UNIT-6 Lean Process Improvement

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Define Lean and its key terms
- ✓ Describe the Toyota Production System and the TPS house
- ✓ Describe the five critical improvement concepts
- ✓ Use the Kano model to understand, describe, analyze, and improve value
- ✓ Identify and reduce various types of waste
- ✓ Create a plan for a more environmentally Lean organization
- ✓ Use the PDSA and R-DMAIC-S models to plan, execute, and evaluate Lean changes
- ✓ Use Lean thinking frameworks, including 5W-2H, Genchi Genbutsu and Gemba
- ✓ Prepare for and complete a basic 5-S
- ✓ Describe the key elements of Kaizen events, particularly a Kaizen blitz
- ✓ Gather, analyze, and interpret data using flow charts, Ishikawa (fishbone) diagrams, SIPOC diagrams, and value stream maps
- ✓ Go back to your organization with a plan to begin incorporating Lean into your corporate culture

Unit 6

Lean Process Improvement

Defining Lean

Lean process improvement is **a culture of ideas, tools, and processes that are designed to eliminate waste and improve workflow, to provide maximum value for minimum cost.** Although it has only emerged as a popular business idea in the past few decades, its basic concepts have existed for over 300 years.

It is important to note that Lean should not be viewed as a quick fix or something that just a particular department does. The companies that have success with Lean efforts are those that incorporate it as part of their culture. Ideally, all employees should have some form of Lean training, whether it is a quick seminar or a complete certification.

The History of Lean

The Beginning of Lean Thinking

During the **mid-1700's**, the production of goods gradually shifted from a single person making a single product to mass production. This period is referred to as the Industrial Revolution. However, right from the beginning of the revolution, some scientists started to realize that mass production could cause waste.

Benjamin Franklin is widely regarded as the first efficiency expert. In his **1758** treatise *The Way to Wealth,* he said, "You call them goods; but, if you do not take care, they will prove evils... if you have no occasion for them, they must be dear to you." This is the core of a key Lean principle: Just-In-Time production.

Scientists Frank and Lillian Gilbreth were famous for their motion studies in the early **1900's**. Frank Gilbreth observed brick workers, for example, and noted that they although they all had the same tasks, each did their work slightly differently using different motions. He felt that developing one best way to lay bricks would reduce the number of motions needed and thereby save effort and time. He eventually reduced each bricklayer's motions to 4.5 from 18.

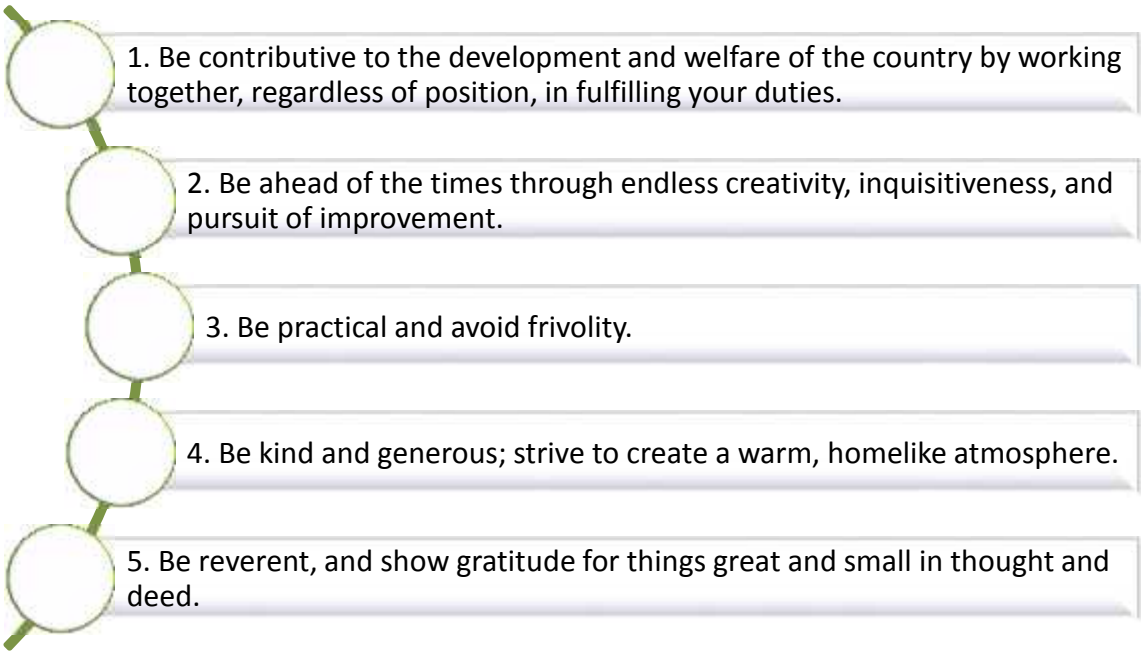
In **1911**, Frederick Winslow Taylor took things a step farther with his book *Principles of Scientific Management.* He said: "And whenever a workman proposes an improvement, it should be the policy of the management to make a careful analysis of the new method, and if necessary conduct a series of experiments to determine accurately the relative merit of the new suggestion and of the old standard. And whenever the new method is found to be markedly superior to the old, it should be adopted as the standard for the whole establishment."

The Automobile Industry

This coincided with Henry Ford's work in the **1920's** to develop the first comprehensive Lean manufacturing strategy to build the Model T automobile. His focus was on improving assembly lines (an idea he got from meat packing plants) by reducing waste and improving the flow of work. He was heavily influenced by the works of Benjamin Franklin, Frederick Winslow Taylor, and the Gilbreths.

The ideas that would later be called "Lean philosophy" also originated in the early 20th century. In **1934**, Sakichi Toyoda changed the family business from textiles to automobile production. Things were not going smoothly, however, and Toyoda sent Taiichi Ohno to America to observe Ford's methods. Ohno's experiences and ideas evolved into the Toyota Production System.
When Sakichi Toyoda died in 1930, his son Kiichiro officially adopted his business philosophy as Toyota's way of doing business.

This philosophy became the Toyoda Precepts:



(Source: http://www.toyota.co.jp/en/environmental_rep/03/rinen.html)

Modern Thinkers

And thus, Lean philosophy was begun. Major efforts to bring this philosophy to the Western world have included:

- *The Machine That Changed the World*, by Daniel Jones, Daniel Roos, and James Womack (1990, reprinted in 2007)
- *The Toyota Way*, by Jeffery Liker (2003)

Lean vs. Six Sigma

You may have heard various terms describing Lean philosophy. You may have heard talk of Six Sigma, different belts, and Six Sigma variations for different industries. What does it all mean?

Six Sigma is a set of tools used to control business processes by reducing defects and improving quality. It is based on the idea that defects result from deviation, and that therefore there should be no more than six sigma (standard deviations) between a process and its norm. Six Sigma involves understanding customer needs, analyzing data, and process improvement. A **Six Sigma Belt** (yellow, green, or black) denotes a particular level of expertise.

Lean refers to a set of tools that are designed to improve flow and reduce waste during a business process or material production. They can be used within Six Sigma efforts or on their own.

Lean Six Sigma combines the two methodologies. First, Lean methodologies are used to improve processes. Then, Six Sigma tools are applied to reduce deviations and defects.
Design for Six Sigma (DSS) and Design for Lean Six Sigma (DLSS) are methodologies used to design (or re-design) products and processes from scratch using Six Sigma or a combination of Six Sigma and Lean tools. These methodologies focus on getting it right the first time rather than improving it later.

It is worthwhile to note that Six Sigma and Lean have been customized and specialized for many industries.

Pre-Assignment Review

One of the difficult aspects of learning about Lean is that many of its terms are unfamiliar or in Japanese. As a pre-assignment, you were asked to define a few of these words. Let's see how you did.

Word List

Kaizen	2
Jidoka	4
Ishikawa	7
Heijunka	6
Muda	8
Pokayoke	3
Kaikaku	1
Genchi Genbutsu	5

Definition List

1. A fast, radical change process
2. Continuous improvement
3. Error proofing
4. Error-free production
5. Go and see (where the action is)
6. Resource leveling
7. The name of the scientist who invented cause and effect (fishbone) diagrams
8. Waste

A Lean Glossary

Let's review some additional terms related to Lean process improvement. You are not expected to memorize all of these terms; rather, keep this page handy as we move through the course. Please ask questions as needed.

Term	Definition
Autonomation or Jidoka	A semi-automatic process; human and machine working together.
Benchmarking	Measuring products, processes, services, etc. against the highest standard.
Blitz	A fast, structured, focused process for improving something (a process, a workspace, etc.).
Cycle Time	The time required to complete one cycle of a particular operation.
Five S (5S)	The principles for achieving and maintaining an effective workplace: Seiri, Seiketsu, Seiso, Seiton, and Shitsuke.
Flow	The way production moves from the beginning (raw material) to the end (customer). This is a key principle of Lean – Lean envisions the flow as one smooth process.
Gemba	A Japanese term meaning, "Where the action is."
Genchi Genbutsu	A Japanese term meaning, "Go and see for yourself."
Heijunka	The process of leveling the workload between resources.
Just-in-Time (JIT)	A production system where each item required is produced and available precisely when needed, in the exact amount.
Kaikaku	A fast, radical change process.
Kaizen	Constant, gradual improvement to a process in order to create less waste but more value.
Lead Time	How long a customer must wait for the product after they place an order.

Term	Definition
Muda	An activity that creates no value but consumes resources and is therefore considered waste. There are seven types of muda which will be covered later on in this course.
Mura	Inconsistency and deviation.
Muri	Irrationality.
Pokayoke	A mistake-proofing device such as quality testing or checklists.
Pull	A production philosophy where only what is ordered by customers is produced. Key element of Just-In-Time.
Push	A production philosophy where products are created regardless of demand.
Takt Time	The rate at which customers are demanding a product. This is the heartbeat of any Lean enterprise.
Value	Desired characteristics provided to the customer at the right time, place, and cost.
Value Stream	The process of designing, producing, and delivering a product.

The Toyota Production System

Overview of the Liker Pyramid

Pyramid Overview

One of the most popular descriptions of Lean philosophy for Western audiences is that portrayed by Jeffery Liker in his 2004 book *The Toyota Way.* This representation organizes the four main principles of Lean as a pyramid. Each part of the pyramid contains one or more key Lean principles.

Parts of the Pyramid

The foundation of the pyramid represents **Philosophy**. Its sole principle is to base your management decisions on long-term philosophy. This ties back to the discussion that we had earlier on Lean being part of the corporate culture.

The second level is **Processes**, where we can eliminate waste and increase value. This involves:

- Creating continuous flow.
- Using pull production systems, where we make only as much product as is demanded by the customer.
- Leveling out work so that resources are not overwhelmed or idle.
- Encouraging members of the organization to get it right the first time and to stop and fix problems.
- Standardizing and documenting work.
- Using visual tools, like lights and signage.
- Use reliable technology.

Once we have the philosophy and processes in place, we can move onto the third level: **People and Partners**. Here, we will aim to:

- Grow leaders and exceptional people and teams.
- Treat your partners as such: encourage them to improve and challenge them in a respectful manner.

At the top of the pyramid, we have **Problem Solving**. In other words, once your Lean system is solidly in place, you can focus on continuously improving your systems. The key principles of continuous improvement are:

- Always go and see for yourself (Genchi Genbutsu); never assume or believe what you are told.
- Remember the old saying, “Ready, aim, fire!” (In other words, take your time when making a decision, but implement it quickly.)
- Become a learning organization. Encourage or require all members to grow and evolve.

Exploring the Philosophy

Short-term philosophy is just like it sounds. It often focuses on the small picture and/or definite ideas and processes. Short-term philosophies can be great for achieving quick results, but they may leave your organization floundering when that result is achieved.

Your organization’s **long-term philosophy** is what will set its long-term path and ultimately determine its success. Your philosophy should not be specifically about Lean processes or tools; rather, embrace Lean ideas and combine them with your corporate culture to create a philosophy to guide your business for years to come.

Considering the Processes

Brainstorm ways that you could implement each principle.

Creating continuous flow

Using pull production systems

Leveling out work so that resources are not overwhelmed or idle

Encouraging members of the organization to get it right the first time

Standardizing and documenting work

Using visual tools, like lights and signage

Use reliable technology

Understanding People and Partners

Challenging Our Partners at Acme Wholesalers

Acme Wholesalers Inc. did a lot of importing from other countries. Their customs team always had a lot of paperwork and there were always a lot of phone calls between the team, the border services agency, and the suppliers trying to get mistakes and corrections sorted out. Everyone in the company knew about the problem but no one knew how to fix it.

One day, the vice-president of Acme Wholesalers was at a conference. He heard about a new computer program provided by the government that enabled companies to order products from other companies. Customs paperwork was then automatically generated for all three parties, and corrections were made via a structured, real-time process.

The vice-president immediately went back to his organization and set up a project team to examine and implement this solution. He challenged them to have 75% of their suppliers on board with this program within a year.

The team did such a great job outlining the benefits of the program that 95% of the suppliers were on board within six months. Errors for those suppliers were reduced by 88% and the team's workload was reduced by 78%. This enabled some members to be re-assigned to new tasks, and other members to take on new continuous improvement efforts. And, the team uses much less paper and other office supplies – extending the savings to the environment and the organization much further.

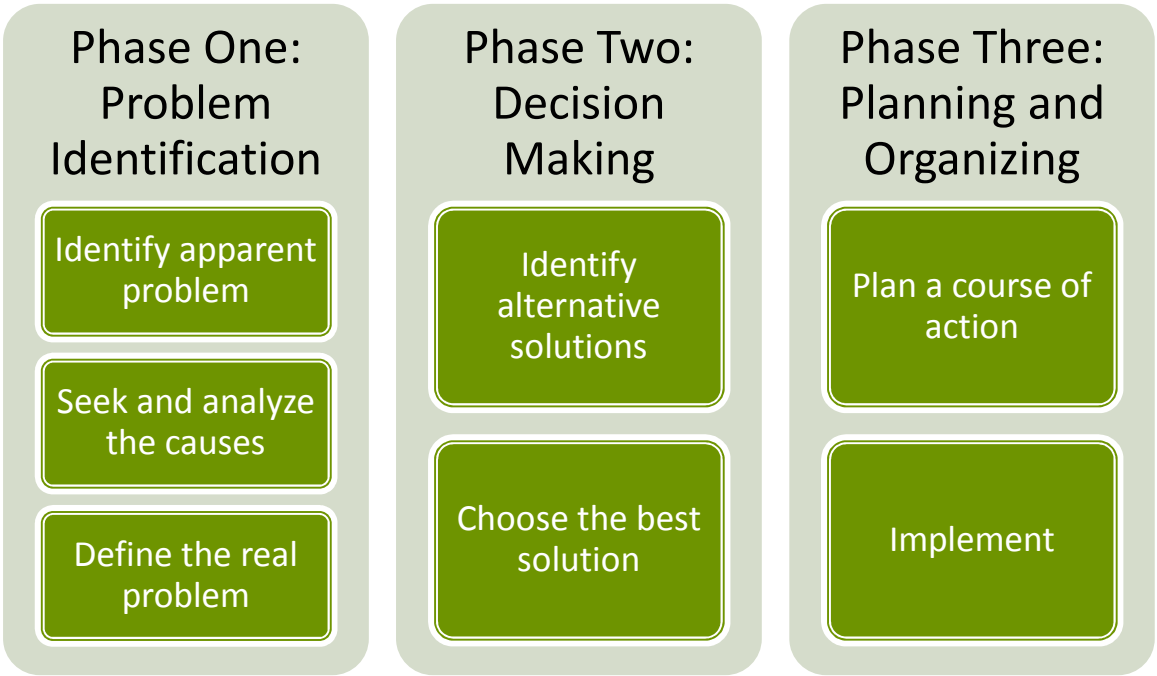
Discussion Question

Think of one way that you could challenge a partner or supplier (or other external partner) to continuous improvement.

Problem Solving Tools

The top of the Liker Pyramid is problem solving. This involves gathering data and using the PDSA cycle (Plan, Do, Study, Act) to continuously improve your organization.

It is important to have a basic understanding of problem solving to successfully achieve this step. Whenever you read a book on problem solving, this model, in some form or other, is sure to be there. It may have six steps rather than seven, or it may have five steps. However, the model doesn't really change...just the authors' ways of breaking it down.



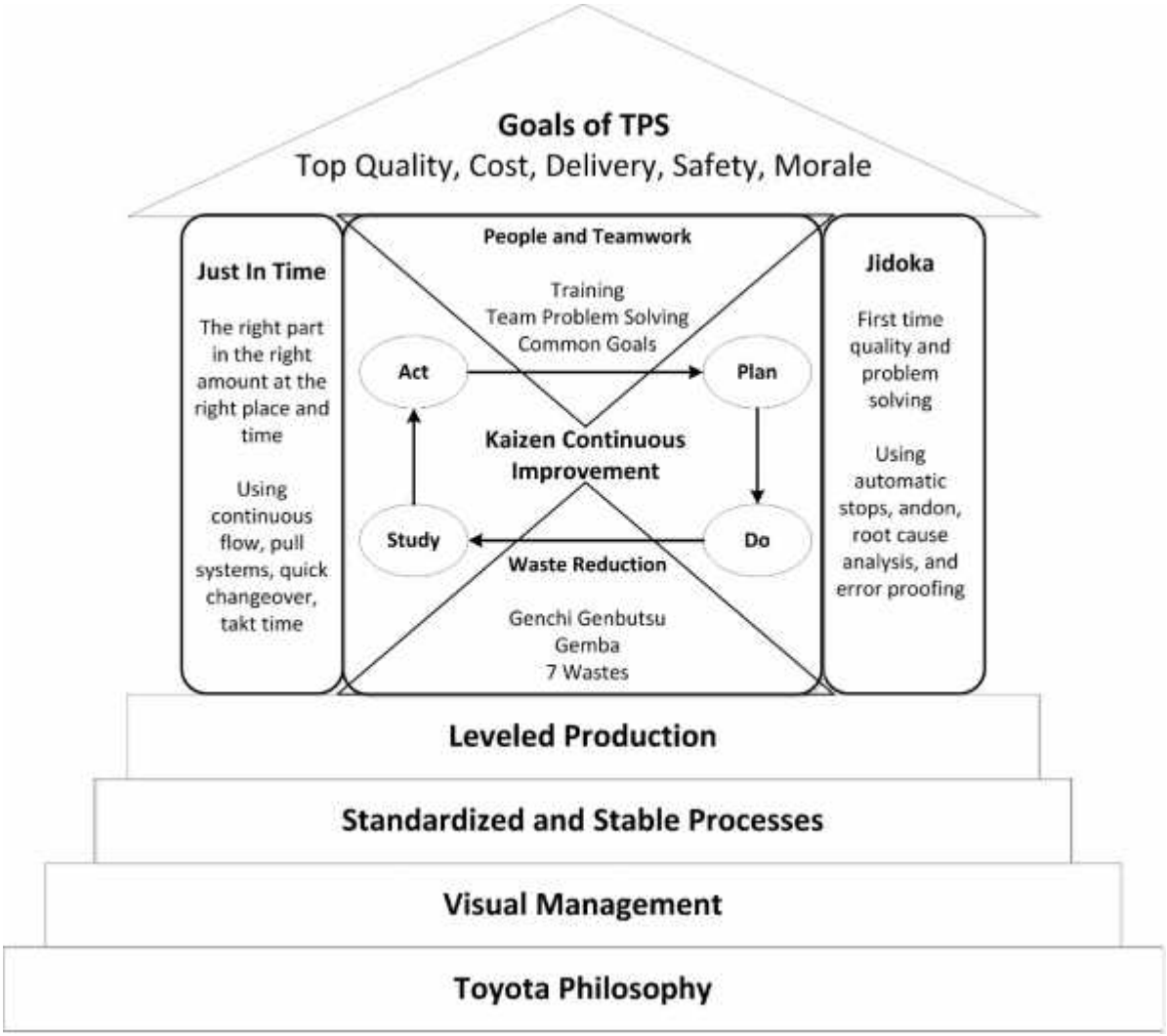
As you work your way from problem to solution, you are actually shifting your focus.

- When you define a problem, you ask yourself: What is my problem?
- As you try to analyze the root causes you ask: Why is it a problem?
- When you are generating options, you ask yourself: What are some ways I can solve my problem?

The Toyota Production System House

Model Overview

The concepts of Lean and the Toyoda precepts are often translated into a house to help us understand how all the elements come together.



The Roof

The goals and objectives of the Toyota Production System make up the roof of the house. The system aims to achieve:

- Top quality
- Minimal cost
- Proper delivery time
- Good safety and morale

The Pillars

Just-In-Time and Jidoka are the two pillars of the system.

- **Just-In-Time** means that you have what you need when and where you need it. It means no shortages, no waste, no bottlenecks, and no waiting. This can be accomplished with continuous flow, pull systems, quick changeovers, and attention paid to takt time (the rate at which customers are demanding product).
- **Jidoka** means error-free production. This means getting it right the first time, every time. This means stopping production if a defect is found, performing root cause analysis to fix the true nature of problems, error proofing processes, assigning appropriate work to people and machines, and using visual signals (andon) to signal progress or issues.

The Core

The core of the system relates back to the principles we looked at earlier: people, problem solving (through Kaizen improvement), and the process of waste reduction. We can look at these three things as the core of the TPS philosophy.

The Foundation

A strong system must have four basic elements:

- Leveled production, so that resources are not overworked or idle (heijunka)
- Standardized, stable, non-varying, documented processes
- Visual management tools (signs, lights, etc.)
- Commitment to the Toyota philosophy of long-term learning, problem solving, and the involvement of people

The Five Critical Improvement Concepts

Key Ideas

There are five key ideas supporting Lean process improvement. Let's take a look at those now.

Value

The Oxford English Dictionary defines it as, "The regard that something is held to deserve; importance or worth."

In terms of Lean, value means what we want out of a product, service, or process. In other words, it is a desirable result that has some worth. Any process should put out more than it consumes. For example, if producing a widget costs $20 but you're only selling it for $15, you are not creating value.

There are two basic ways to increase value: **increase revenue** or **decrease cost**. Both of these can be done with Lean processes.

Waste

Waste is the second key concept of Lean. It is the opposite of value: anything that we do not want, or a result that has no worth. Eliminating waste is at the root of most, if not all, Lean processes.

In his book *Toyota Production System*, Taiichi Ohno says, "In production, 'waste' refers to all elements of production that only increase cost without adding value – for example, excess people, inventory, and equipment."

Variation

All processes have variation, no matter how undesirable it is. For example, the earth takes about 365.25 days to revolve around the sun. What most people don't know is that that figure is just an average: sometimes it's a bit more and sometimes it's a bit less. Variations in production, however, inevitably cause waste.

The key to Lean processing is identifying the cause of variations and resolving them where possible. Variations usually arise from three key areas.

System Variations
These variations arise from common, random, or systemic causes. An example is the solar system variation that we just discussed. To reduce this type of variation, you need to change the system by identifying the root cause(s) of the variation and addressing that specific problem.

Special Cause Variations
These are caused by an assignable event. For example, your sales go down because of a competing product introduced to the marketplace at a much lower price than your product. To reduce special cause variations, find out what is causing it and examine how it impacts performance. There may be ways that you can minimize the negative effects and boost the positive effects.

Structural Variation
These variations happen because of cycles or long-term trends. For example, you may sell a particular product only at Christmas. You often cannot address this type of variation directly (for example, you can't cancel Christmas!). However, you may be able to make changes to reduce the impact of the cycle or trend.

Complexity

Complexity is another factor that can cause waste. There are four aspects to complexity:

- **Size** (how many parts are involved in the process)
- **Volume** (the size of the process)
- **Density** (relationship of size and volume)
- **Time** to complete a product cycle

The smaller these parts are, the simpler the system is. Increasing any of these items will increase complexity. This means that in order to make a process lean and efficient, we should make its components simple and straightforward.

Continuous Improvement

The final concept is continuous improvement. Lean processes must not be a one-time event. Your path towards improvement should be a continuous cycle. The most important part of this is creating a commitment to constant learning and knowledge management. This can be done through organizational problem solving, a commitment to cyclical Lean efforts, and the PDSA cycle, which we will discuss later on in the course.

Case Study

Case Study

Smith Plumbing is facing some serious problems. After some major organizational changes, their profits have dropped and their customer base has shrunk significantly. The new president has implemented a system where plumbers return to home base to have their previous job signed off on by two supervisors. The sign-off process includes an interview, a checklist, and a carbon copy form. Only then can plumbers receive their next assignment. Another source of frustration is that the instructions with the sign-off process are unclear, causing each supervisor to complete it in a different way.

Plumbers complain that this has significantly reduced their available field time, particularly since supervisors are not always available. As well, the new president has discontinued the Smith Superstars membership program, which gave customers one free service after ten paid services. There have been many complaints from customers about this change.

Task

You have been asked to use your new Lean knowledge to help Smith Plumbing get back on track. Offer some suggestions based on each of the five key critical improvement concepts.

Value

Waste

Variation

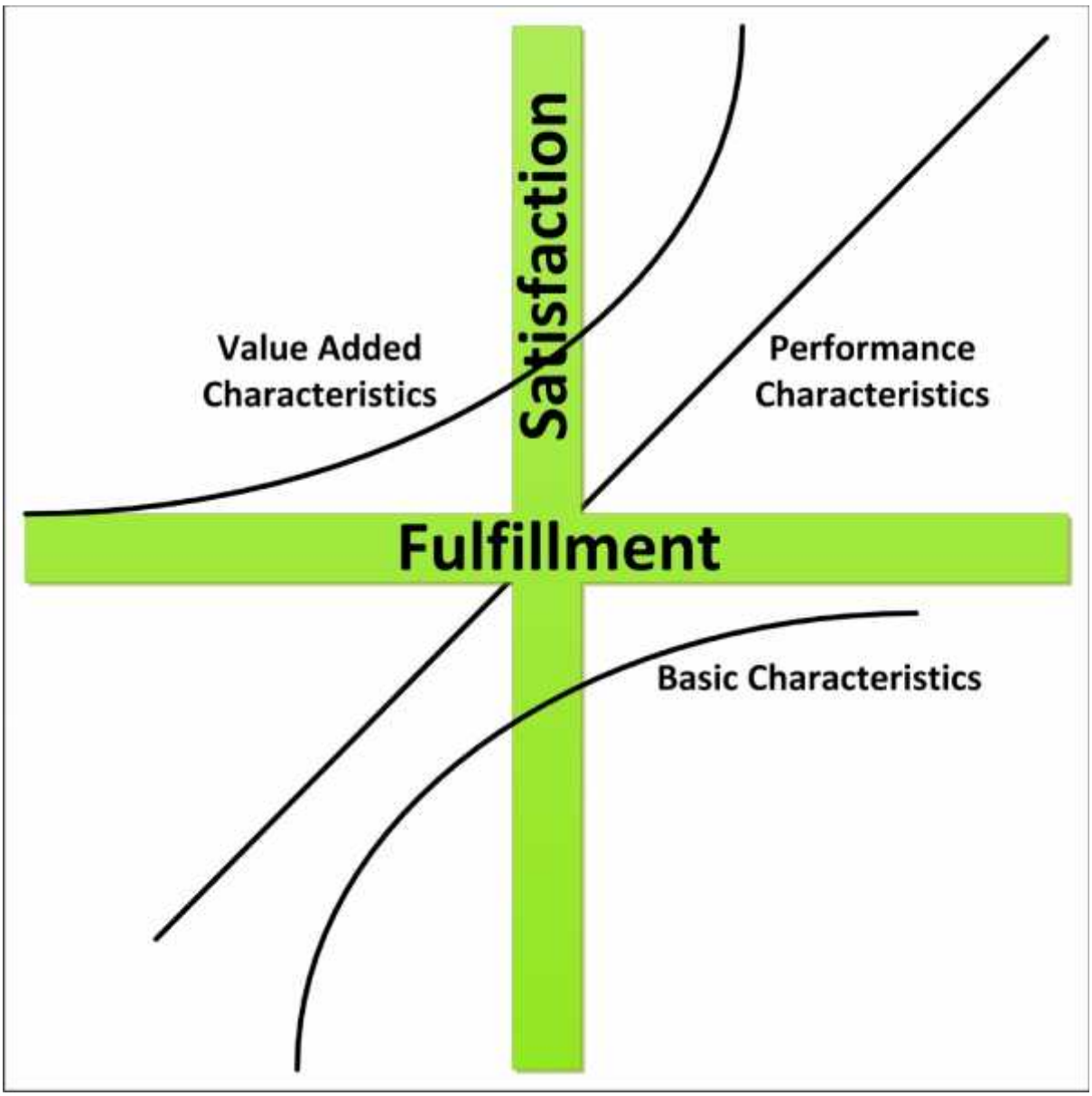
Complexity

Continuous Improvement

Understanding Value with the Kano Model

The Kano Model

One way to understand value is with Dr. Noriaki Kano's needs model. It appears in many forms; we have presented our version here.



Breaking Down the Model

Kano's model states that there are three kinds of customer expectations. The first level is the **basic characteristics**. These are the things that customers expect, don't ask for, and take for granted. If you don't provide them, customers will be dissatisfied. If you do provide them, you won't get any brownie points.

The second type is **performance characteristics**. These are the things that customers want but don't need. An example might be free bonus items or faster delivery. The more of these that you can offer, the more satisfied the customer will be.

Lastly, we have the **value added characteristics**. These are the things that the customer doesn't expect, so if they aren't present, they won't be dissatisfied. However, if you can offer one of these experiences to your customers, their satisfaction levels will increase exponentially.

Example: New Car

Basic Characteristics

- Has wheels and tires
- Doors open
- Will drive

Performance Characteristics

- Power windows and doors
- Air conditioning
- MP3 player

Value Added Characteristics

- Vehicle is washed and waxed for free
- Salesperson delivers the vehicle to your door

Types of Waste

The Three Categories

The concept of eliminating waste is one of the core ideas of Lean process improvement. Let's explore the three categories of waste.

Muda

Muda is the Japanese word for waste. Taiichi Ohno originally identified seven wastes, although others have been added due to changes in manufacturing.

Ohno's wastes are:

- Overproduction (making more of something than needed)
- Unnecessary motion
- Surplus inventory
- Unnecessary processing steps
- Excessive transportation
- Idleness and waiting
- Defects

Muri

Another waste is when resources (people or equipment) are overburdened. This can cause problems with safety, reliability, and quality.

Mura

Mura means unevenness: sometimes a person sits idle and sometimes they are overburdened. The process of leveling this out (heijunka) is one of the pillars of the TPS house.

Making Connections

List some examples and some ways to eliminate each type of waste.

Types of Waste	Examples	Ways to Eliminate
Muda		
Muri		
Mura		

Creating a Lean Enterprise

Going Green with Lean

In order to create a Lean, green enterprise, there are five R's that we can use to guide us. (These are similar to the three R's popularly used in environmental campaigns.)

Recover

If you operate a manufacturing plant, look at your processes and see where scrap and waste can be recovered and reused. (This can also be applied on an individual level, for example, using unwanted printouts as scrap paper.) You may also be able to recover energy. For example, some organizations have had great success converting steam output from machines to power.

Recycle

This is a concept that most of us should be familiar with. When something has served its use, see if it can be used for something else. At the very least, participate in your area's recycling programs.

Redesign

Can your products and processes be designed to use less energy, last longer, require less maintenance, and be more environmentally friendly during and after their use?

Reduce

This is another concept that you should be familiar with. Reducing the energy and materials used to produce a product should be an important focus of any manufacturing organization. Organizations should also look at how to reduce the resources that a product consumes during its lifetime, and the resources required for disposal, and how to reduce those levels.

Remanufacture

More and more, businesses are making new products from old products. For example, this may involve using still-functioning parts from various old machines to create a new machine. Or, products may be broken down to create something entirely new.

The Characteristics of a Lean Organization

About John Bicheno

In his series *The Lean Toolbox*, author John Bicheno lists 20 key elements of Lean organizations. These elements summarize the work of Lean masters (including James Womack, Daniel Jones, Richard Schonberger, Eliyahu Goldratt, and Masaaki Imai) and management experts such as Peter Drucker. (Don't forget that all of these people based their work on the early masters: the Toyodas, Henry Ford, and Taiichi Ohno.)

20 Keys

The 20 elements are:

1. The customer is the starting and ending point.
2. Think simplicity.
3. Reduce or remove waste.
4. Think in terms of process.
5. Increase visibility and transparency wherever possible.
6. Encourage routine and standardization.
7. Make flow as constant and smooth as possible.
8. Pull at the customer's rate, rather than pushing product through.
9. Get the timing right. Starting work at the optimal time will increase flexibility and reduce waste and risk.
10. Be proactive and preventative rather than reactive.
11. Keep production and process timelines as short as possible.
12. Make continuous improvement a priority for everyone.
13. Encourage internal and external players to be partners rather than competitors.
14. Create a supply chain that creates value.
15. Remember Gemba: go to where the action is and seek the facts.
16. Reduce variation where possible.
17. Encourage participation and accountability from all employees.
18. When making changes, start with the smallest component and build up.
19. Build trust internally and externally by sharing information and acting as a partner.
20. Build and distribute knowledge throughout the organization.

The Plan, Do, Study, Act (PDSA) Cycle

Model Overview

So far, we have discussed a number of Lean ideas that can be implemented in an organization. But where do you start? One answer is PDSA (also known as PDCA):

This cycle was developed by Walter Shewhart in the late 1930's and made popular in the 1980's by Edward Deming. Let's look at each aspect more closely.

Plan

Think about:

- What do we want to achieve?
- What problems must be solved?
- What are the goals and objectives?
- What processes or systems do we want to change?
- How will we determine if we're using the right approach?

Do

Next, try out the idea on a small scale. Some examples:

- If you think an online advertising method will be more effective than the current mail-outs, try it on a control group.
- If you think a new printer will be more efficient, try it out in one department.
- If you think a new machine will improve manufacturing defect rates, try it out for one product or on one line.

Study (also called Check)

Now study the results. Your goal is to understand what worked and what did not, and add to it what you know about the proposed changes.

- What positive and negative things did we learn?
- Will the experiment work on a large scale? Why or why not?
- If it will not work, what can be done to make it work?

Only now can you make an informed decision. You may have to go back to one of the previous stages, or you might be able to go onto the next stage.

Act

Now that you have a good understanding of the proposed change, it's time to put your plan into action.

Using the R-DMAIC-S Model

R-DMAIC-S

An advanced version of PDSA is the R-DMAIC-S model used in Six Sigma:

R-DMAIC-S and PDSA

You can even imagine the PDSA cycle inside the R-DMAIC-S model:

Let's look at this model more closely.

Recognize

The first step is to recognize a need for improvement. You may see your cashiers operating in an ineffective way, a manager may let you know that your accident prevention policy is outdated, or an employee might suggest a more effective method of scheduling production.

In any Lean organization, where there is an ongoing commitment to improvement and learning, an inventory of possible projects should be maintained and regularly updated and reviewed. Then, projects should be prioritized, selected, and assigned. This committee would also be responsible for making sure projects adhere to Lean methodologies and stay on track.

Define

Next, the problem to be solved is defined. This is where the who, what, where, when, why, and how of the approach is determined. Often, project management tools like project charters, business cases, and statements of work are used to lay out what is to be done.

Measure

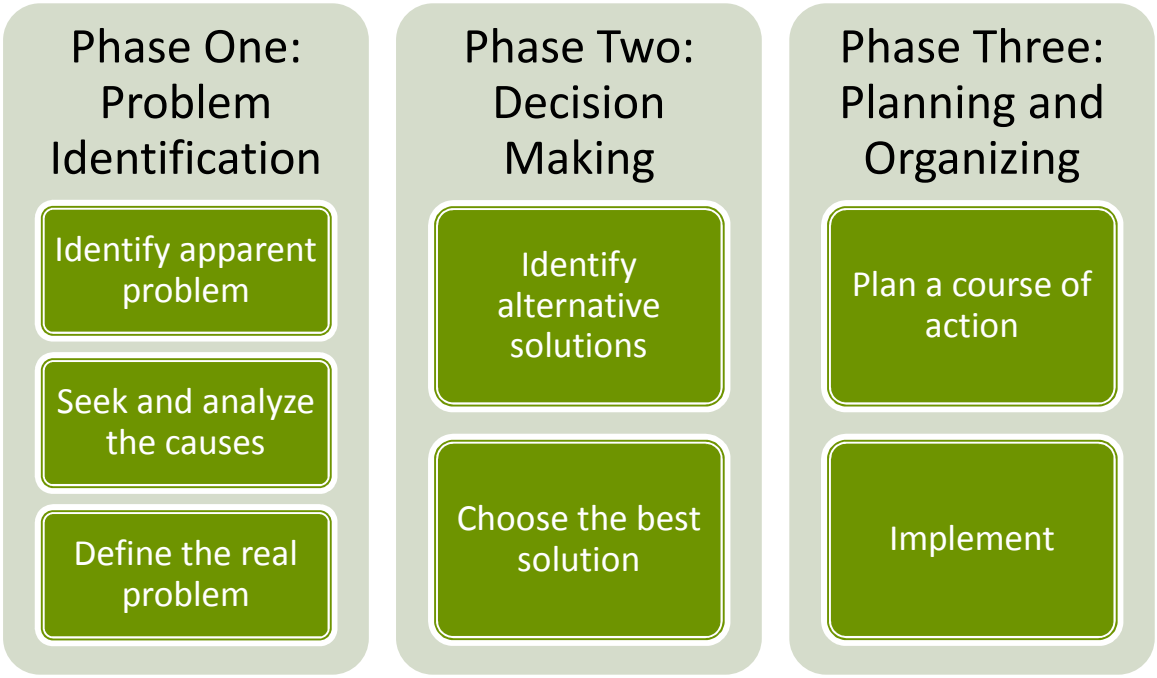
The third step is to measure the data to set pre-change benchmarks and set priorities for improvement.

Analyze

Next, we will analyze the data and set specific improvement priorities.

Improve

Now it's time to solve the problems and make changes. You will typically follow the problem solving model that we used yesterday:



Control

The next phase is about keeping up the work that has been done. This can be done through various control tools, inspections, and evaluations.

Sustain

The last part of the process is to sustain the learning and share it throughout the organization. An overall project success evaluation may be appropriate.

Lean Thinking Tools

5W-2H

In school, you may have learned about the 5 W's and the H of good reporting:

- Who?
- What?
- Where?
- When?
- Why?
- How?

This framework is often used in Lean to gather information, with the addition of another H: **How much?**

Genchi Genbutsu and Gemba

Getting Involved in the Work

One Lean principle is **Genchi Genbutsu**, which means going to see for yourself. This is closely tied to **Gemba**, which means where the action is. Lean encourages upper management to get into the day-to-day work and get their hands dirty. Many Japanese companies make their upper management work on the floor as part of the training process, including Honda, Nikon, and Toyota.

The Three-Foot Circle

Taiichi Ohno, the founder of the Toyota Production System, had several famous techniques involving Genchi Genbutsu. One was the three-foot circle. If an engineer had an idea for improving the production line, Ohno would take the engineer to the production floor. He would then draw a circle a few feet in diameter and make the engineer stand there and watch the process for a few hours. After that, if the engineer still thought the idea was a good one, then they would begin planning to implement it.

Performing a 5-S

What is 5-S?

Visual tools are an important part of Lean that we have not specifically discussed yet. Lean advocates visual tools such as charts and diagrams (for analysis) and lights and colors (in the workplace itself), in the belief that they increase transparency, communication, and visibility.

For visual tools to have their maximum impact, the work area must first be cleaned and organized. This is called a 5-S. This process may take place at an individual workstation, a team floor, or throughout an entire company. There are many templates and checklists out there for conducting a 5-S. We will offer a brief guide here to get you started, but we strongly encourage you to customize it for your workplace.

Preparing for 5-S

- Gather the team.
- Make sure everyone is trained in the process and in any necessary safety regulations.
- Appoint a team leader.
- Let others in your organization know about the effort and what help you may need (from maintenance, IT, etc.).
- Set up a supply area with signs, red tags, cleaning materials, paint, labels, marker, tape, etc.
- Set up a red tag area (holding space) for items to potentially be removed from the area.

Sort (Seiri)

- Sort through the items in the work area. Place them in groups, considering how often you use each item, what situation might require it, how urgently you might need it, and the item's size and weight.
- Place objects that you use every day in a convenient location in the workspace.
- Place items that are required often but not used daily in a convenient storage space.
- Place a red tag on all other items. This tag should list the item name, quantity, original location, and any other pertinent information. Place the item in the red tag area. You will review this area after five and 30 days and retrieve or discard items as needed.
- Create a plan for keeping the work area tidy.

Shine (Seiso)

- Clean the workplace.
- Inspect equipment.
- Create a plan for keeping the work area shiny and clean.

Straighten (Seiton)

- Create a workflow map of the workspace. Show equipment, tools, people, and work areas. Draw lines to show the various paths that employees must take throughout the workday.
- Now, create a more efficient map. Include the location of supplies and how much of each should be kept there, and where additional supplies are kept. (These are called location indicators. Larger signs corresponding to the map can then be created and hung in the supply area.)
- Make sure to include the team that works in the area in both processes.
- Next, create a plan to rearrange the workspace. Make sure that you adhere to company policies, industry regulations, safety rules, etc.
- Get the plan approved.
- Gather resources and make it happen!
- Post the new workspace map for easy reference.

Standardize (Seiketsu)

- Make the sort, shine, and straighten steps part of the team's work routine.
- Encourage workspace members to record ideas for further improvement.
- Share the standards with everyone.

Sustain (Shitsuke)

- Ensure that information is properly communicated and that all employees are trained.
- Obtain support from all levels of the work area.
- Evaluate the program on a regular basis.

Kaizen Events

About Kaizen and Kaizen Events

What is Kaizen?

Kaizen is the Japanese word for improvement, or “change for the better.” It encompasses the philosophy of continuous, incremental improvement of an activity. It is used in many forms. Here we are going to look at Kaizen events, where an individual or a team uses a specific approach to tear down and rebuild a process or product so that it functions more efficiently, with less waste and more value.

Kaizen events typically take place at five different levels. (A Kaizen event is also known as a Kaikaku.)

Level One: Individual

The individual should constantly strive to reduce waste and improve efficiency in their own processes at their own workstations. They should keep records of ideas for additional improvement.

Level Two: Mini Point Kaizen

At the next level, individuals work with their team (typically about six people) to improve their workspace. They may perform a 5-S, change a process, or change work flows. This level is often done on the fly or through one- or two-day workshops.

Level Three: Kaizen Blitz

This level is also known as a Point Kaizen. It is similar to a Mini Point Kaizen but is longer (usually three to five days) and involves larger work teams and sometimes outside parties. These events typically address bigger issues, such as large workspace changes or cross-departmental process changes.

Level Four: Flow Kaizen

At this level, many people from different departments in the organization work to improve cross-functional value streams. They may be led by a project manager and/or be assisted by outside consultants. An example would be a plan to change packaging and shipping methods: the marketing, packaging, shipping, and transporting teams would all need to be involved. These events typically take several weeks to three months.

Level Five: Supply Chain Kaizen

These events are very similar to Level Four, except they involve other organizations. In the example above, where the plan is to change packaging and shipping methods, third party transportation companies and the outsourcers who provide packaging materials may be involved. A project manager and consultants are almost always present. These types of projects can take months or years.

Typical Kaizen Blitz Workflow

Successful Lean organizations do Kaizen blitzes regularly and frequently. They use the PDSA cycle discussed earlier to make changes quickly and efficiently. Although the event itself takes place within a short period of time, extensive preparation and event management is required to ensure that the process is completed effectively and delivers the required results.

The event workflow should look like this:

Personal Reflection

Think of one example of each type of Kaizen event that could take place in your workplace.

Level One: Individual

Level Two: Mini Point Kaizen

Level Three: Kaizen Blitz

Level Four: Flow Kaizen

Level Five: Supply Chain Kaizen

Data Gathering and Mapping

Flow Charts

About Lean Tools

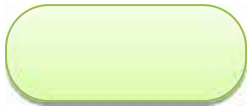
As you delve deeper into Lean principles and take on more complex projects, you will need more advanced tools to record and analyze data. We will look at some of those tools in this session. This is only an introduction; you may need more education to be able to create and use these tools properly.

The first tool that we will look at is a flow chart. You have likely seen or used these before: they literally draw out a process or system. For this reason they are often called system or process maps. We are going to start with a very basic chart, but keep in mind that Lean flow charts can get quite complex.

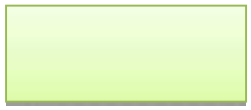
Types of Symbols

Most flowcharts are made up of three main types of symbols.

Elongated circles signal the beginning or end of a process.



Rectangles show actions or instructions.



Diamonds show the part of the process where decisions are made.

Within each symbol is a word or short phrase that describes the action that takes place at that step. Symbols are connected one to the other by arrows, showing the flow of the process.

These are only the basic symbols; there are many other symbols in use. However, since a flowchart is a communication tool, it is important to use symbols that your readers will understand.

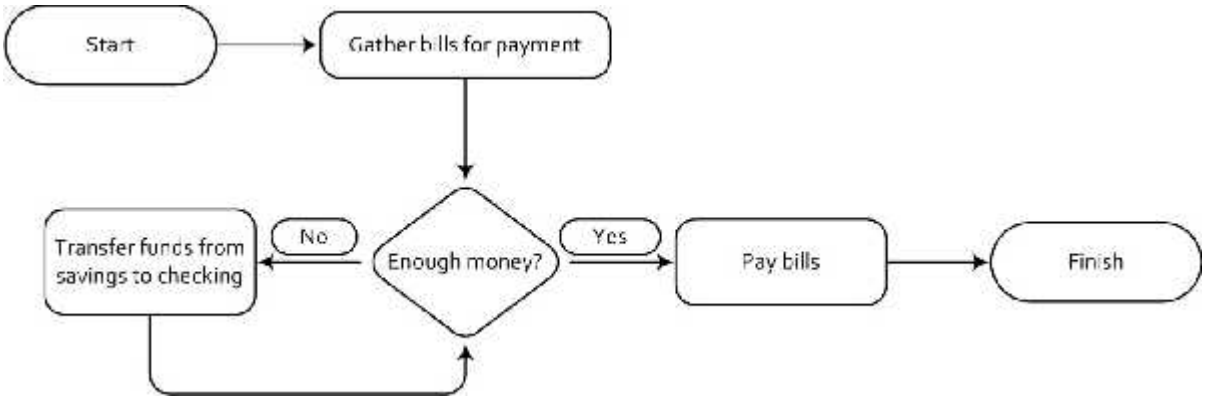
Creating the Flow Chart

To create your flowchart, brainstorm tasks and list them in the order that they occur. Ask questions like, “What happens next?” and, “Is there a decision that needs to be made before the next step?” If you are trying to work out where to improve a process, for example, ask the people who actually do the work for their input.

Be careful because a flowchart can become very complicated and take up several pages. If that is the case, consider breaking processes up into smaller charts or use connector symbols to show where a task continues (or originates) on the next page. Connectors can also be used to track back and repeat a step.

Sample Flow Chart

This example is a flow chart for paying bills.

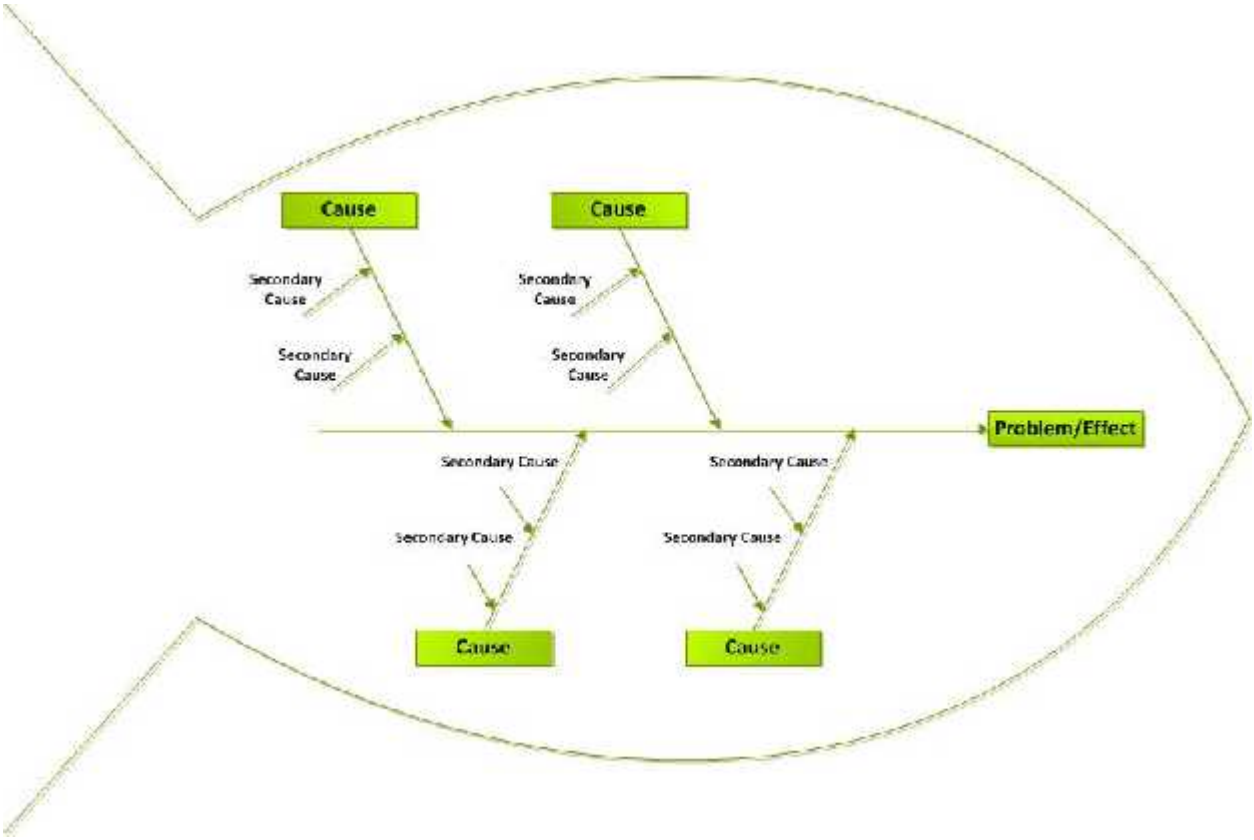


Making Breakfast

Draw a simple flow chart for making breakfast.

Ishikawa (Cause and Effect) Diagrams

The next tool that we will look at is an Ishikawa diagram. You may also know this as a fishbone or cause-and-effect diagram.



The problem or undesired effect is placed on the right-hand side of a piece of paper. A straight line is then drawn to the left-hand side. Primary causes are branched off of that, and secondary causes are branched off of those. The purpose of this is to help you identify the real causes of the problem and then address them appropriately.

SIPOC Diagrams

The SIPOC Method

SIPOC stands for Suppliers, Inputs, Processes, Outputs, and Customers. These are the five key components of any organizational system. It is a good way to define a system or process and break down its parts before trying to improve it.

There are many different ways that this diagram can be drawn. The simplest template is:

Suppliers	Inputs	Processes	Outputs	Customers

Sample SIPOC

Let's look at the example of making chocolate chip cookies:

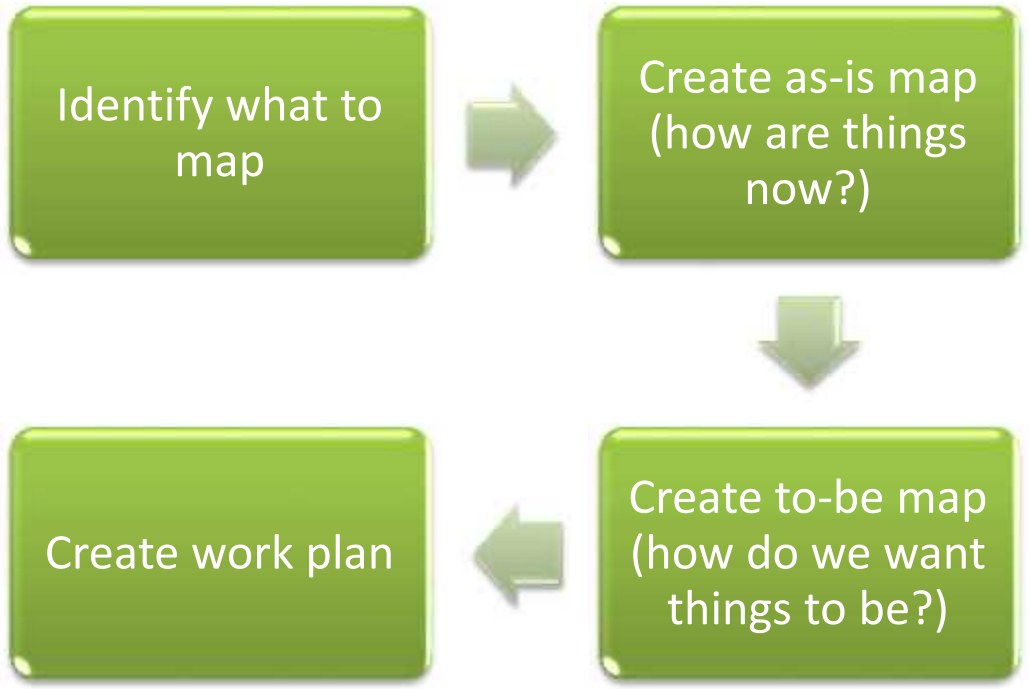
Suppliers	Inputs	Processes	Outputs	Customers
Grocery store	Dry ingredients	Mix ingredients	Cookies!	Me
	Wet ingredients	Put cookies on sheet		Joe
	Cookie sheet	Bake cookies		
	Oven	Cool cookies		

Value Stream Maps

Creating the Value Stream Map

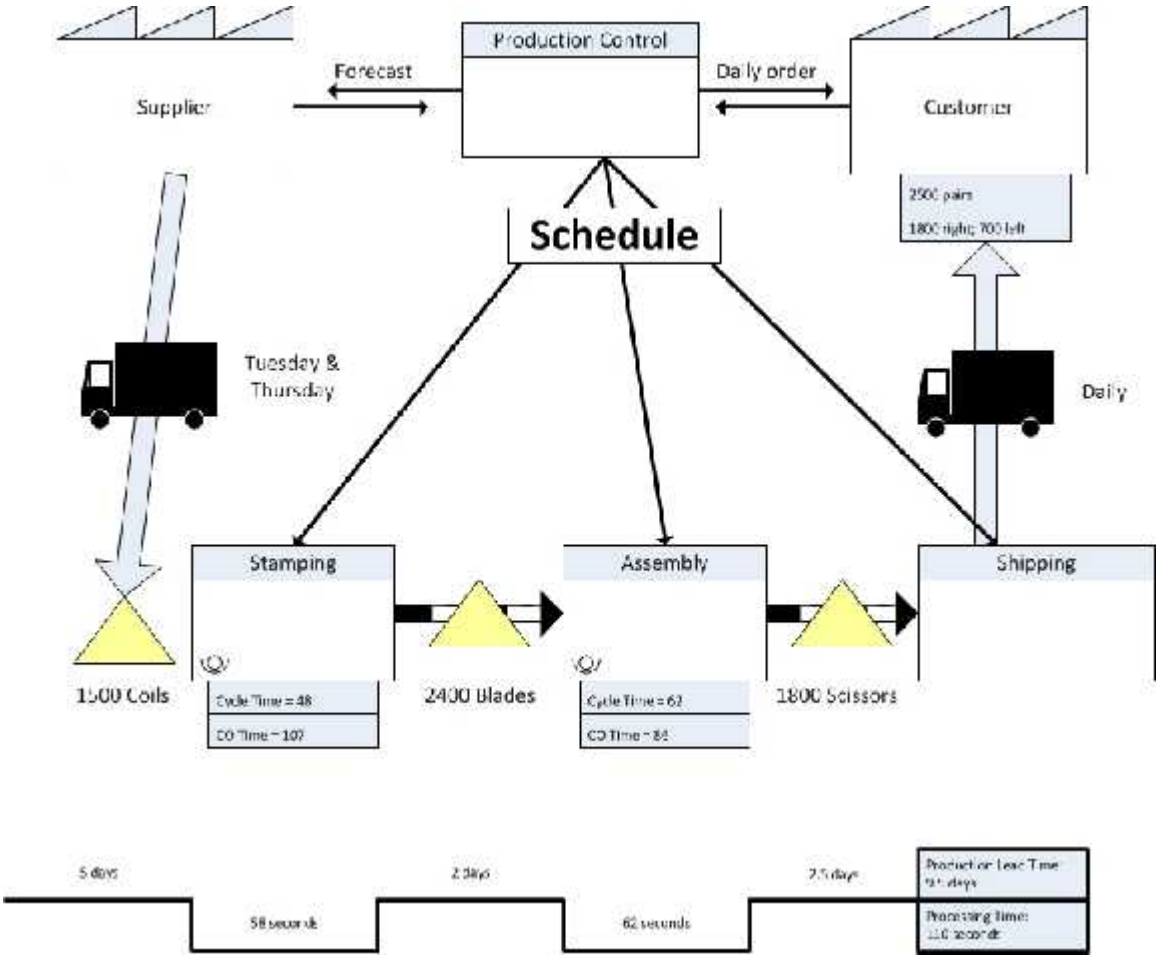
A value stream map looks quite complicated, but its concept is quite simple. It is basically a map showing how the product's life cycle begins and ends. The customer is usually the start and end point.

The process has four steps:



Sample Value Stream Map

Here is a sample value stream map.



Tips for Effective Data Analysis

Before you begin gathering data, make sure that your improvement goal is clearly stated. Your data gathering question should aim to answer one question. (Hint: Use one of the 5 W's or 2 H's discussed earlier.)

For example, you might want to know, "What was the difference between sales last year and sales this year?" or, "What is the defect rate for the Widget Master 5000?"

Next, decide what will be measured (profits, expenses, returns, defect rate, etc.) and how it will be measured. You may choose several metrics to analyze. Now, decide what data gathering tools you will use and how data will be recorded.

Once data has been gathered, be careful when analyzing it. It is easy to analyze the data in such a way that it gives you the results that you are looking for. Double and triple check your analysis. Make sure any conclusions are truly supported by the data.

Likewise, be careful when depicting data visually. Be sure to choose the right type of visual aid. Sometimes a simple line graph will suffice. At other times, you may need a more visual tool (such as a flow chart) or a more complicated statistical tool (such as a histogram). Try to choose the simplest type of illustration possible.

Making Connections

What type of tool would be best in each of these situations?

Show the cause of widget returns

Show how widgets are shipped

Lay out the steps for packaging a widget

Summarize the people, materials, and processes for creating a widget

A Plan to Take Home

Roadblocks and Pitfalls

Next Steps

With this course we have learned a lot about Lean, including what Lean is; what the philosophy looks like; how to think Lean; how to perform Lean improvements; and how to gather, record, and analyze data with Lean tools. For the last part of this course, we are going to help you build a plan to incorporate Lean into your company's culture.

Making Connections

In the space below, write down what some of the problems with implementing Lean in your organization might be. Try to think of solutions for each problem.

Possible Problem	Possible Solution

Common Problems

Training at the Wrong Time
Lean training should not be done in a blitz as the new flavor of the day. Training should be done just in time for a particular Lean event and then used immediately.

Uneven Responsibility and Delegation
Strive to make everyone in your organization familiar with Lean. Lean improvement leaders must be advocates for Lean and for the organization. Lean must not be something that one particular person or team does; it must be something that the entire company embraces day-to-day. This means, too, that senior management must get in and get their hands dirty.

Seeing Lean as a Short-Term Solution
In the same vein, Lean must not be viewed as a short-term, Band-Aid solution. When Lean first began gaining popularity in the Western world, it was treated much like a fad. This resulted in partial Lean implementations

that, of course, did not succeed as expected (or failed outright). As we have emphasized during this course, Lean is not your average toolkit – it is a corporate culture that must be fully embraced to ensure success.

Fear

Lean can be a very intimidating topic, and indeed, some of its ideas (particularly Six Sigma ideas) can be very complex and tough to grasp. Not only is it rife with Japanese terms, its basic philosophy, while simple, can be hard to live up to. We suggest that you start small and work your way up. Any change can be a difficult one – it's how you manage it that makes the difference.

Creating a Successful Organizational Structure

Keys to Success

Organizations that have had great success with Lean all have a few common characteristics. As you might imagine, one of the driving factors is the approach to Lean: successful companies see it as a long-term systemic change and have enthusiastic leadership supporting the effort. Consistency and persistency are the two keys.

Process Overview

Many organizations have found the following process helpful in giving Lean a foothold in their organization.

Breaking Down the Model

Establish a Lean Team
Your first step is to establish a Lean champion. In a small organization, this may be just one person with a part-time Lean champion role. In a larger organization, you may establish a Lean Promotion team which will be responsible for overseeing and coordinating Lean events. Remember, your Lean champion should be very familiar with Lean and the organization.

As the Lean champion or Lean team spreads Lean throughout the organization, their role and the very structure of Lean in your company will expand and change. Make sure that you plan for this.

Customize Lean
As you have seen throughout the course, there are a lot of ways that Lean can be interpreted and applied – and this is just the beginning! Decide what tools and training you want to offer and grow from there.

Perform Training
Clearly, the person or people that you have identified as your Lean champion(s) will be the first people to get training. Upper management should also be in this group. Next, the organization should decide what the first Lean project should be. Those organizational members will be the next to get training and perform a project… and so the first wave begins.

Review and Modify
Once the first pilot project is complete, evaluate how it went, and revise as needed. Then, train other teams and perform other projects, revising your Lean approach as you go.

Where To Get Started?

Once your Lean champion has been established and your organizational framework is complete, it can be hard to pick a project. Do not choose the biggest, hardest project. Rather, pick a small, manageable project in an area that the Lean champion is familiar with. Make sure that the endeavor has clear goals and is easily measurable.

Most Lean projects fall into one of nine categories. These categories should help jump-start some project ideas.

- Change the work environment
- Reduce or eliminate waste
- Enhance relationships with customers, suppliers, or other third parties
- Error-proof systems
- Improve the focus on a product or service
- Improve work flow
- Manage time
- Manage variation
- Optimize inventory

A Plan for Success

What roadblocks might your organization encounter? How might you get around or solve those?

What successes might your organization inherently have? How might you build off of those?

What will be your first step back at the workplace?

Can you think of some project ideas based on the nine categories?

Further Reading:

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