10 Steps to become a Lean Enterprise

Lean Expert Training Course

Step 9
Continuous Process Improvement
Part 3

Lean Expert Course Workbook – Step 9 Continuous Process Improvement Part 3

Table of Contents

Welcome

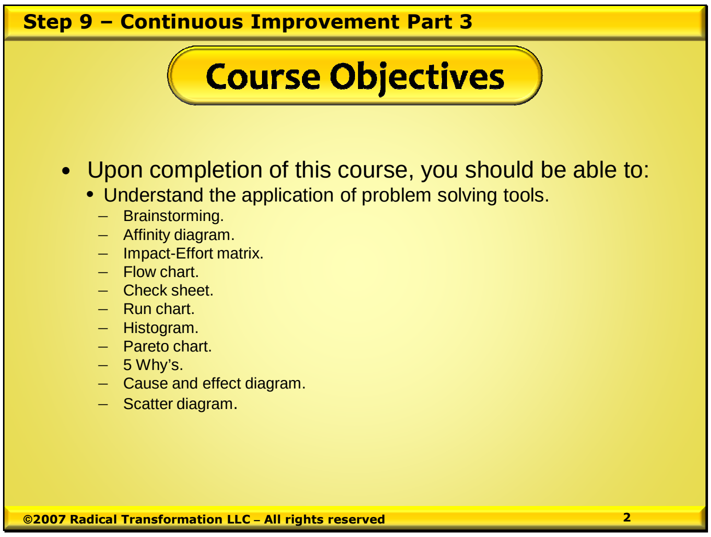
We would like to welcome you back to our next module in this online training course.

This training module is called "Step 9 – Continuous Improvement Part 3."

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!



<u>Course Objectives</u>

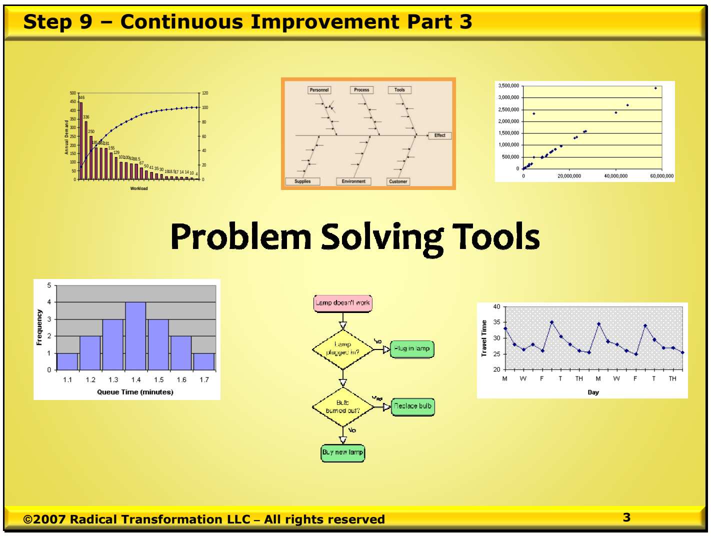
Here are the course objectives for Step 9 – Continuous Improvement Part 3.

We specially designed this course to give the information you need to get a full understanding of each step required to become a Lean Enterprise.

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

- Understand the application of problem solving tools.
  - Brainstorming.
  - Affinity diagram.
  - Impact-Effort matrix.
  - Flow chart.
  - Check sheet.
  - Run chart.
  - Histogram.
  - Pareto chart.
  - 5 Why's.
  - Cause and effect diagram.
  - Scatter diagram.

Now we are going to work through each course objective.



Problem Solving Tools

There are many tools and techniques that apply to problem solving.

There are also many variations of each of these tools and techniques.

It is often overwhelming for anyone who is trying to understand which tool is best for any given situation.

I believe it is best to learn how to use one or two of these tools until one can become confident at applying them.

At this point they can take another tool and learn how to use it and add it to their toolbox.

They can keep learning and adding tools to their toolbox until they feel like they have enough to meet their needs.

So, the question is: How many tools does the typical problem solver need?

The tools and techniques demonstrated in this presentation are necessary for most people to learn.

Without a basic understanding of these tools an organization will not be able to be transformed into a Lean Enterprise.

They represent the standard problem solving tools for a comprehensive Lean implementation into any organization.

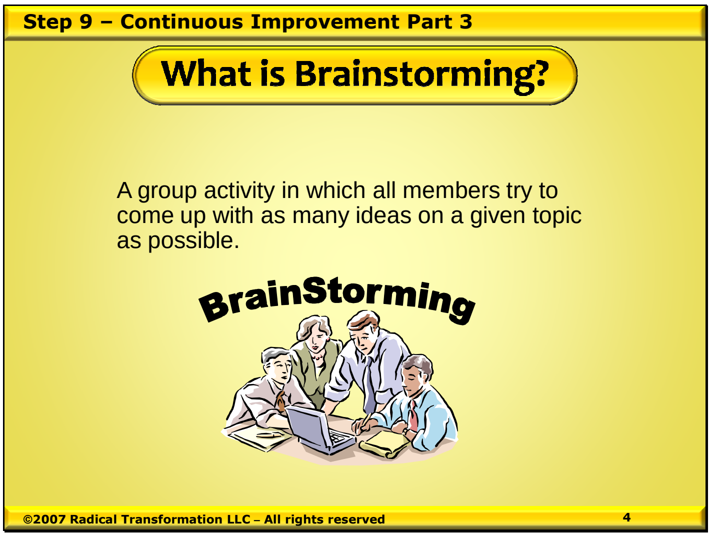
Some companies get by with just a few of these tools, it really depends on what the management team are trying to achieve.

However, here is a quote to explain the need for learning problem solving tools:

"As much as 95% of quality related problems in the factory can be solved with seven fundamental quantitative tools." - Kaoru Ishikawa

These seven quality tools were first emphasized by Kaoru Ishikawa, a professor of engineering at Tokyo University and the father of “quality circles”.

The seven basic quality tools are included in this training module.



What is Brainstorming?

Brainstorming is an effective way to generate ideas on a specific issue and then determine which idea or ideas are the best solution.

Brainstorming is most effective with groups of 8-10 people and should be performed in a safe and relaxed environment.

If participants feel free to relax they will stretch their minds further and therefore produce more creative ideas.

A brainstorming session requires a facilitator, a brainstorming space and something on which to write ideas, such as a white-board or a flip chart.

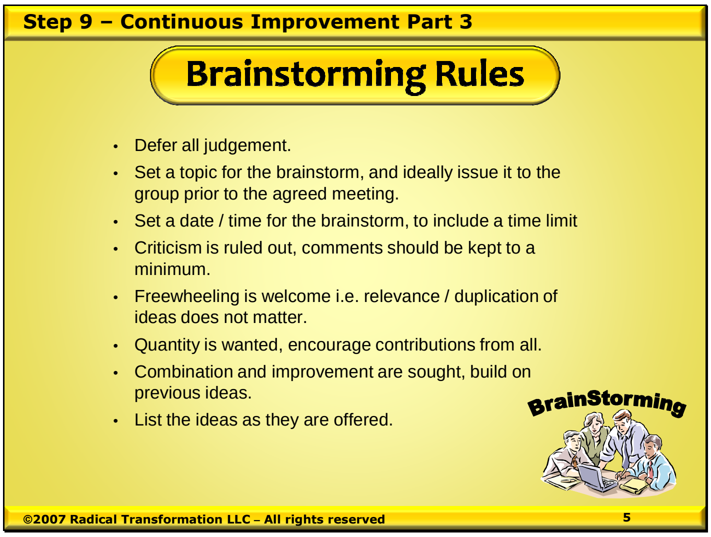
The facilitator's responsibilities include guiding the session, encouraging participation and writing the ideas down.

Brainstorming works best with a cross functional group of people.

Participants should have different backgrounds and be chosen from various departments throughout the organization.

Ensure people from outside of the process are included as they can bring fresh ideas that can inspire the subject matter experts.

There are numerous approaches to brainstorming, but the traditional approach is generally the most effective because it is the most energetic and openly collaborative, allowing participants to build on each other's ideas.



Brain Storming Rules

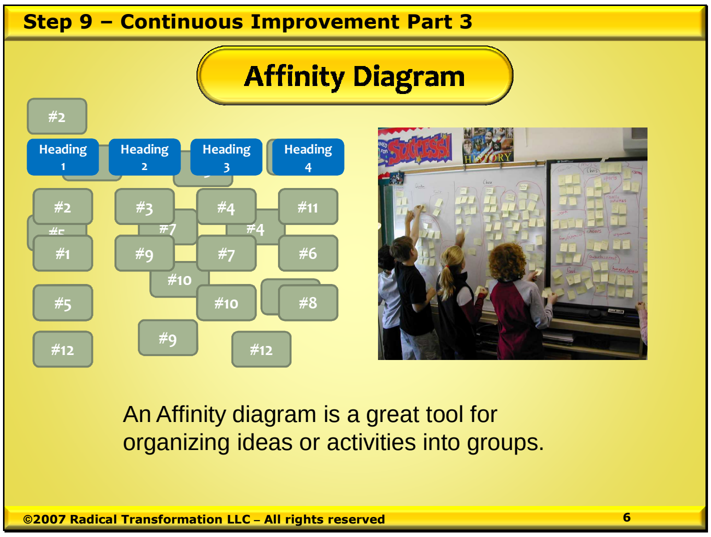
There are some basic rules that need to be followed to make the brainstorming session a productive process.

These basic rules allow everyone in the session to know what is and is not appropriate.

Here is a list of these basic rules:

- Defer all judgement. There are no bad ideas, accept them all.
- Set a topic for the brainstorm, and ideally issue it to the group prior to the agreed meeting.
- Set a date / time for the brainstorm session and include a time limit.
- Criticism is ruled out, opinions or comments should be kept to a minimum.
- Freewheeling is welcome i.e. relevance / duplication of ideas does not matter.
- Quantity is wanted, encourage contributions from all participants.
- Combination and improvement are sought after, build on previous ideas to create better ideas. This is known as piggy-backing on other people's ideas.
- List the ideas as they are offered. Capture everything as it is given.

Following these basic rules will create a better experience for everyone involved.



Affinity Diagram

The affinity diagram is a business tool used to organize ideas and data. It is a quality tool commonly used in problem solving or project management.

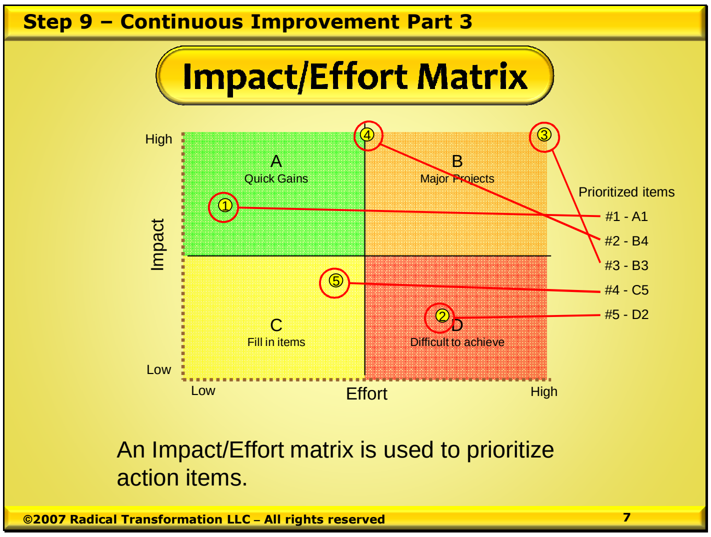
An affinity diagram helps to synthesize large amounts of data by finding relationships between ideas and grouping them.

The affinity diagram is also called the KJ method, after its developer Kawakita Jiro who was a Japanese anthropologist.

In this screen, is an animation demonstrating the different steps for using an affinity diagram.

The process for using an affinity diagram to Identify and organize the opportunities for improvement is as follows:

1. Write all the opportunities on post-it's and place them on a board or wall
2. Next, start organizing the post-it's with similar ideas into groups.
3. Once you have completed the second step there will be multiple groups. Give each group of post-it notes a main heading to categorize and clearly identify the types of opportunities.
4. The next action is to prioritize each category based on its impact to improve the business compared to the amount of effort required to implement the improvements in terms of cost, resources, time, etc. We will discuss this process in the next screen.



<u>Impact/Effort Matrix</u>

An Impact/Effort matrix is used to prioritize ideas or action items, etc.

Impact means the level of improvement to the organization financially, systemically, etc.

Effort means all of the resources required to implement the improvement i.e. time, money, people, etc.

Here are the steps for creating and using an Impact/Effort Matrix:

1. Draw a rectangle and divide it into quadrants. Insert “**Impact”** on the center of the left axis of the shape and “**Effort”** on the center of the bottom axis.
2. Write **“High”** at the top of the left axis and right end of the bottom axis.
3. Write **“Low”** at the bottom of the left axis and the left end of the bottom axis.
4. Determine the amount of **Impact** a problem solution will have on the process.
5. Determine the amount of **Effort** required to implement the problem solution.
6. Place a number for each problem solution into the cross referenced point inside of a specific quadrant.
7. Prioritize the implementation of each problem solution based on where they are located on the matrix.

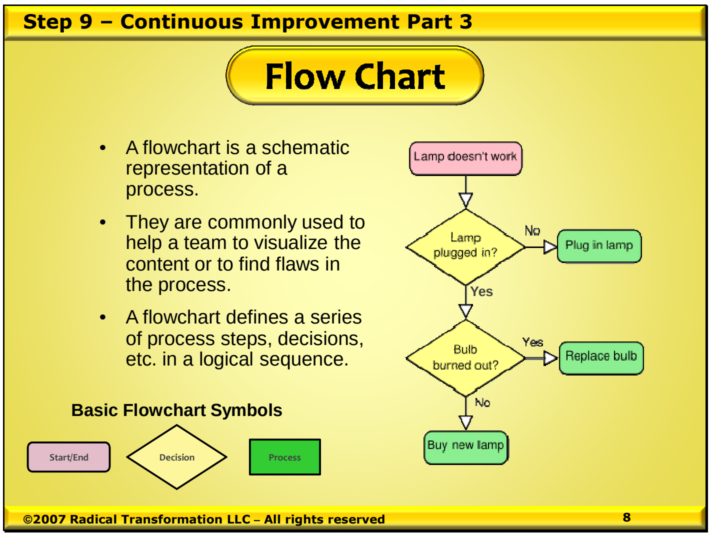
In this screen, is an animation demonstrating the use of this tool to prioritize each problem solution or idea.

Quadrant A - High Impact/Low Effort items are urgent and important. They will deliver quick gains so they should be completed as soon as possible.

Quadrant B - High Impact/High Effort items are major projects. They often need inputs or support from outside of the organization i.e. corporate, customers, etc. These items will need project management to ensure they are staying on track.

Quadrant C - Low Impact/Low Effort items are important but not urgent. These should be completed when nothing else is available to work on in Quadrants A or B.

Quadrant D - Low Impact/High Effort items are very difficult to complete because there is very little improvement or pay back for the amount of effort required.



Flow Chart

A flowchart is a graphical or schematic representation of a process that identifies the flow of activity.

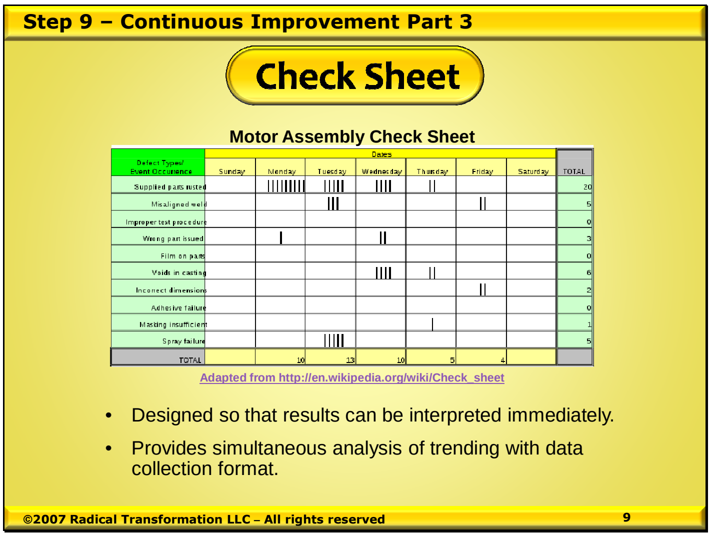
One of the best ways to create a flowchart is to use post-it notes stuck onto butcher paper.

Once the team has the process all completed they can produce it on drawing paper or using software.

Here are some of the benefits of using flowcharts:

- They pictorially explain the steps of a process and promote understanding.
- Often there are differing ideas about how a process actually works.
- A flowchart can help a team to reach an agreement about the sequence of steps.
- Flowcharts promote understanding much better than written procedures do.
- A flowchart can replace pages of text.
- They are an excellent tool for employee training. Training Flowcharts are easy to follow because they visually demonstrate the sequence of the process steps.
- They can help train employees to perform a standardized process.
- Flowcharts can be used to identify process issues and opportunities for improvement.
- When the process steps have been identified and drawn, problem issues are easier to see.
- It is much easier to detect opportunities for improvement by refining a process, analyzing decision points, eliminating redundant steps, and rework loops.

- They can be used to illustrate customer-supplier relationships, helping the employees to understand the customer-supplier connection.
- They can see how their activities affect the customers and suppliers.



Check Sheet

The check sheet is a simple document that is used for collecting data in real-time and at the location where the data is generated.

The document is typically a blank form that is designed for the quick, easy, and efficient recording of the desired information.

This data can be quantitative or qualitative.

When the information is quantitative, the check sheet is sometimes called a tally sheet.

A characteristic of a check sheet is that data is recorded by making marks ("checks") on it.

A typical check sheet is divided into columns and rows to create regions that have a different significance.

Data is read by observing the location and number of marks on the sheet.

There are 5 basic types of check sheets:

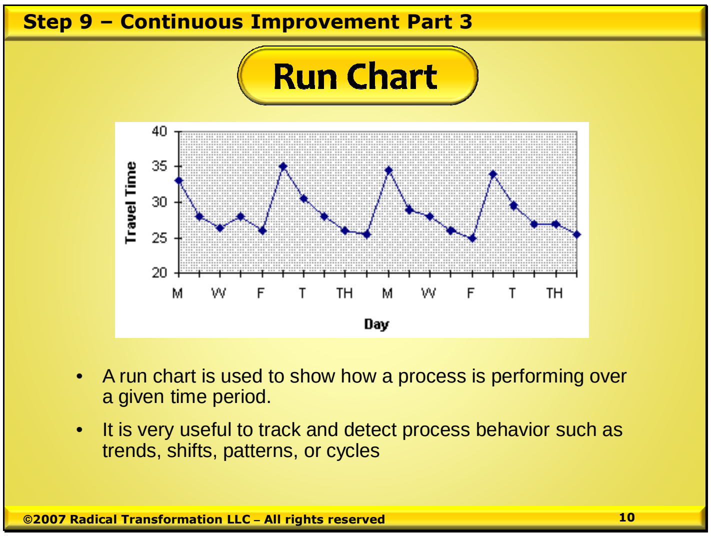
1. **Classification:** A trait such as a defect or failure mode must be classified into a category.

2. **Location:** The physical location of a trait is indicated on a picture of a part or item being evaluated.

3. **Frequency:** The presence or absence of a trait or combination of traits is indicated. Also number of occurrences of a trait on a part can be indicated.

4. **Measurement Scale**: A measurement scale is divided into intervals, and measurements are indicated by checking an appropriate interval.

5. **Check List**: The items to be performed for a task are listed so that, as each is accomplished, it can be indicated as having been completed.



Run Chart

In this screen, is an example of a run chart. It is used to display how a process performs over time.

It is a basic line graph of data points that are plotted in the sequence that any process events occurred.

These data points represent measurements, counts, or percentages of process output.

Run Charts are used to assess and recognize patterns formed by the data points.

The sample run chart in this screen has a reoccurring pattern.

A change in the pattern represents a change in process behaviour.

An improvement team would lay several of these run charts out on a table or tape them onto a wall to see if they can identify a specific pattern.

They would then try to isolated the activities represented by these patterns to determine what changes occurred at those points.

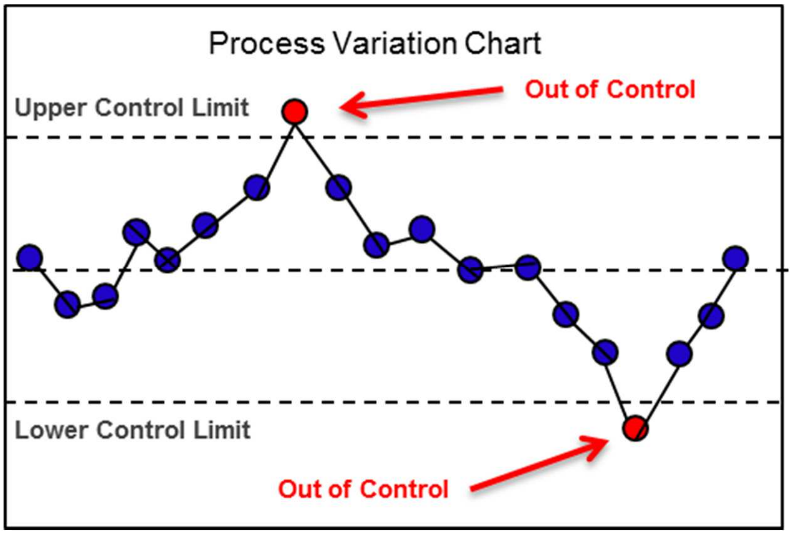
A run chart should not be confused with a control chart because they are similar but different.

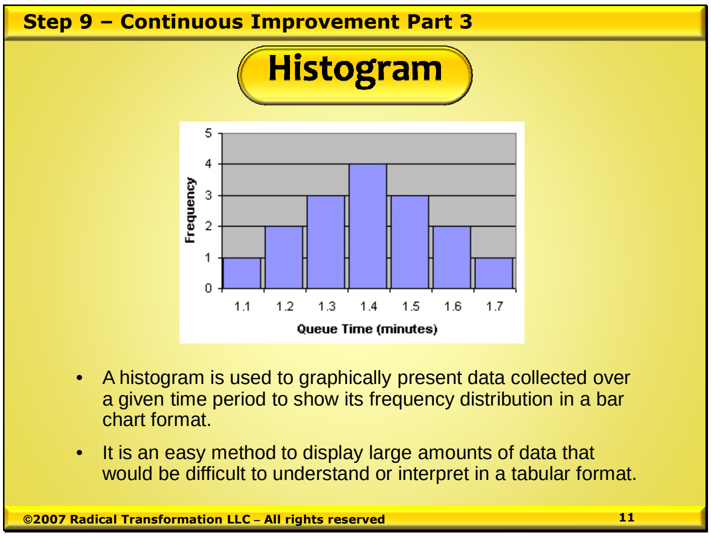
A control chart has upper and lower limits on the chart to determine if a process is in or out of control.

However, a run chart is used to identify patterns of process behaviour over time.

A run chart can be converted into a control chart by calculating the values for the average ($\bar{x}$ or mean) and the upper and lower control limits.

Here is an example of a Control Chart:





Histogram

A histogram is a specialized type of bar chart.

Individual data points are grouped together in classes, so that you can get an idea of how frequently data in each class occur in the data set.

High bars indicate more points in a class, and low bars indicate fewer points.

The typical applications of a histogram in root cause analysis include:

- Presenting data to determine which causes are dominant.
- Understanding the distribution of occurrences of different problems, causes, consequences, etc.

A histogram can typically help answer the following questions:

- What is the most common system response?
- What distribution (center, variation and shape) does the data have?
- Does the data look symmetric or is it skewed to the left or right?

In the most common form of histogram, the independent variable is plotted along the horizontal (x) axis and the dependent variable is plotted along the vertical (y) axis.

The data appears as colored or shaded rectangles. In this screen, is an example of a common form of a histogram?

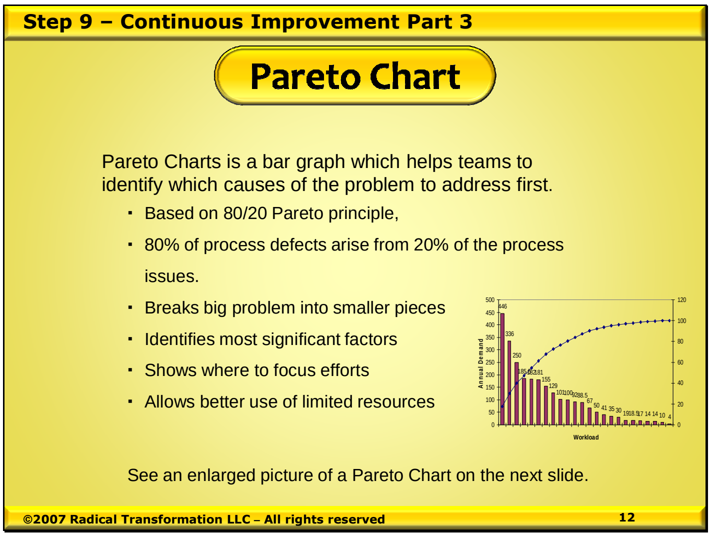
The groups of data in a histogram are known as “bins”.

Each bin is represented by a rectangular shape.

The shape of the histogram is sensitive to the number of bins.

If the bins are too wide it exhibits large biases and important information might be omitted.

On the other hand, if the bins are too narrow the histogram is almost unbiased.



Pareto Chart

The purpose of the Pareto chart is to highlight the most important among a (typically large) set of factors.

In problem solving, it often represents the most common sources of defects, the highest occurring type of defect, or the most frequent reasons for customer complaints, and so on.

A Pareto chart is a bar graph.

The lengths of the bars represent frequency, and are arranged with longest bars on the left and the shortest to the right.

The longest bars visually represent the vital few factors that are causing most of the problems.

Concentrating any improvement efforts on the vital few will have a greater impact and be more cost-effective than any other factors.

Pareto Charts helps an improvement team to identify which causes of the problem to address first.

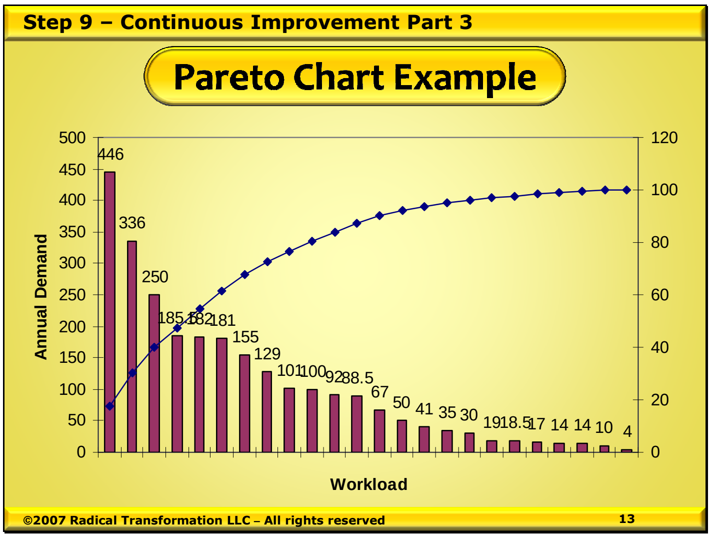
It is based on the 80/20 principle, which is 80% of process defects arise from 20% of the process issues.

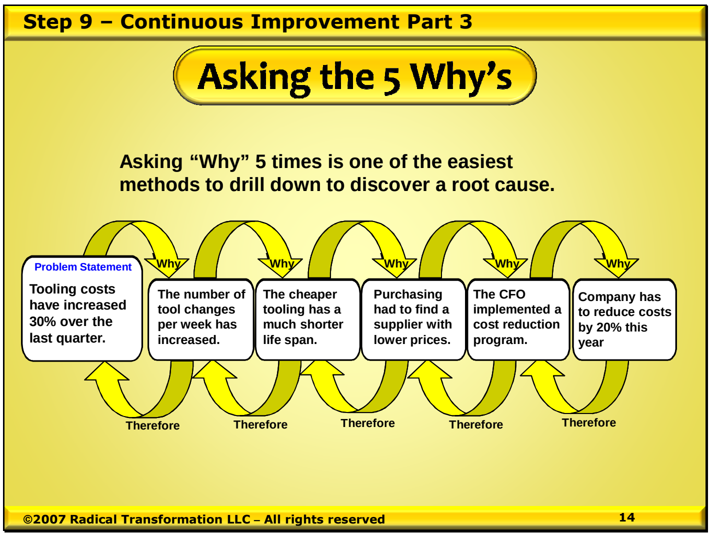
Possible uses for a Pareto chart are:

- Breaks big problem into smaller pieces.
- Identifies most significant factors.

- Shows where to focus efforts.
- Allows better use of limited resources.

Here is an example of a Pareto Chart:





Asking the 5 Why's

The 5 Whys is a method used to explore the cause-effect relationships underlying a particular problem.

Ultimately, the goal of applying the 5 Whys method is to determine a root cause of a defect or problem.

"The 5 Why's" consists of using an interviewing technique, which involves asking the person who is experiencing a problem to explain the symptoms.

As the person explains and shares their understanding of the problem the interviewer would ask "Why".

The reason for asking "Why" is to get them to stay focused on the task and drill down into the root cause(s).

It is the same method used by children as they learn about the world around them.

Children will often go into the "why mode" where they consistently ask "why".

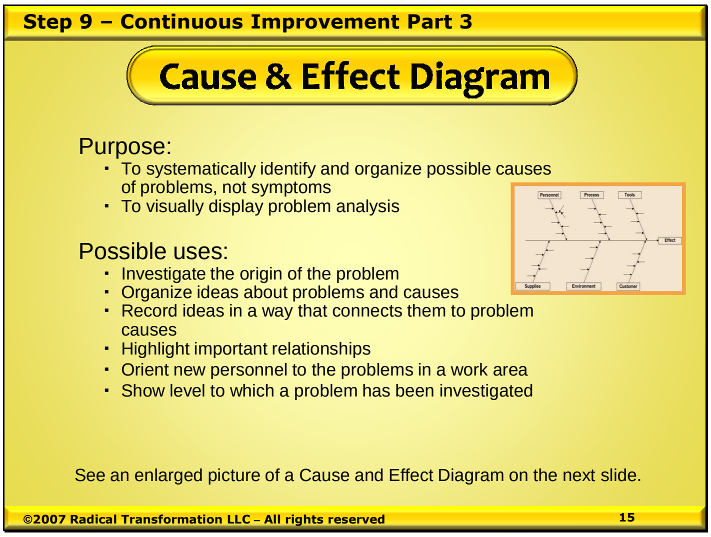
They will continue to do this until they feel they have received enough information to satisfy their needs or they move onto another subject.

Adults can use this same method to delve deeper into the circumstances of a problem to discover its root cause by asking the 5 Why's.

In this screen, is an animation that will demonstrate the application of the 5 Why's process.

Each “Why” helps a team to delve deeper into each of the symptoms until they discover the root cause of the problem.

The 5 Why’s are used in conjunction with the Cause and Effect (Fishbone or Ishikawa) diagram.



Cause and Effect Diagram

The Cause and Effect Diagram was popularized by Professor Ishikawa.

He first used it in 1943 to help explain to a group of engineers at Kawasaki Steel Works how a complex set of factors could be related to help understand a problem.

Cause and Effect Diagram has since become a standard tool of analysis in conjunction with other analytical and problem-solving tools and techniques.

Cause and Effect Diagrams are also often called Ishikawa Diagrams or Fishbone Diagrams because the diagram itself can look like the skeleton of a fish.

The purpose of a Cause and Effect Diagram is:

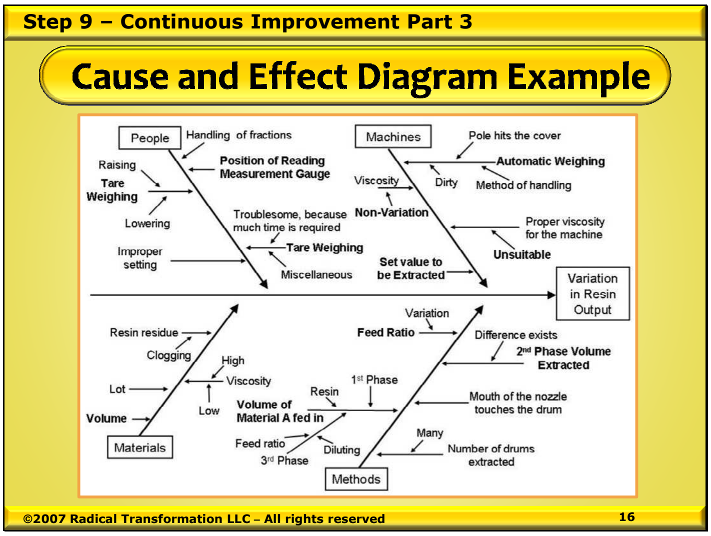
- To systematically identify and organize possible causes of problems, not symptoms.
- To visually display problem analysis.

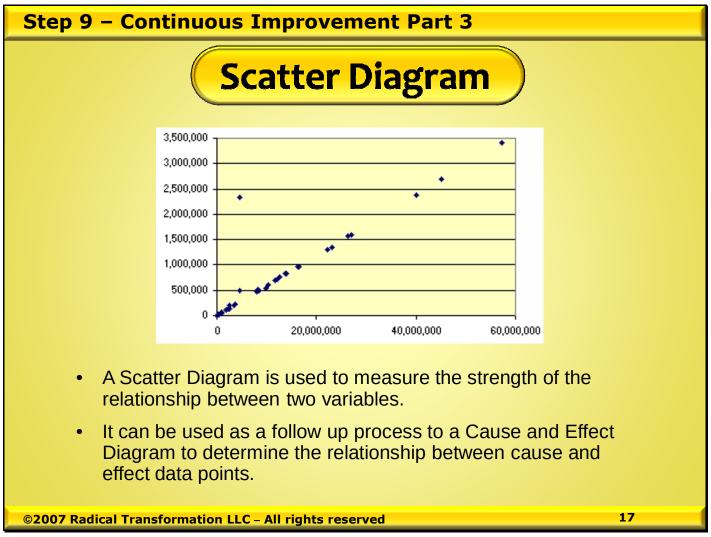
Possible uses of a Cause and Effect Diagram are to:

- Investigate the origin of the problem.
- Organize ideas about problems and causes.
- Record ideas in a way that connects them to problem causes.
- Highlight important relationships.

- Orient new personnel to the problems in a work area.
- Show the level to which a problem has been investigated.

Here is an example of a Cause and Effect Diagram:





<u>Scatter Diagram</u>

A Scatter Diagram is used to measure the strength of the relationship between two variables.

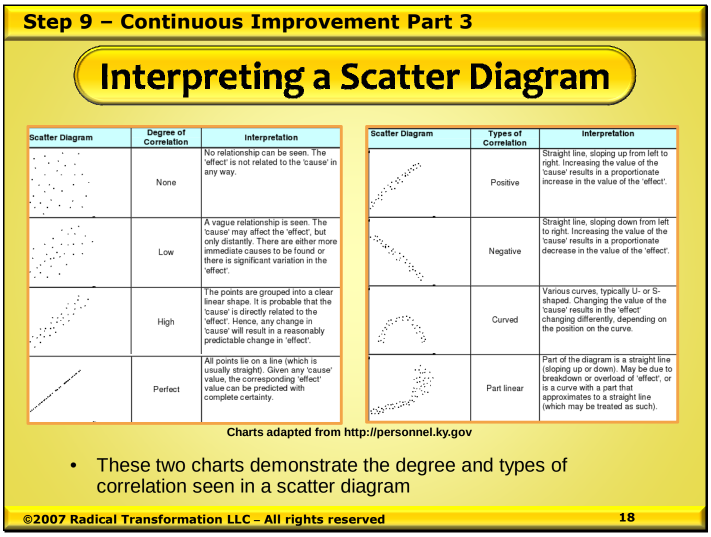
If the variables are correlated, the points will fall along a line or curve. The better the correlation, the tighter the points will hug the line.

In this screen, is an example of a scatter diagram.

The data points fall close together forming a tight line or cluster, therefore there is a good correlation between the two variables in this graph.

Correlation implies that as one variable changes, the other also changes.

It can be used as a follow up process to a Cause and Effect Diagram to determine the relationship between cause and effect data points.



Interpreting a Scatter Diagram

In this screen, are a couple of charts demonstrating how to interpret a scatter diagram.

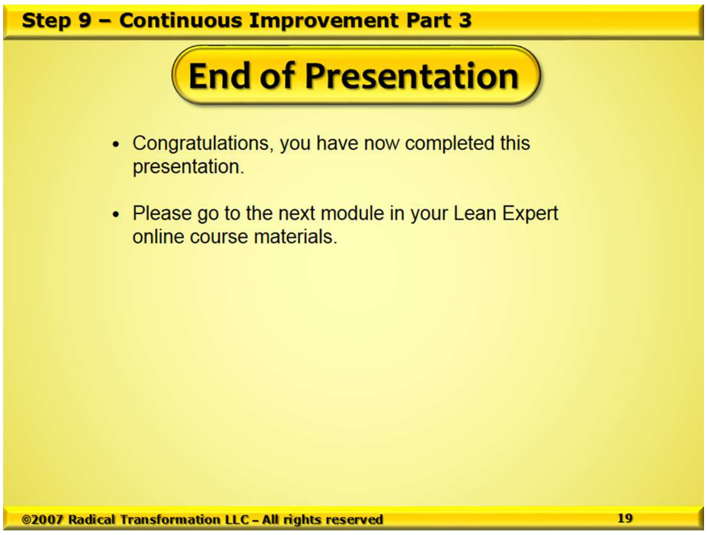
The chart on the left of the screen, is demonstrating how to interpret the four levels of relationship or degree of correlation:

1. None - no cause and effect relationship can be seen.
2. Low - there is a vague cause and effect relationship.
3. High - there is a probable cause and effect relationship.
4. Perfect - there is a predictable cause and effect relationship.

The chart of the right of the screen, is demonstrating how to interpret the types of correlation:

1. Positive - increase in cause value is proportionate increase to effect value.
2. Negative - increase in cause value is proportionate decrease to effect value.
3. Curved - changing the cause value changes the effect value differently depending on the position on the curve.
4. Part Linear - change in pattern may be due to breakdown or overload of the effect.

This information about the interpretation of the scatter diagram is detailed. In most cases an improvement team is trying to establish a clear relationship between the cause and effect values.



<u>End of Presentation.</u>

Congratulations, you have now completed this presentation.

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

Reference Materials

1. **Understanding A3 Thinking: A Critical Component of Toyota's PDCA Management System.**

   By: Durward K. Sobek II and Art Smalley. Published by Productivity Press 2008.

2. **Managing to Learn: Using the A3 Management Process.**

   By John Shook. Published by Lean Enterprise Institute 2008.

3. **Solve That Problem! Tools and Techniques for Continuous Improvement (How to Be Better).**

   By Steve Smith. Published by Kogan 1998.

4. **Quality Toolbox.**

   By Nancy R. Tague. Published by ASQ Press 2005.

5. **Out of Crisis.**

   By W. Edwards Deming. Published by MIT Press 2000.

6. **The Deming Management Method.**

   By Mary Walton. Published by Berkley Publishing Group 1986.

Documents List

1. **Cause and Effect Template** **(free download from website)**
2. **Histogram Template** **(free download from website)**
3. **Pareto Template** **(free download from website)**
4. **Run Chart Template** **(free download from website)**