10 Steps to become a Lean Enterprise

Lean Expert Training Course

Step 2

Value Stream Mapping

Part I

Lean Expert Course Workbook - Step 2 Value Stream Mapping Part 1

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Lean Expert Course Workbook - Step 2 Value Stream Mapping Part 1

Welcome.

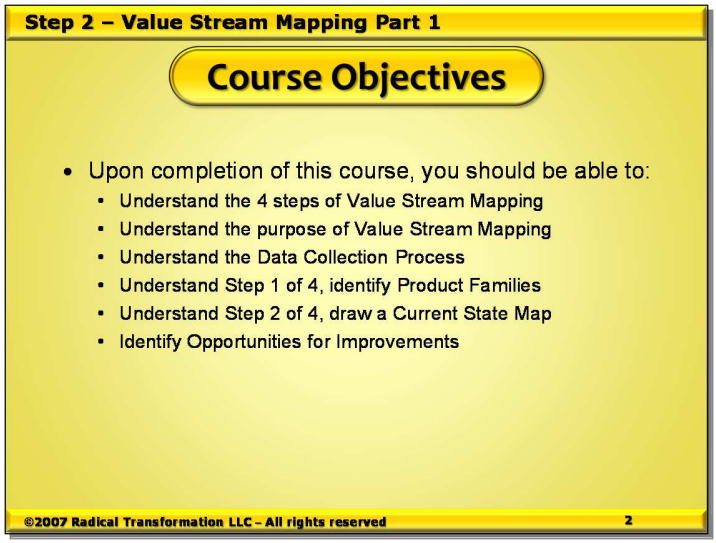
We would like to welcome you back to our next module in this online training course.

This training module is called “Step 2 – Value Stream Mapping Part 1.”

This module is a continuation of our Lean Expert online course series called “10 steps to become a Lean Enterprise.”

This program has been specifically designed to demonstrate our step by step methodology that will allow any organization to become a Lean Enterprise.

Let’s continue your lean journey!



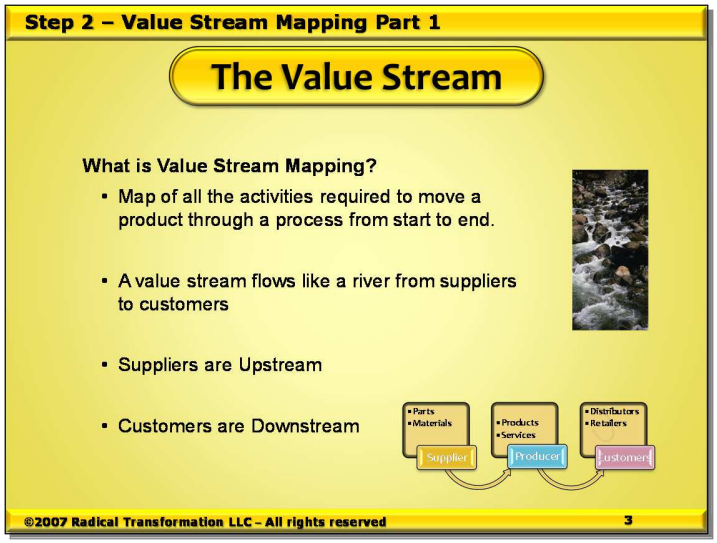
Course Objectives

Here are the course objectives for the Lean Expert Step 2 – Value Stream Mapping Part 1 training module. We specially designed this module so you will get a full understanding of each of the required steps to complete an Enterprise Level Value Stream Map (ELVSM). This is a critical element in the "10 Steps to become a Lean Enterprise" program.

Upon completion of this course, you should be able to:

- Understand the 4 steps of Value Stream Mapping.
- Understand the purpose of Value Stream Mapping.
- Understand the Data Collection Process.
- Understand Step 1 of 4, Identify Product Families.
- Understand Step 2 of 4, draw a Current State Map.
- Identify Opportunities for Improvements.

Now we are going to work through each course objective.



The Value Stream

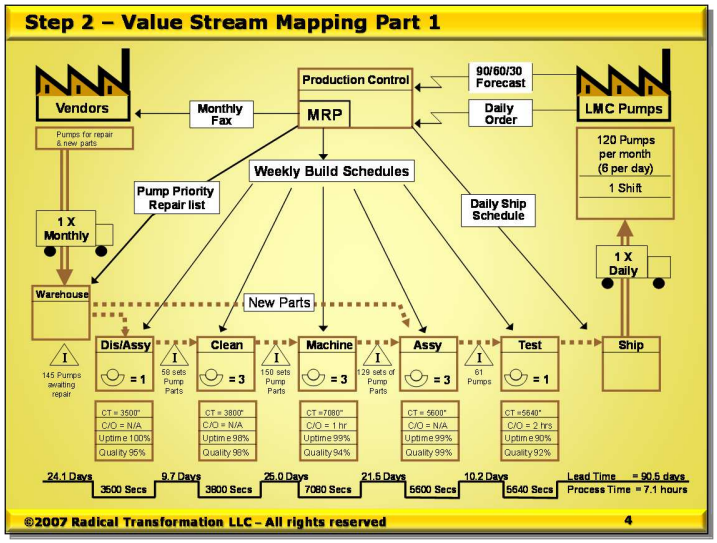
Let's start by asking a question. What is a Value Stream?

A value stream is a map of all the value added and non-value added actions required to move a product through a process from start to end and place it into the hands of the customer. The value stream helps a business to focus on how to improve delivery to the customer.

A value stream flows just the same as a river. It has relative location points in the flow known as upstream and downstream.

All the supplier companies are upstream of the business producing the product or service.

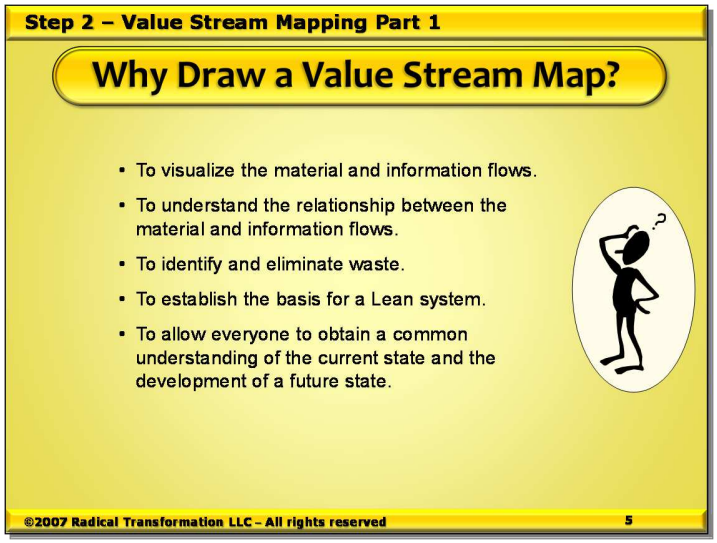
All the Customers and End Users are downstream of the business producing the product or service.



Example of a Current State Value Stream Map

This is an example of a current state value stream map. It may look a little overwhelming at first, but we will break it down into easy to understand steps.

We will be working through each of the necessary activities to demonstrate how to create this current state value stream map. It is based on an actual case study from a client company.



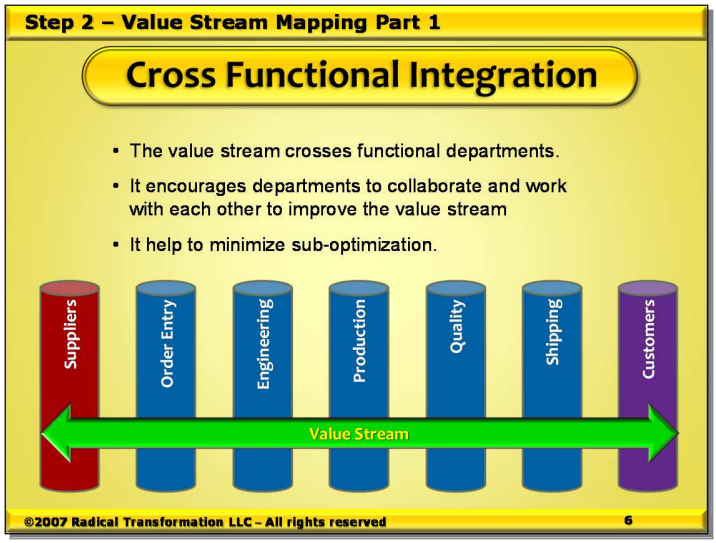
Why Draw a Value Stream Map?

The main reason for drawing a value stream map is to allow everyone in an organization to have the same level of understanding about what is actually happening in real time. Another important reason is to allow every employee to be able to understand the process and talk about it using the standard value stream terminology. It allows functional departments in an organization to communicate using a common language of the value stream which brings people into alignment towards a common goal.

A value stream map is a graphical tool which helps everyone in a business to visualize the material and information flows. This is very important because everyone throughout the organization needs to understand the relationship between the material and information flows. The main advantage of doing this is that a team can draw a value stream map to create a new system on a sheet of paper without moving any equipment or interrupting production.

The purpose of drawing a value stream map is to begin the process of identifying and eliminating waste that exists in each of the processes. This action will allow the organization to start to change their processes and establish the basis for a Lean system.

An organization will not be able to become a Lean Enterprise without the ability to discuss and manage at the value stream level.



Cross Functional Integration

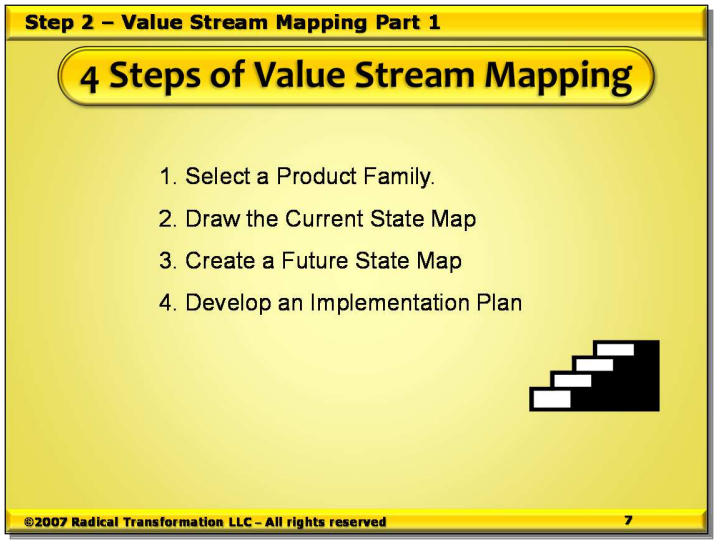
The value stream crosses all functional departments inside an organization. It also includes external organizations such as suppliers and customers.

Any departments that touch the information or material flows need to be involved in the development and management of the enterprise level value stream. Some companies will ask their suppliers and customers to send a representative to participate in the development of their enterprise level value stream map.

Understanding the enterprise level value stream encourages departments to collaborate and work together to improve the delivery of products or services to their customers.

Departments have traditionally remained separate from each other to maintain their own identifies but this practice encourages them to become isolated from each other which leads to sub-optimization.

Each functional department has a part to play in supporting the enterprise level value stream and delivering value to each of their internal and external customers.



4 Steps of Value Stream Mapping

There are four steps to a value stream mapping process:

1. Select a Product family.
2. Draw a Current State Value Stream Map.
3. Create a Future State Value Stream Map.
4. Develop a Value Stream Implementation Plan.

These four steps are easy to read but their application is a more difficult task to accomplish. A value stream team can only be responsible for completing these four steps to the best of their collective capabilities. It will require leadership support to follow through and give guidance on each step, and then to implement the finished plan.

The most important step is not listed and that is *executing the plan*. This step is the responsibility of the leadership team. It is surprising how many companies get their employees to develop enterprise level value stream maps and implementation plans but never *execute the plan*.

This is the ultimate waste of resources. An organization cannot become a Lean Enterprise without the discipline to create, develop, and implement an enterprise level value stream management system.

Step 1of 4 - Select a Product Family

We can start by asking a question: "*What is a Product Family*"?

It is a group of products that pass through similar steps and utilize common equipment or resources in downstream processes.

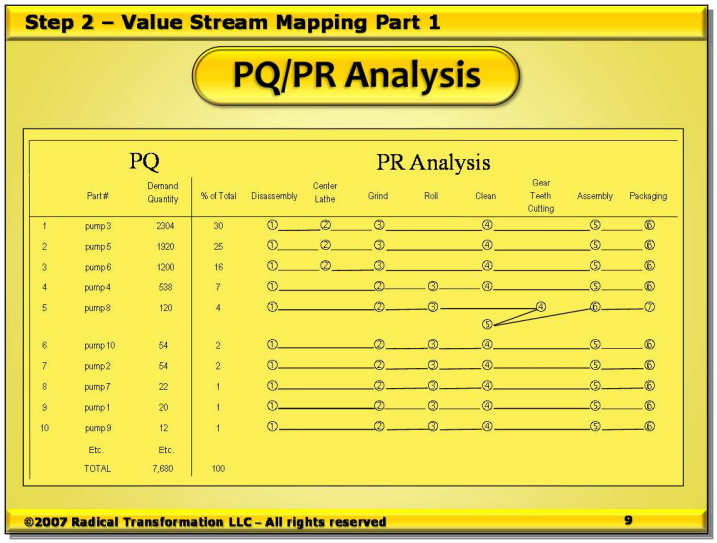
The main tool used to identify a product family is called a "Product Quantity and Process Route Analysis (PQ/PR)".

A Product Quantity Analysis looks at historical ordering data to determine the actual quantities for each of the products over time.

A Process Route Analysis identifies the movement or flow of each product from the start to the finish. It identifies and defines the process routing that each product will follow.

The typical Information in a PQ/PR Analysis is:

- Sequence number.
- Part number.
- Demand quantity for each product.
- Frequency or percentage of total demand.
- Operation routing for each product.



Create a PQ/PR Matrix

When you look at this screen you will see the typical Information from a PQ/PR Analysis presented in a matrix format. Each column in the matrix is important and defines the following:

1. Sequence number.
2. Part number.
3. Demand quantity for each product.
4. Frequency or percentage of total demand.
5. Operation routing for each product.

Each row in the PQ/PR matrix has information about an actual product. As each product is entered into the matrix a process pattern will start to emerge. These process patterns will begin to identify any products that use the same operations. It is an important visual tool to help identify these operational similarities.

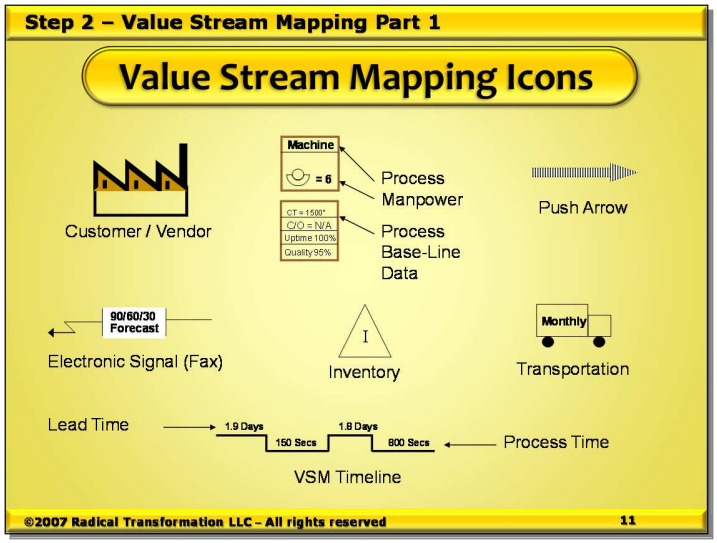
Products that follow the same processes routings are grouped together to form product families. There could be one or multiple product families within each value stream.

Step 2 of 4 - Create the Current State Map.

In Step 2 of the Value Stream Mapping process it is important to follow a standard procedure to create a map.

Here are some simple recommendations that will keep you on track:

- Start with an easy project. Begin to value stream map a process within your own plant or facility.
- Use actual, observed data wherever possible. Do not believe any historical data even though everyone will tell you it's accurate.
- Begin at the end point of a process and proceed in reverse flow
- Walk the entire process first before you start recording any data. Get comfortable with the process and how it is working.
- Every team member must create their own value stream map. Don't let each person draw part of a map and then everyone try to combine their maps to create the whole map. This is usually not successful in achieving a good result.
- Use pencil and paper to hand draw the map during the value stream event. This will help to keep all team members focused on the real process. It will be possible to use computer software to create an electronic version of a map at a later date.



Value Stream Mapping Icons.

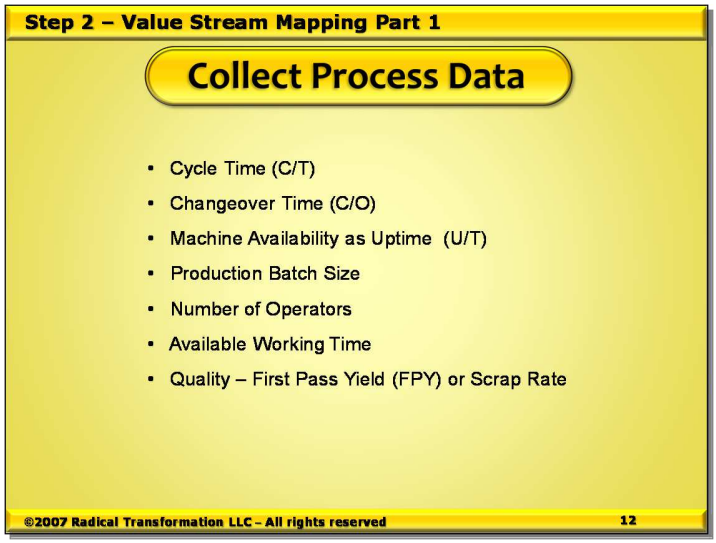
On this screen, you can see a selection of different icons. These are standard icons that are used in a current state value stream map.

It is not unusual for some companies to develop their own value stream mapping icons. The reason for doing this would be if the company is in a special field where standard icons do not represent their processes.

The only issue with this approach is that when people have been trained to use standard value stream mapping icons they may become confused with non-standard icons. In this situation, a company would need to do orientation training to demonstrate how it is designing and implementing its own icons.

Many of these standard icons are self-explanatory. As you go through each of the steps to develop a current state value stream map, you will start to identify and understand them.

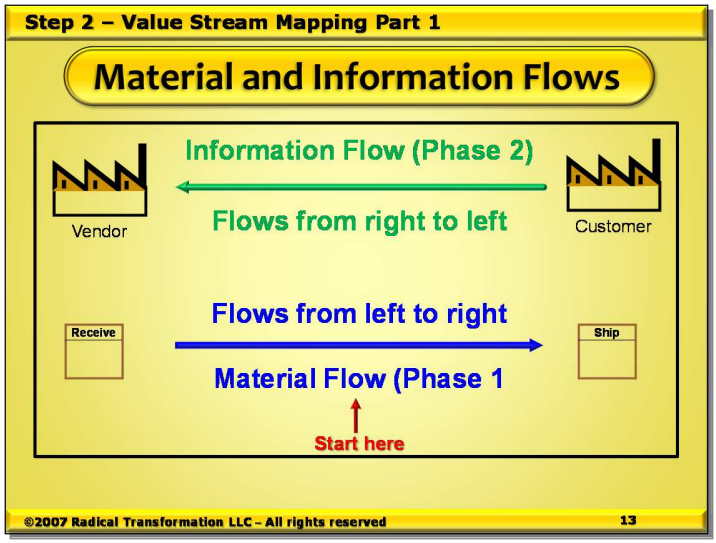
Practice makes perfect; this is the mantra for the application of any of the lean principles. The more you apply your knowledge, the more experienced you become at implementing lean techniques.



Collect Process Data

During a value stream mapping event it will be necessary to define a data collection procedure. What information will you need to develop a current state map? Here is a list of different data types:

- Process Cycle Time (C/T), which is the time taken to complete one item.
- Changeover Time (C/O), which is the time taken to change over from the last good item from the previous run to the first good item in the next run.
- Machine Availability, which is the time a machine is actually available for work. It is recorded as Uptime (U/T) which does not include machine downtime or production stoppages.
- Production Batch Size is the number of items being processed together.
- Number of Operators defines the actual number of people working on the process.
- Available Working Time is the total attendance hours less any non-working break and lunch time.
- Quality metric is often recorded as First Pass Yield (FPY) or Scrap Rate %.



Material and Information Flows

On this screen, you will learn about the two types of flow that are identified in a value stream mapping event:

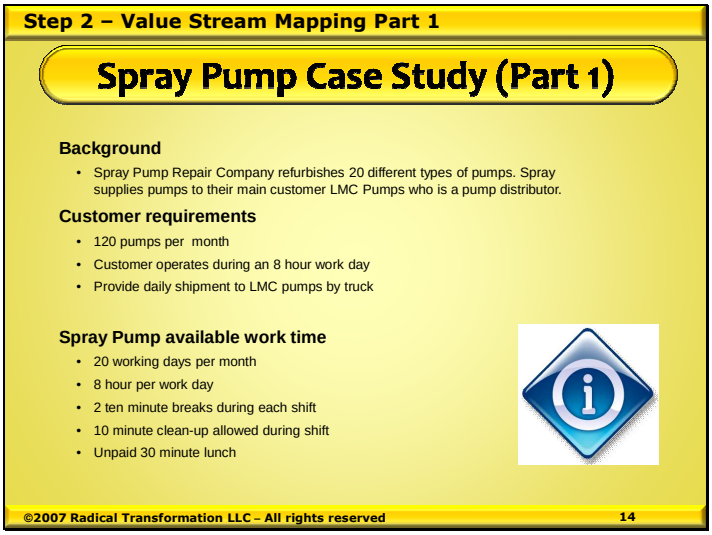
- Material Flow.
- Information Flow.

Information Flow is drawn moving from the right to left on the upper half of a piece of paper.

Material Flow is drawn from left to right on the lower half of a piece of paper.

A current state value stream mapping process has two phases. The first phase starts by identifying and drawing the material flow. The information flow is identified and drawn during the second phase of the process.

The information flow starts with the customer and moves towards the vendors, where they will connect into the material flow to create a complete loop back to the customer.



Spray Pump Repair Company Case Study (Part 1)

Now we are going to use a case study to draw a current state value stream map. Before we can do this we must collect the necessary information about the company and its processes. We have made it easier by outlining the information here and on the following screen.

Background

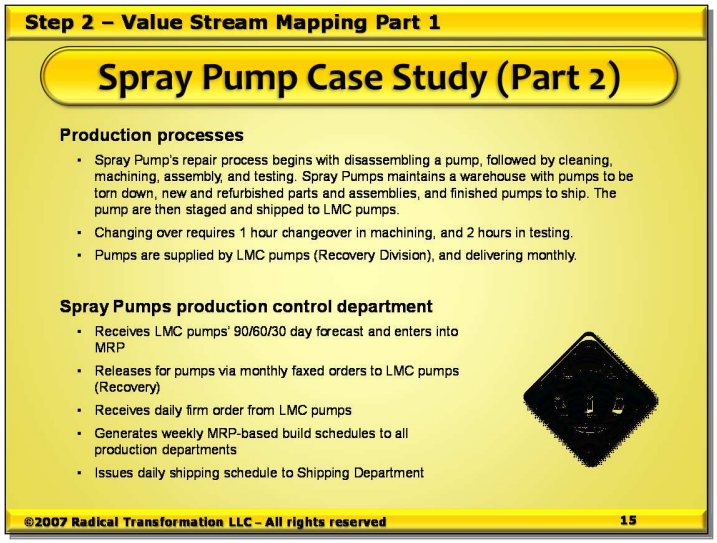
- Spray Pump Repair Company refurbishes 20 different types of pumps. Spray supplies pumps to their main customer LMC Pumps who is a pump distributor.

Customer requirements:

- 120 pumps per month.
- Customer operates during an 8 hour work day.
- Provide daily shipment to LMC pumps by truck.

Spray Pump Repair Co. Available Work time:

- 20 working days per month.
- 8 hour per workday.
- 2 ten minute breaks during each shift.
- 10 minute clean-up allowed during a shift.
- Unpaid 30 minute lunch.



Spray Pump Repair Company Case Study (Part 2)

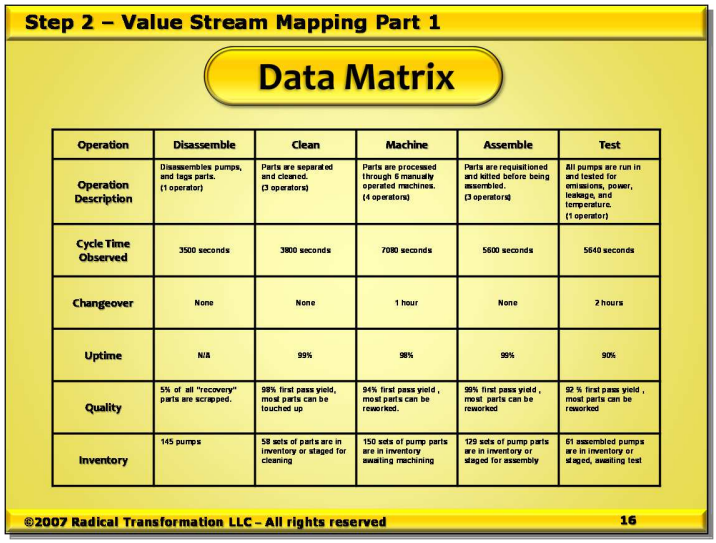
Here is the second screen with the remainder of the necessary data:

Production processes:

- Spray Pump Repair Company's repair process begins with disassembling a pump, followed by cleaning, machining, assembly, and testing. Spray Pump Repair Company maintains a warehouse with pumps to be torn down, new and refurbished parts and assemblies, and finished pumps to ship. The pumps are then staged and shipped to LMC pumps.
- Changing over requires 1 hour changeover in machining, and 2 hours in testing.
- Pumps are supplied by LMC pumps (Recovery Division), and delivering monthly.

Spray Pump Repair Company's production control department:

- Receives LMC pumps' 90/60/30 day forecast and enters into MRP.
- Releases for pumps via monthly faxed orders to LMC pumps (Recovery).
- Receives daily firm order from LMC pumps.
- Generates weekly MRP-based build schedules to all production departments.
- Issues daily shipping schedule to Shipping Department.



Spray Pump Repair Company Case Study – Data Matrix

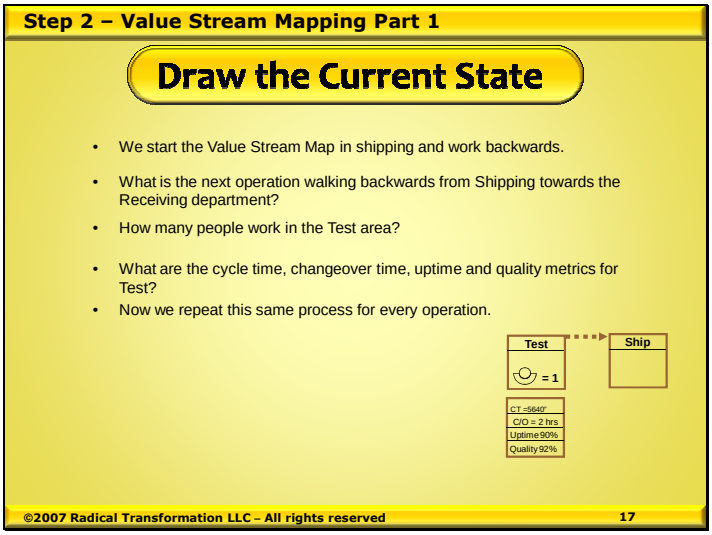
All the data that you saw on the previous two screens can be organized using a spreadsheet and presented in a matrix format.

This data matrix shows all the activities or operations at the top of each column. These operations are in the order that they happen in the process routing.

Each row in the matrix contains the process data for:

- Cycle Time (C/T) for each operation to produce one complete product.
- Changeover Time (C/O) for any equipment used at each operation.
- Uptime (U/T) for any equipment used at each operation.
- Quality records as First Pass Yield % or Scrap Rate % for each operation.
- Inventory recorded as the number of pumps waiting at each operation.

All the information in the data matrix is a critical requirement before you can start to create a current state value stream map for Spray Pump Repair Company.



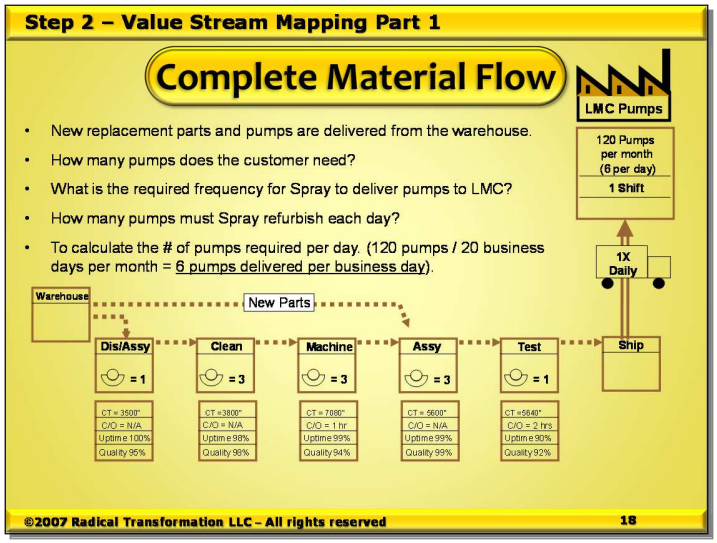
Draw the Current State Value Stream Map

Now that we have finished preparing and collecting the data, we can take a piece of paper and start drawing the current state value stream map. We begin to draw the current state value stream starting in the shipping department and work backwards through each operation. We start creating the map in reverse because we are able to see things from the viewpoint of the customer. If we were doing this exercise in a company facility, we would be walking the value stream in real-time.

What is the next operation walking backwards from Shipping towards the Receiving department?
If you check the data matrix, you will see it is the Test area. We can draw the process box for the Test area.

How many people work in the Test area?
You can see there is only one person, and the symbol in the process box represents a single individual person. Next to the symbol is the number 1 to show only one person is working in this area.

What are the cycle time, changeover time, and uptime and quality metrics for Test?
All of this data can be taken from the data matrix and entered into the Test data box as demonstrated on the screen. Now we repeat this same process for every operation along the material flow.



Complete the Material Flow

On this screen you can see that every operation has been added to the current state value stream map. All process and data boxes have been drawn with the relevant data for each operation from the data matrix.

Spray Pump Repair company keeps all of its pumps that are waiting for repair and all new replacement parts stored in its warehouse. *Pumps waiting for repair are delivered to the Disassembly operation to start their refurbishment process. New replacement parts are delivered direct to the Assembly operation.

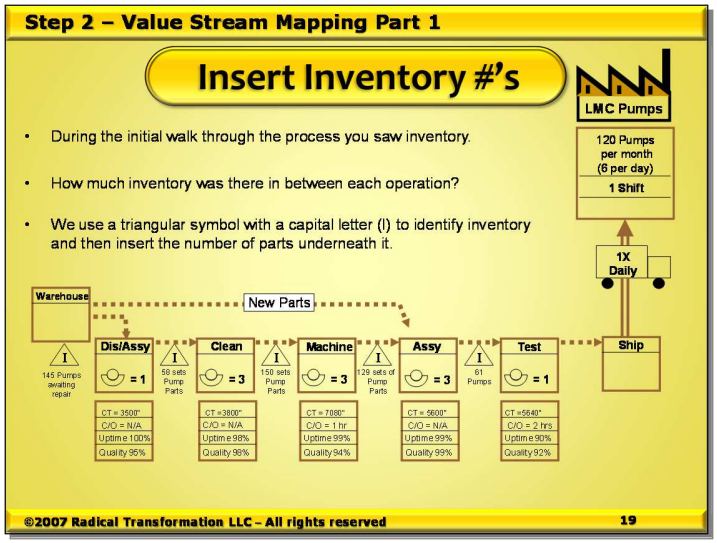
This section of the current state value stream map will focus on defining the production requirements for the material flow. It will require a series of questions to be answered to establish the customer's needs.

1. *How many pumps does the customer need? The answer is they want 120 pumps per month. Note: There are 20 business days in a month.

2. What is the required frequency for Spray Pump Repair Company to deliver pumps to LMC? The answer is they require 1 delivery every business day.

3. How many pumps must Spray Pump Repair Company refurbish each business day? We must use the answers from these questions to calculate the # of pumps required per business day.

120 pumps / 20 business days per month = ***6 pumps delivered per business day.***



Insert the Inventory Numbers

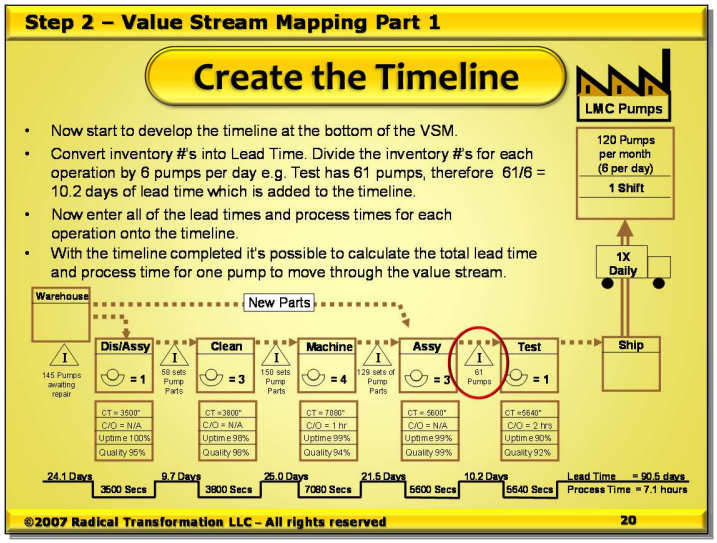
*During the initial walk through to observe the process, the value stream team members will have noticed inventory or work in process (WIP) at each operation. An excessive build-up of inventory at any point is an indication that an operation is a constraint and creating a bottleneck in the process.

So, we must ask another question. How much inventory was there in between each operation?

We use a triangular icon with a capital letter "I" to identify inventory. The total amount of inventory that was observed at each workstation when the team collected the data is written underneath the triangular icon.

We can find this information in the data matrix and write it onto the current state value stream map in between each operation.
The total inventory will appear on the current state value stream map on the screen. The inventory totals were:

Disassembly	=	145 pumps.
Clean	=	58 pump sets.
Machining	=	150 pump sets.
Assembly	=	129 pump sets.
Test	=	61 pumps.



Create the Value Stream Timeline

Now we can start to develop the timeline at the bottom of the current state value stream map. This is a castellated line with upper and lower parts to the timeline.
The upper sections are where the team will enter the lead time for each operation. The lower sections of the line are where the team will enter the process time for each operation.
First we must convert the inventory quantities at each operation into days of inventory or lead time. We do this using this calculation:

Divide the inventory #'s for each operation by 6 pumps per day.

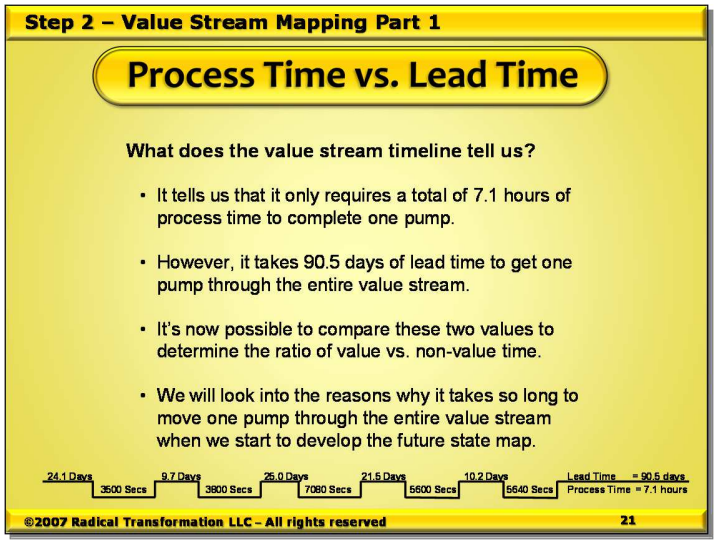
E.g. Test has 61 pumps, therefore 61/6 = 10.2 days of inventory or lead time, which is added to the upper level of the timeline.

Now calculate and enter all the lead times and process times for each operation onto the timeline. This is demonstrated on the screen.

With the timeline completed it's now possible to calculate the sum total lead time and process time. These times represent the actual time for one pump to move through the entire value stream.

Lead Time = 90.5 days.

Process Time = 7.1 hours.

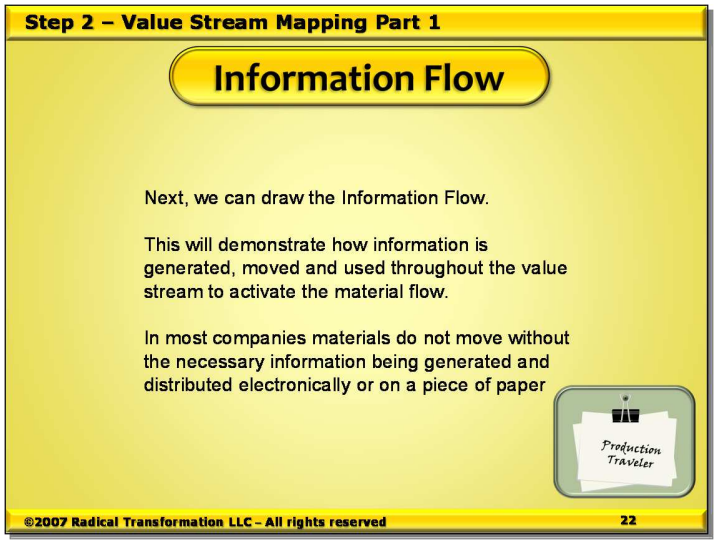


Process Time vs. Lead Time

Once the timeline has been completed, we can compare the lead time to the process time. What does the value stream timeline tell us?

- It tells us that it only requires 7.1 hours of total process time to complete one pump.
- However, it takes a lead time of 90.5 days to get that one pump through the entire value stream.
- Using the two values, we can calculate the ratio of value added vs. non-value added time. This is a ratio of 7.1 hours vs. 90.5 days. We need to convert the lead time of 90.5 days into hours, we do this by multiplying 90.5 by 8 hours per day = 724 hours.
- The ratio calculation is 7.1 ÷ 724 x 100 = 0.98% of value added time. This is telling us that each pump is being physically worked on for only 1% of the total lead time. It is experiencing one or more of the eight wastes, i.e. waiting, transportation, rework, etc. during 99% of the total lead time.

We will look into the reasons for the value added time being only 1% and why it takes so long to move one pump through the entire value stream when we start to develop the future state map.



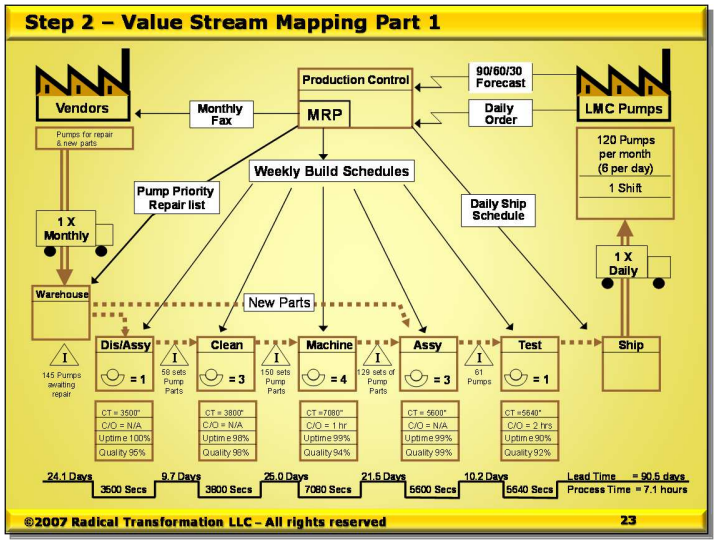
Information Flow

Now that the material flow has been completed, we can start to draw the information flow onto the current state value stream map.

The information flow will demonstrate how the information is generated, moved, and used throughout the value stream to activate the material flow.
In most companies materials do not start to move without the necessary information being generated and distributed electronically or on a piece of paper.

Production managers rely on some type of document to instruct them to initiate the manufacturing process. Without it they will not know what, when, who, or how to do anything.

We will go through a step by step procedure to develop and add the information flow to the value stream map.



Draw the Information Flow

All information in a value stream map begins by defining a customer's requirements. These requirements will define the what, when, and where a business will deliver to their customer. It is then a business management team's responsibility to define exactly how they will respond to be able to meet their customer's requirements. Let us now start to develop the information flow.

Spray Pump Repair Company has a Production Control department. It relies on a Manufacturing Resource Planning (MRP) system to coordinate capacity planning, production scheduling, and material replenishment for the value stream.

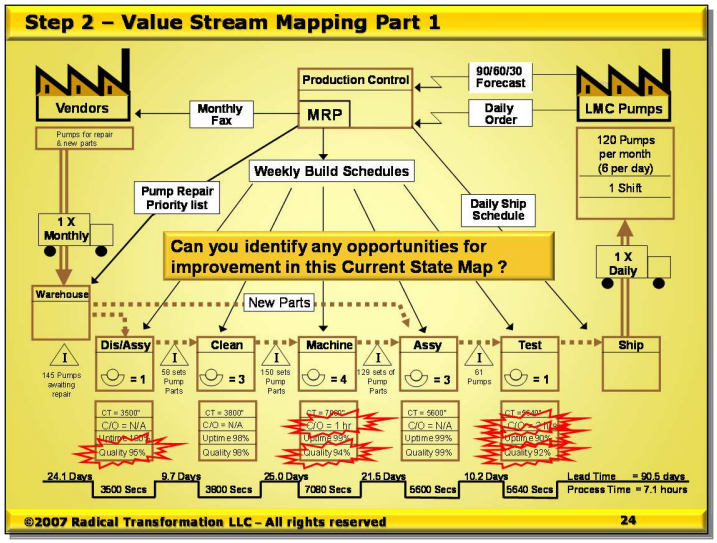
Spray's Production Control department receives two faxed documents from LMC Pumps. One is a 90/60/30 day forecast which allows Spray to anticipate what the customer's future requirements are likely to be. The second document is a firm daily order based on the customer's actual requirements.

The Production Control Department sends a monthly fax to their vendors to give them an indication about what they are probably going to need based on LMC Pumps forecast. Spray's vendors will deliver once during the month. The MRP system generates three documents:

1. A daily Pump Priority Repair List that is based on LMC Pump's daily order. This document is sent to the warehouse, informing them to prepare specific types of pumps for repair.

2. A Weekly Build Schedule which is sent to each operation. It is informing them which pumps to repair and build during the week.

3. A Daily Shipping Schedule is sent to the Shipping department. It tells them what pumps to ship to the customer.



Identifying Opportunities for Improvement.

The current state value stream map is now completed. The only thing left to do is to identify any opportunities for improvement in the map. We start this process by asking a question:

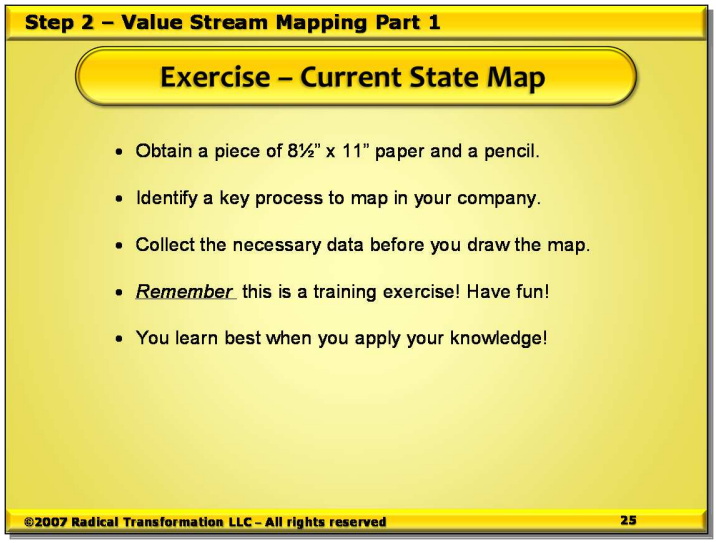
Can you identify any opportunities for improvement in this current state value stream map? To answer this question we have to define what an opportunity for improvement is.

An opportunity for improvement is something that is creating waste in the value stream. The waste is reducing the amount of value being delivered to the customer. It is important to start by looking for low hanging fruit. You can dig deeper when you get more experience with the value stream mapping process. Take a look at the screen to see if you can see any obvious opportunities for improvement.
Here are the opportunities for improvement the value stream team identified.

Machining (1 hour) and Test (2 hours) have long changeover times. This means an operation is not able to produce anything during a period of changeover time. These two operations will become bottlenecks and restrict the flow. We need to find ways to reduce these two changeover times to below 10 minutes if possible.

Test has an uptime of 90%, which means the operation is not producing for 10% of the available time. This uptime performance is way below the other operations which will impact the effectiveness of the Test operation. Uptime and the changeover issue in Test will have a worsening effect on the overall value stream.

Disassembly, Machining, and Test have quality issues with 95%, 94% and 92% respectively. What is causing these low percentages in comparison to the rest of the operations? It is important to find out why these three operations are not capable of reaching a 98% – 99% range on a consistent basis.



Exercise

We would like you to get involved in another practical exercise. We want you to draw your own current state value stream map.

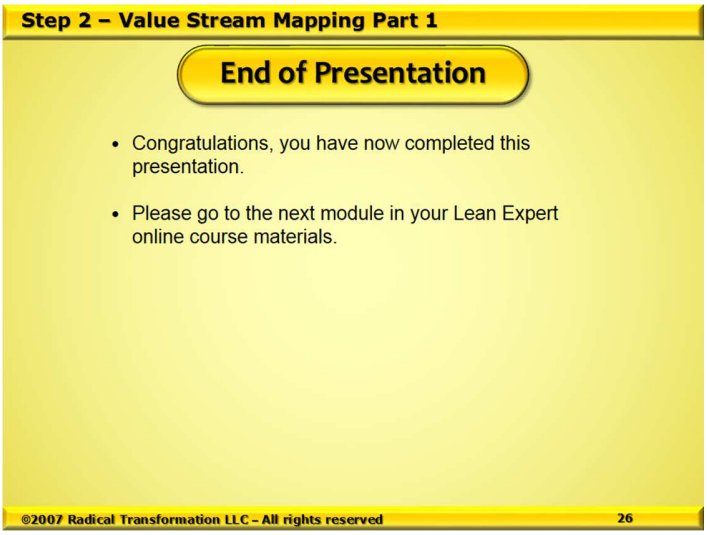
Obtain a piece of 8½" x 11" paper and a pencil.

Identify a key process to map in your company.

Collect the necessary data before you draw the map.

It's important to remember, this is a training exercise designed to help you, so try to have fun with it. You learn best when you apply your knowledge.

Note: Please get the necessary permissions before mapping a business processes.



End of Presentation.

Congratulations, you have now completed this presentation.

Please go to the next training module in your Lean Expert online course materials.

Lean Expert Course Workbook - Step 2 Value Stream Mapping Part 1

Reference Materials

1. **Learning to See: Value Stream Mapping to create value and eliminate muda**

   By: Mike Rother and John Shook. Published by Lean Enterprise Institute (LEI) 1998.

2. **Value Stream Management: Eight steps to Planning, Mapping and Sustaining Lean Improvements.**

   By Don Tapping, Tom Luyster and Tom Shuker. Published by Productivity Press 2002.

3. **Value Stream Management: Eight steps to Planning, Mapping and Sustaining Lean Improvements.**

   By Don Tapping, Tom Luyster and Tom Shuker. Published by Productivity Press 2002.

Lean Expert Course Workbook - Step 2 Value Stream Mapping Part 1

Documents List

No documents are required for this training module.

