective <ul style="list-style-type: none"> • A family is a group of products that go through similar processing steps equipment • Document the product family by listing part numbers in the family and the quantity and frequency they are needed by the customer
Value Stream Manager	<ul style="list-style-type: none"> ➤ A <i>Value Stream Manager</i> is needed to drive change in a value stream <ul style="list-style-type: none"> • Because companies tend to be organized by department/function, no one is generally responsible for the value stream perspective • The VSM reports to the Business Leader and has the power to make change happen • Must be someone who can see across boundaries over which the product flows ➤ Do not split up the mapping among area managers and then piece their individual maps together ➤ Do not map your organization - map the flow of products through the organization
Using the Tool	<ul style="list-style-type: none"> ➤ Value stream mapping can be used as a communication tool, a business planning tool, and a change management tool ➤ Mapping for a product family should take no longer than about two days ➤ Value stream mapping follows a simple four step process: <ul style="list-style-type: none"> • Identify the product family to focus on • Develop the current-state drawing by collecting information at the place of work • Develop the future-state drawing • Develop an implementation plan to change from current to future-state
Value Stream Map	<p>The diagram illustrates a Value Stream Map for a production process. At the top, a 'Weekly Schedule' is shown, which is influenced by '5-week Forecast' from Michigan Steel Co. and 'Daily Order' from State Street Assembly. The production flow consists of several stages: STAMPING (200T, 500 Ft. coils), S. WELD #1 (4600 L, 2400 R), S. WELD #2 (1100 L, 600 R), ASSEMBLY #1 (1800 L, 850 R), ASSEMBLY #2 (1200 L, 640 R), and SHIPPING (2700 L, 1440 R). Each stage includes specific metrics: C/T (Cycle Time), C/O (Changeover Time), Uptime, and EPE (Equipment Position Error). For example, STAMPING has a C/T of 1 second, C/O of 1 hour, and Uptime of 95%. The final 'SHIPPING' stage has a 'Production Lead Time = 23.5 days' and 'Value Added = 154 sec. Time'. The diagram also shows 'Daily Ship Schedule' and '30/60/90 day Forecasts' from State Street Assembly.</p>

PART II – THE CURRENT-STATE MAP	
Current-State Map	<ul style="list-style-type: none"> ➤ Mapping begins at the door-to-door level of the plant using process categories instead of recording each processing step ➤ A set of symbols is used to represent processes and flows and needs to be consistent within the company ➤ Once the overall flow is seen, you can change the level of detail as necessary
Showing the Customer 	<ul style="list-style-type: none"> ➤ Mapping begins with the customer requirements ➤ The customer is depicted as a factory icon in the value stream map and is normally placed in the upper right-hand corner (see symbol to left) ➤ A data box is placed underneath this icon and displays the requirements of the customer in detail.
Showing the Basic Production Processes  	<ul style="list-style-type: none"> ➤ Indicate a process using a process box in the value stream map ➤ Use a process box to indicate one area of material flow and the box stops wherever processes are disconnected and the material flow stops ➤ Material flow and processes are drawn from left to right in the value stream map ➤ In value streams that have multiple flows that merge, draw these over one another ➤ A data box is placed underneath each process box that displays pertinent information from each process. Some examples of data to collect include: <ul style="list-style-type: none"> • <i>Cycle Time</i>: the time between parts coming off the process • <i>Changeover Time</i>: the time to switch from producing one product type to another • <i>Number of People</i>: the people required to operate the process • <i>Available Working Time</i>: time per shift minus breaks, meetings, training, etc. • <i>Equipment Uptime</i>: the amount of time equipment is available during the shift • <i>EPE (every part every ___)</i>: a measure of production batch size ➤ A triangle with an “I” in it is depicted in each location where there is inventory. <ul style="list-style-type: none"> • Beneath the icon is data for the inventory.
Showing the Supplier 	<ul style="list-style-type: none"> ➤ The supplier is depicted also as a factory icon in the value stream map and is normally placed in the upper left-hand corner. ➤ A data box is placed underneath this icon as well and displays the supplier data, such as lot/pack size, etc.
Showing Info Flow  	<ul style="list-style-type: none"> ➤ A narrow line is used to show manual information flows ➤ A narrow line modified with a lightning-like wiggle is used to show electronic information flows ➤ A small box is used to label or describe different information flow arrows
Showing Material Flow (Push) 	<ul style="list-style-type: none"> ➤ A thick, dashed line is used to show material flow (push) ➤ Push means that a process produces something regardless of the actual needs of the downstream customer process <ul style="list-style-type: none"> • Typically results from producing to a schedule that guesses what the next process will need ➤ Each process has its own schedule and operates to it as an “isolated island.” ➤ The mapping icon for push movement of material is a striped arrow
Process Timeline	<ul style="list-style-type: none"> ➤ Once the value stream map is completed, a timeline is placed under the process boxes and inventory triangles to compile the production lead time ➤ Production lead time is the time it takes one part to make its way through the shop ➤ Lead times for each inventory triangle are calculated as inventory quantity divided by daily customer requirement ➤ Add lead times and inventory times through the processes to determine lead time ➤ Add up only the value-added times (processing times) for each process

PART III – WHAT MAKES A VALUE STREAM LEAN?	
Overproduction	<ul style="list-style-type: none"> ➤ A common problem with mass (batch) production is that processes operate as isolated islands, producing product according to a schedule instead of customer needs <ul style="list-style-type: none"> • While the value-added time for producing one product is short, the total time spent in the entire process is long due to defects, extra handling, etc. ➤ Future state value stream maps must eliminate the sources of waste <ul style="list-style-type: none"> • To reduce long lead times, you must do more than eliminate obvious waste • Too many lean efforts have simply been “seven-waste scavenger hunts.”
Characteristics of a Lean Value Stream	<ul style="list-style-type: none"> ➤ “All we are really trying to do in lean manufacturing is to get one process to make only what the next process needs when it needs it. We are trying to link all processes in a smooth flow without detours that generates the shortest lead time, highest quality, and lowest cost.” ➤ There are seven guidelines that can be used: <ul style="list-style-type: none"> • Produce to Takt time • Develop continuous flow wherever possible • Use supermarkets where continuous flow is not possible • Send the production schedule to the last process (pacemaker process) • Level out the production mix • Level the production volume • Develop the ability to make every part every day
Produce to Takt Time	<ul style="list-style-type: none"> ➤ Takt time is how often you should produce one part or product, based on the rate of sales, to meet customer requirements. ➤ Takt time is calculated by dividing customer demand rate per shift into your available working time per shift. ➤ Takt time is used to synchronize the pace of production with the pace of sales
Develop Continuous Flow When Possible	<ul style="list-style-type: none"> ➤ Continuous flow refers to producing one piece at a time <ul style="list-style-type: none"> • Each item passes immediately from one process step to the next without stagnation
Supermarkets When Flow isn't Possible	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px;"></div> </div> <ul style="list-style-type: none"> ➤ Some parts of the value stream are not conducive to continuous flow. <ul style="list-style-type: none"> • Control production of these systems by linking them to their downstream customer through a supermarket-based pull system. ➤ Supermarkets are needed every place continuous flow is interrupted. <ul style="list-style-type: none"> • The purpose of this type of pull system is to provide production instructions to the upstream process without trying to predict downstream demand. • The supermarket icon is open to the left, towards the supplying process (which is the owner of the supermarket) • When the customer withdraws from the supermarket, the withdrawals trigger pre-printed kanbans to be sent from the supermarket to the supplier process. ➤ Prior to introducing a supermarket, be sure that continuous flow has been introduced
Send the Schedule to the Last Process	<ul style="list-style-type: none"> ➤ Utilizing supermarkets allows you to only need to schedule one point in your value stream, your pacemaker process ➤ <i>Pacemaker Process</i>: most downstream continuous-flow process in the value stream
Level Production Mix	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 5px; margin-right: 5px;">OXOX</div> </div> <ul style="list-style-type: none"> ➤ Grouping the same products and producing them all at once makes it difficult to serve customers who want something different from what is currently being produced ➤ To level the product mix, distribute the production of different products evenly over a time period ➤ The more the process is leveled at the pacemaker process, the greater the ability to respond to customer requirements with short lead time ➤ The icon for load leveling is a box with “OXOX” in it placed on an info flow area.

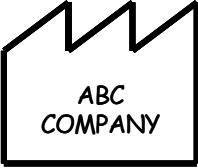



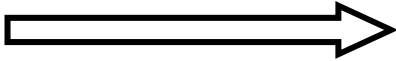



STUDY NOTES: Learning to See


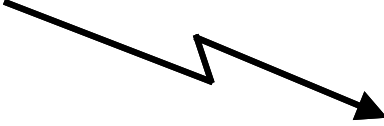


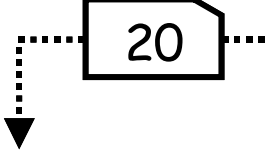


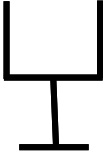
<p>Level the Production Volume</p>	<ul style="list-style-type: none"> ➤ Releasing large batches of work to the shop floor causes many problems: <ul style="list-style-type: none"> • Work is performed unevenly over time • The current production situation is difficult to monitor • Responding to changing customer requirements is difficult ➤ Leveling the production volume establishes a consistent, level production pace and creates predictability in the production flow <ul style="list-style-type: none"> • Enables you to detect problems and enables you to take corrective action. ➤ The level or increment of work is called the <i>pitch</i> or management time frame <ul style="list-style-type: none"> • A key question is ‘how often do you know your performance to customer demand?’ • If a week of work is released at one time, the answer is probably only once a week.
<p>Make Every Part Every Day</p>	<ul style="list-style-type: none"> ➤ Shortening changeover times and running smaller batches allows processes to respond to changing downstream needs more quickly. <ul style="list-style-type: none"> • Also allows inventory to be reduced as less inventory will be required to be held in supermarkets

PART IV – THE FUTURE-STATE MAP

<p>Future State Value Stream Map</p>	
<p>Future State Map</p>	<ul style="list-style-type: none"> ➤ The purpose of value stream mapping is to highlight sources of waste and eliminate waste through the implementation of a future-state value stream ➤ There are eight key questions to be asked when determining the future state: <ul style="list-style-type: none"> • What is the takt time? • Will you build to a finished goods supermarket or directly to shipping? • Where can you use continuous flow processing? • Where will you need to use supermarket pull? • At what single point in the production will you schedule production? • How will you level the production mix at the pacemaker process? • What increment of work will you consistently release? • What process improvements will be necessary?

PART V – ACHIEVING THE FUTURE STATE	
Implementation Steps	<ul style="list-style-type: none"> ➤ It is the value stream manager’s responsibility to break implementation into steps ➤ Divide your future-state value stream map into ‘value stream loops’ and create an implementation plan that improves each loop: <ul style="list-style-type: none"> • <i>The Pacemaker Loop</i>: encompasses the flow of material and information between your customer and your pacemaker process. This is the most downstream loop • <i>Additional Loops</i>: are upstream material and information-flow loops Each supermarket usually corresponds with the end of another loop
Value Stream Plan	<ul style="list-style-type: none"> ➤ Create a yearly value stream plan to help guide future-state implementation plans <ul style="list-style-type: none"> • Shows exactly what you plan to do by when • Has measurable goals • Has clear checkpoints with real deadlines and named reviewers ➤ Consider the ‘value stream loops’ when determining where to start implementation <ul style="list-style-type: none"> • Which processes are well-understood by your people • Where is the likelihood of success is high (to build momentum) • Where you can predict big bang for the buck ➤ Begin implementation in the downstream pacemaker loop and transition upstream. ➤ Improvements to a value stream loop often follow this pattern: <ul style="list-style-type: none"> • Develop a continuous flow that operates based on takt time • Establish a pull system to control production • Introduce leveling • Practice kaizen to eliminate waste, reduce batch size & shrink supermarkets
Management Responsibility	<ul style="list-style-type: none"> ➤ It is management’s responsibility to develop a vision of an improved, lean flow for the future and lead its implementation. Must have: <ul style="list-style-type: none"> • A firm conviction that lean principles can be adapted to work in your setting • A willingness to try, fail, and learn ➤ Management needs to dedicate time and to really learn lean and value stream management for themselves and then teach it. ➤ Align the organization with close-to-the-operation support instead of self-directed work teams. <ul style="list-style-type: none"> • Close-to-the-operation support means all indirect operations are considered support for direct operations • The work of support operations must be tied to the takt and pitch times of the direct value adding operations. ➤ A new set of performance metrics may be needed instead of the traditional financial metrics to provide meaningful information for managing a lean operation ➤ Lean measures should adhere to the following principles: <ul style="list-style-type: none"> • Measures should encourage desired behavior by the front lines • Measures should provide information for senior managers to make decisions • The first principle above takes precedence over the second

APPENDIX – VALUE STREAM MAPPING ICONS	
Process	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Process Name <div style="border: 1px solid black; height: 40px; width: 100%;"></div> </div>
Outside Sources	
Process Data Box	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> C/T=120 sec. C/O=22 min. 3 SHIFTS W/T=20 hrs 3% SCRAP </div>
Inventory	 <p>225 pieces 1.5 days</p>
Truck Shipment	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Tuesday + Thurs  </div>
Movement of Material by Push	
Movement of Finished Goods to Customer	
Supermarket	
Physical Pull	
Transfer of Material in FIFO Sequence	<p style="text-align: center;">FIFO</p> <div style="text-align: center;">  </div>

Information Flow (Physical)	
Information Flow (Electronic)	
Information Box	
Level Loading	
Production Kanban	
Withdrawal Kanban	
Signal Kanban	
Kanban Post	
Safety Stock	