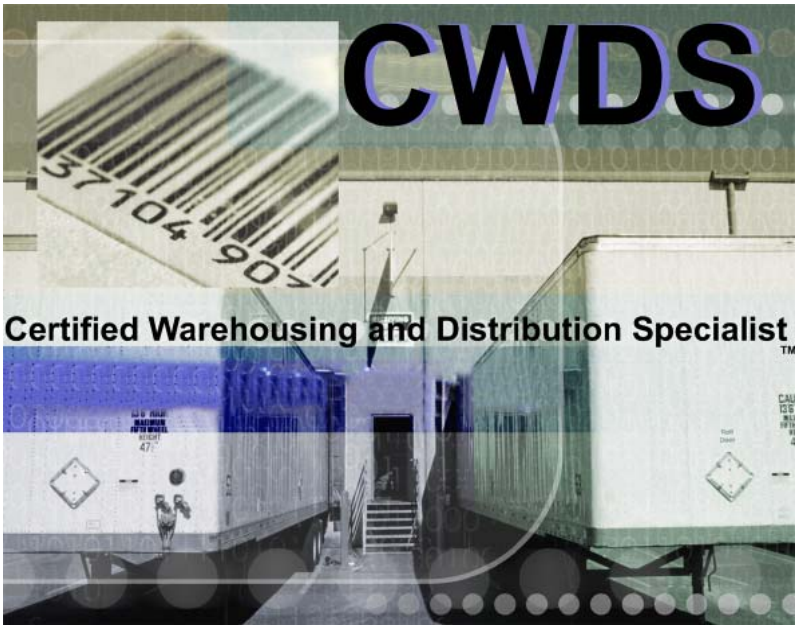

Problem Solving

QUICKSTART®
TECHNICAL COLLEGE SYSTEM OF GEORGIA

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Introduction

Overview

Six Steps to Problem Solving

In this section, you will learn how to follow a structured six-step process using the "Problem Solving Model" that will enable you to identify and solve problems.

The problem solving steps are:

- Step One: Define
- Step Two: Investigate
- Step Three: Produce Solutions
- Step Four: Select the Best
- Step Five: Try It
- Step Six: Evaluate

Problem Solving Tools

This section introduces tools used within this process to contribute to the success and continued excellence of an organization.

You will work in large and small groups to use each tool. Each group will then discuss their experiences and identify appropriate times for using the tools in the manufacturing environment.

While these skills are not used during day-to-day activities, they are needed to solve specific problems when participating in ad hoc functional and cross-functional teams.

Examples:

TQM – Total Quality Management Teams

CIT – Continuous Improvement Teams

Objectives

The information, activities, and practice provided during this unit will enable you to:

1. Justify a structured approach to solving problems.
2. Use a systematic six-step process for solving problems.
3. Assess the circumstances of a problem.
4. Analyze alternative solutions to a problem.
5. Plan how the solution will be implemented or executed.
6. Evaluate the effectiveness of an implemented solution.
7. Reassess a decision and take corrective action as necessary.
8. Handle difficult situations more efficiently and effectively.
9. Use basic tools to aid in the problem-solving process.

Six Steps to Problem Solving

Definition of a Problem:

> *"A problem exists when a product does not meet specifications or when production does not meet demand."*

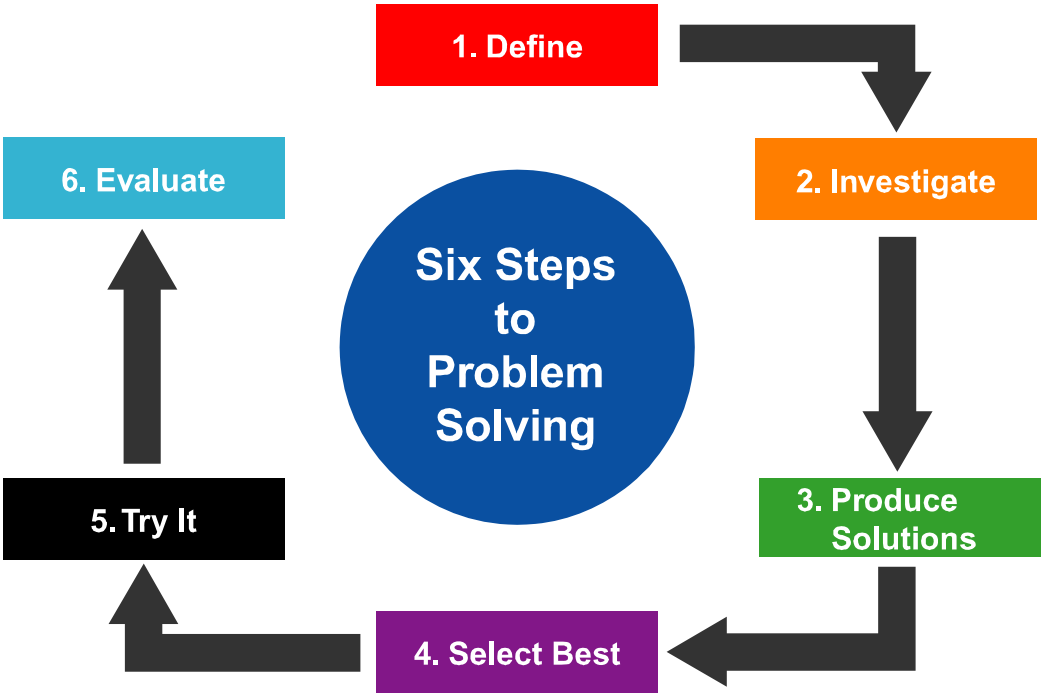
Problem solving refers to the ability to use critical thinking to assess situations and to act decisively to resolve problems when they arise.

World Class Manufacturing requires workers to have the freedom to stop and correct a process when it is producing a bad product. In this system, management provides employees with the authority and the tools required to solve problems or to improve the system of production. This is known as employee involvement.

All institutions exist to provide a product or service. Products or services are designed to perform specific functions. When products are produced in accordance with design specifications, the product will perform as required. A quality product is one that is within specifications. When products do not measure up to specifications, a problem exists that must be rectified. A company's success, in fact its very survival, depends on ensuring that problems are solved so that quality products are produced.

Human beings are natural problem solvers. Over the decades, some of the greatest inventions were created as a result of finding a solution to a problem. During the problem solving process, we analyze, we ask questions, we gather facts, and we follow up to see what worked and what did not.

This section presents a six-step problem solving process that includes identifying problems, applying a systematic approach to solving the problem, and following up to ensure that the problem was resolved.



Problem Solving Model

Step One: Define

Defining the problem is not always as easy as it sounds. A common tendency is to race off toward possible solutions without taking time to give careful consideration of the problem itself.

- List Possible Problem Areas
- Collect Data
- Select an Area to Work On
- Focus on the Facts
- Simplify the Problem

List Possible Problem Areas

It is often helpful to use a variety of tools and techniques to identify possible problem areas. Some of these tools and techniques will also be helpful when collecting data. These tools include brainstorming, check sheets, flow charts, and interviewing.

Collect Data

Collecting data will help to identify key problem areas as well as possible root causes. Asking questions is often a good way to better understand a problem. Detail and background information are important to achieving a solution. Always verify information by checking several sources.

Attempting to solve a problem while still gathering information may lead to faulty conclusions.

Select an Area to Work On

Problems should be prioritized and solved based on their relative importance to the business. They should also be selected based on their probability of success.

Focus on the Facts

Decide which information is relevant and which is irrelevant, you may then define the problem.

Simplify the Problem

Once you have gathered all the information and looked at it from all points of view, you should now simplify the problem and represent it clearly and concretely. For example, sketch a drawing of the problem, describe the problem in words, make a diagram to show the chain of events. Describe the desired state in measurable terms.

Step Two: Investigate

Once you understand the problem and all the factors involved, the real work begins.

- Break Down the Problem
- Find the Root Cause

Break Down the Problem

Many problems are actually a collection of smaller problems. It can be helpful to break down a problem into several smaller problems and deal with them separately. For example, it might be necessary to find out exactly what steps are involved in a particular process to isolate the problem.

Look for any smaller problems that may be contributing to the overall problem.

Find the Root Cause

The "root cause" is the single and original cause of the problem. You may have to dig deep to find the underlying or "root" cause of the problem. One of the easiest traps to fall into is assuming that you know what is causing the problem without taking time to investigate further.

If only the "symptom" of the problem is fixed, the same problem will recur.

Step Three: Produce Solutions

In most situations, there are several different approaches to solving a problem.

- Generate Possible Solutions
- Clarify Solutions
- Develop Options

Generate Possible Solutions

Identify as many ways as possible to solve a problem. Be willing to accept novel or unusual options and ideas.

Clarify Solutions

Be sure to clearly understand the potential solutions and their implications.

Develop Options

Consider options beyond the obvious to resolve a problem. Be well prepared and willing to look at an ordinary situation from a new perspective.

Step Four: Select the Best

Identify the best possible solutions.

- Identify Possible Alternatives
- Select a Solution
- Plan Solution Implementation

Identify Possible Alternatives

Criteria may be developed for evaluating possible solutions. Forces that can either help or hinder implementation must be identified. After reviewing all the possible alternatives and identifying the pros and cons of each, you must make a decision based on what you know.

Select a Solution

After uncovering the root cause of the problem and generating some possible solutions, you are now ready to act.

Plan Solution Implementation

The solutions should be divided into sequential, easy to manage steps. A control system and contingency plan should be defined. When other individuals are involved, each must know what he or she must do and be committed to carry out his or her share. Planning tools such as Gantt Charts, Pert Charts, or Flow Charts may be used.

Step Five: Try It

Execute the Plan

Put the plan into action. Implementation of a solution should be monitored. Contingency plans may be utilized as required.

Step Six: Evaluate

Find out how well your solution worked.

- Collect Data
- If the Problem is not Resolved, Return to Step 1
- Review What Happened

Collect Data

Data collection is important in order to learn how effectively the solution solved the identified problem. Data may be compared with data collected to analyze the problem in Step 1. In this way, the solution may be compared with the desired state, defined in Step 1. If new problems arise as the solution is implemented, they will need to be addressed.

If the Problem is Not Resolved, Return to Step 1

If the problem has not been resolved, you must start the process over again.

Find out if the solution is working or if an alternative solution should be tried. It might be necessary to refer the problem to a manager or a different department.

Review What Happened

Take some time to reflect on what the problem can potentially teach you and how the entire organization can benefit. Determine what worked well and what could be improved. Other departments or people may need to be notified of the problem.

Future problems can be prevented by using the experience and the information attained to make necessary changes to improve products, services, or procedures.

Once the problem is resolved, close the loop on the problem solving process.

Activity: Ranking the Steps

The Situation

You are the manager of a unit of a small paint production facility that supplies paint for light industrial use. You have been contacted by a local distributor of the product concerning a color separation problem. During the last six months, there has been sporadic incidence of color separation after the paint has been applied to metal surfaces.

This paint product has consistently met production specification standards before leaving the plant. In the field, the problem has been corrected by using additive prior to reapplication. Although this solution has been successful, the continued incidence of the problem has resulted in increased costs and loss of confidence in the product itself.

The Assignment

Review the following list of activities that can lead to the successful resolution of this problem. The activities are listed in random order.

Your task is to sequence these activities in the order that you would follow in identifying the problem, resolving the problem, and learning from the experience.

Activities

Steps 1 and 2 of the Problem Solving Model include defining and investigating the problem:

Step 1: Define

1. List Possible Problem Areas
2. Collect Data
3. Select an Area to work On
4. Focus on the Facts
5. Simplify the Problem

Step 2: Investigate

6. Break Down the Problem

7. Find the Root Cause

Number the following activities in the order in which they would occur.

___ A. Test results at the plant showed that the product meets specifications, therefore the investigation will concentrate on post-production.

___ B. The problem is that sporadic color separation occurs during post-production handling.

___ C. Since the problem occurs with new as well as older (though not outdated) product, and since contamination has not been found in post-application testing, it appears that storage is affecting the incidence of color separation.

___ D. Possible problem areas may include product formula, contamination, age of product, or storage.

___ E. A flow chart which shows the movement of product through post-production was created. The goal will be to completely eliminate the incidence of color separation.

___ F. Interviews were held with distributors and end-users who have experienced the problem, and product tests were conducted during and after production in order to gather information about the problem.

___ G. Each of the elements of post-production was broken down into the following areas: storage, contamination, and age of product.

Steps 3 and 4 of the Problem Solving Model developing and refining possible solutions:

Step 3: Produce Solutions

8. Generate Possible Solutions
9. Clarify Solutions.
10. Develop Options

Step 4: Select The Best

11. Identify Possible Solutions
12. Select a Solution
13. Plan Solution Implementation

Number the following activities in the order in which they would occur.

___ H. Additional options may need to be developed based on the needs of individual distributors or end-users.

___ I. Possible solutions include using a different storage container or storing the product in a climate controlled location.

___ J. Climate controlled storage will be implemented.

___ K. Although potential storage locations may already exist, a container change may cause unknown product interactions.

___ L. After considering a list of pros and cons of the two best possible solutions, a decision will be made to address the long term solution of the problem.

___ M. Possible storage areas will be identified. Input from distributors, end-users, and plant personnel will be solicited. Once approved areas are identified, the product will be moved to those locations.

Steps 5 and 6 of the Problem Solving Model include implementing and evaluating the solution:

Step 5: Try It

14. Execute the Plan

Step 6: Evaluate

15. Collect Data
16. If the Problem is not Resolved, Return to Step 1
17. Review What Happened

Number the following activities in the order in which they would occur.

___ N. Future product development will include storage recommendations.

___ O. Controlled storage areas will be utilized.

___ P. It is expected that no further problems will be recorded.

___ Q. Once controlled storage is implemented, incidence of the color separation problem will be recorded and compared to the number of previous incidences.

Notes:

Problem Solving Tools

Principles of Excellence

The success of companies that are industry leaders or labeled "excellent" is usually attributed to hard work, high quality products, and a firm focus on several sound management philosophies and principles.

Principles of Excellence include:

- Focus on customer needs and expectations.
- Recognize shared responsibility for quality and the success of the company.
- Prevent errors.
- Emphasize shared involvement to continuously improve the quality of services.
- Efficiency of processes.

Tools help us organize data and facts. There are eight problem solving tools that include:

1. **Brainstorming** to generate a list of ideas.
2. **Flow Charting** to illustrate a process.
3. **Tally Sheets** to capture data.
4. **Pareto Charts** to show the number of items fitting into any one category.
5. **Run Charts** to graph data plotted over time.
6. **Cause and Effect Diagrams** to organize potential causes of a problem.
7. **Force Field Analyses** to analyze the driving and restraining forces that surround a proposed change.
8. **Action Plans** to identify what needs to be done, who is responsible for what and when.

Brainstorming

Goals for Brainstorming

The following are the goals for brainstorming:

- Generate a wide variety and extensive number of ideas
- Ensure everyone becomes involved
- Ensure nothing is overlooked
- Create an atmosphere of creativity and openness

Brainstorming Methods

Brainstorming methods include:

- Round Robin Style
- Free-Wheeling

Round Robin Style

Everyone takes a turn offering an idea.

Record each idea on a flip chart.

Anyone can "pass" on a turn.

Continue until there are no more ideas.

Free-wheeling

Share ideas all at once.

List all ideas as they are "shouted-out."

Rules for Brainstorming

1. Criticizing ideas is not allowed.

   There should be no evaluation or criticism of others' ideas during the process. Criticism will only inhibit team members from sharing their ideas.

2. Each person has equal opportunity to express ideas.

   It is important that no person(s) dominate the offering of ideas. This can be accomplished using a structured process where everyone is given a "turn" to offer ideas in an orderly manner.

3. The QUANTITY of ideas is more important than quality of ideas.

   The goal at this time is to generate as many ideas as possible.

4. Piggybacking and hitchhiking on ideas is encouraged.

   Ideas breed other ideas. There is no ownership of ideas in a brainstorming session. Once an idea has been offered, it "belongs" to the team. Thus, team members should try to get new ideas from each other. Frequently one member's idea will trigger another slightly different idea.

Steps in Running a Brainstorming Session

1. Select someone to act as group facilitator.
2. Establish a time limit.
3. Identify recorders.
4. Determine method of brainstorming.
5. Write down the problem statement.
6. Generate ideas.
7. Record all ideas.
8. Pause to review list.
9. Add to list.
10. Stop brainstorming when everyone has had a chance to participate and no more ideas are being offered.

At the end of a Brainstorming session, you should:

- Clarify ideas from the brainstorming session.
- Combine like ideas (with permission of the group).
- Eliminate exact duplicates.
- Label ideas.
- Prioritize ideas.
- Develop an action plan for top-priority items

Activity: Brainstorming

Large Group

You will work together as a group to brainstorm ideas for causes of a high reject rate from the milling operation.

A volunteer will facilitate the brainstorming session and write the ideas on a flip chart.

Use the Round Robin Style, where everyone takes a turn offering ideas and anyone can "pass" on a turn during this Brainstorming session. Remember, all ideas are valid and no one is allowed to be critical.

When the ideas die down, review the list and refine the ideas on the list that you feel are worthwhile.

One method of refining the list is called "multi-voting." Multi-voting is a process where everyone votes on the idea they like best, either through secret ballot or by show of hands. The goal is to get the list down to a manageable size. Once the list of ideas is manageable, a process improvement team is assigned a topic. Once the data is obtained, you must do something with it.

Small Group

Work together in small groups (3-4 per group) and brainstorm the reason for poorly baked bread.

Situation:

Customers of the Daily Bread Company have noticed a change in the taste and quality of bread purchased from that company. Lately, the bread has not been as soft and seems to lack some of its normal good flavor.

Select a recorder and spokesperson.

Brainstorm the reasons why the bread is not of the normal quality. Print your findings on a flip chart.

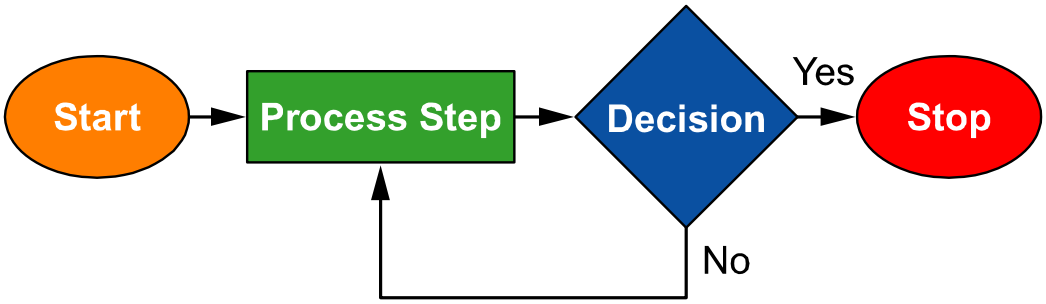
Report findings for each group and discuss.

Flow Charting

Flow Charts are pictorial representations of the major steps in a process. Because pictures are powerful communication tools, flow charts can be useful in describing and documenting relationships among various steps in a process.

Flow chart symbols include:

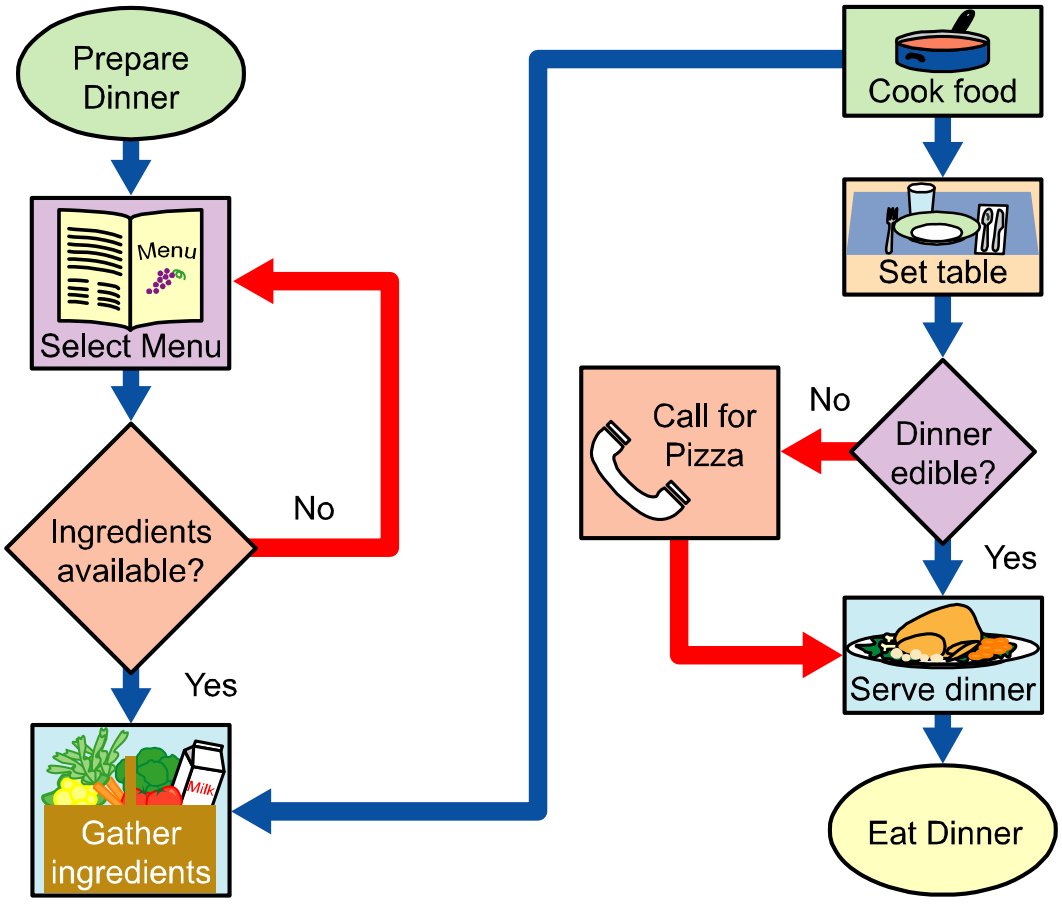
- Ovals demonstrate Starts and Stops.
- Rectangles represent Process Steps.
- Diamonds are Decision Points which always require Yes/No answers.



Flow Chart Symbols

Steps in Preparing a Flow Chart

1. Define the process boundaries to be charted (what will and will not be discussed).
2. List major steps in the process.
3. Arrange the steps in sequence.
4. Draw the flow chart.
5. Study the flow chart.



Sample Flow Chart

Activity: Flow Charting

Large Group Flow Chart

Work together as a group to create a flow chart that starts with receiving raw materials and ends with a manufactured product ready for shipping to the customer.

Small Group Flow Charts

Work together in small groups of 4 to 5. Select a facilitator to draw a flow chart on a flip chart depicting the steps involved in changing a tire.

Each group will display their flow chart on the wall and select a spokesperson to read and explain their process charts to the rest of the class.

Tally Sheets

A Tally Sheet is a form constructed and used for recording how often an event occurs. Tally Sheets are used to gather data based on simple observation in order to begin to detect patterns.

Tally Sheets are used:

- to identify a logical starting point in the problem-solving cycle.
- to physically track the number of occurrences over a specified time.
- to understand the significance of the number of times an event occurs.
- to collect information.

Custom Milling
Mill Defects

Date 6-3 Time 10:00am - 9:00pm

Number of Complaints 20

Analyst Name Jill Mamy

Defect	Tally	Total
Out of Spec. Width	/	1
Out of Spec. Length	𝍸	5
Rough Spots	𝍸 𝍸 /	11
Can't Adjust	/	1
Lens Broken	//	2

Remarks _____

Custom Milling Tally Sheet

Steps in Preparing a Tally Sheet

1. Identify what is being observed and counted. Everyone should be looking for the same thing.
2. Decide on a time period for collecting data.
3. Design a form (Tally sheet) that is clear and easy to use.
4. Collect the data consistently.
5. Count the occurrence of the event being observed over a specific period.
6. Total the check marks and observe trends.

Results of Tally Sheets provide data to track defects in items or processes and detect patterns that signal underlying problems.

Activity: Tally Sheet

Work in small groups of 4 or 5.

Scenario:

A manufacturer of portable classrooms and accessories wishes to improve their products. They decided to collect information regarding the abuse of structural items such as walls, floors and ceilings. They wish to gather this information at different intervals between classroom sessions.

Work together to create a Tally Sheet to record the type and number of defects or damage found in the classroom.

A volunteer facilitator should draw a box of the Tally Sheet and clearly label the time, date, title and sample types of inquiries.

Upon completion, the volunteer spokesperson will review the Tally Sheet with the rest of the class. Each group should hang their Tally Sheets on the wall to be used in the next Group Activity.

Remember, Tally Sheets:

- provide a quick form of data collection
- show obvious pattern recognition
- provide specifics
- provide data which may need further investigation to make a decision

Date	Time:	MISC. DEFECTS	Analyst Name
3/11/02	0001-2359		B.B. Hanes
Mill	**Shift**		**Total**
A	1,2,3	25	25
B	1,2,3	10	10
C	1,2,3	4	4
D	1,2,3	5	5

Optical Framus Milling Tally Sheet

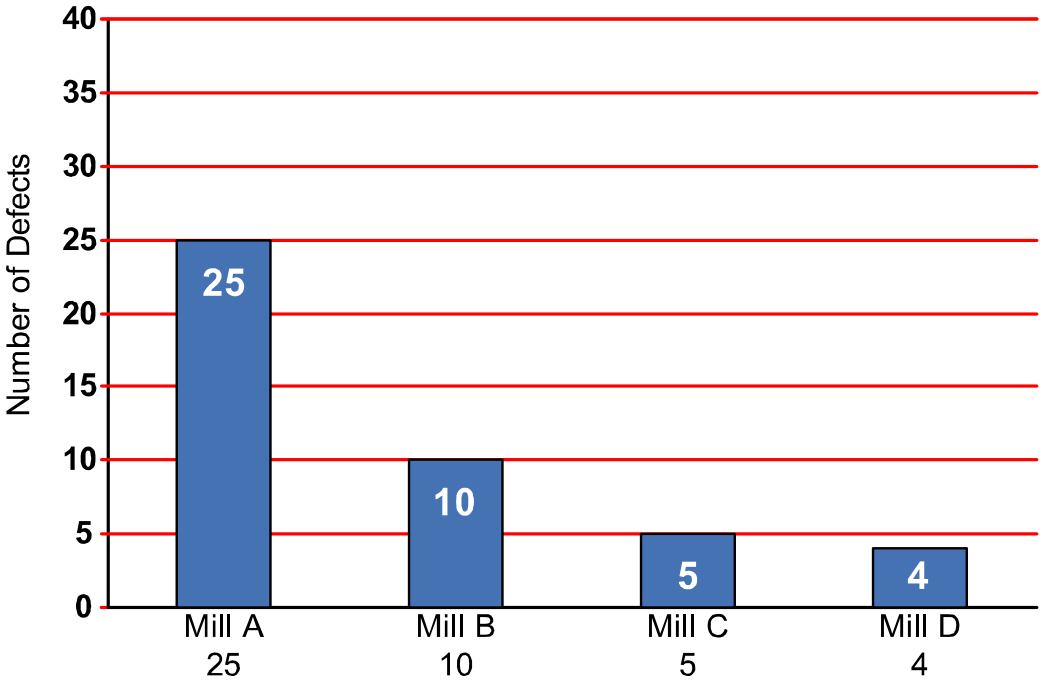
This Tally Sheet was created to gather information about all the defects created during a 24 hour operation of four different mills. This data will be used to build the next tool, a Pareto Chart.

Pareto Charts

Once data is gathered it needs to be explained in some logical format. A Pareto Chart is a special type of bar graph that you can use as a tool to display the relative importance of all problems or conditions in order to choose the starting point for problem solving.

The chart derives its name from Alfredo Pareto, the man who created the chart. The Pareto Principle states that 80 percent of problems are caused by 20 percent of the processes/people/machines.

The sample Pareto Chart illustrates the same data as the data collected on the Tally Sheet in the previous section.



Optical Framus Milling Pareto Chart

Steps to Preparing a Pareto Chart

1. Select the categories and the units of comparison such as frequency, time or cost.
2. Order the categories from largest to smallest.
3. Compare the frequency or cost of each category relative to all other categories.
4. Draw and label the left vertical axis with the unit of comparison. Scale this axis from 0 to the grand total of all categories.
5. Draw and label the horizontal axis with the categories, largest to smallest, left to right.
6. Draw bars for each category. Each bar's height should be the category sum as measured on the left vertical axis.
7. Title the Pareto Chart.
8. Study the results.

Activity: Pareto Chart

Work in the same groups that compiled the Tally Sheet data for classroom defects.

Use the Steps to Preparing a Pareto Chart to create a Pareto Chart illustrating the information gathered on the Tally Sheets used to record the type and number of defects or damage found in the classroom.

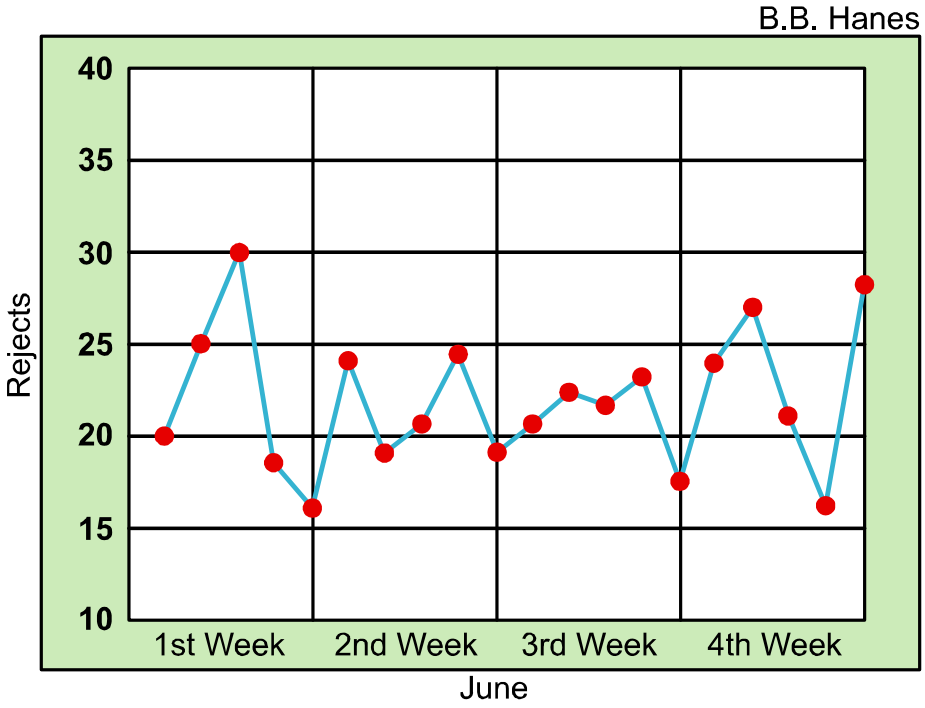
Each group should select a volunteer facilitator to draw the chart on a flip chart and a spokesperson to read and explain their Pareto Chart to the rest of the class.

Run Charts

Run Charts are line graph data plotted over time and used to monitor long run average changes and to note trends. A sophisticated version of a Run Chart is a Control Chart that includes calculated limits that are rarely exceeded unless there is a fundamental change in the process.

This sample Run Chart:

- includes the subject name, the date, time, and recorder
- depicts rejects over time
- includes a vertical axis which shows the number of occurrences
- includes a horizontal axis which shows the time or date for each observation



Daily Reject Run Chart

Activity: Run Chart

Work together as a group to design a Run Chart. Use the chart and information that follows to track defects from Mill A on Shift 2 for four weeks in the month of June.

Rejects for Month of June - Mill A - Shift 2

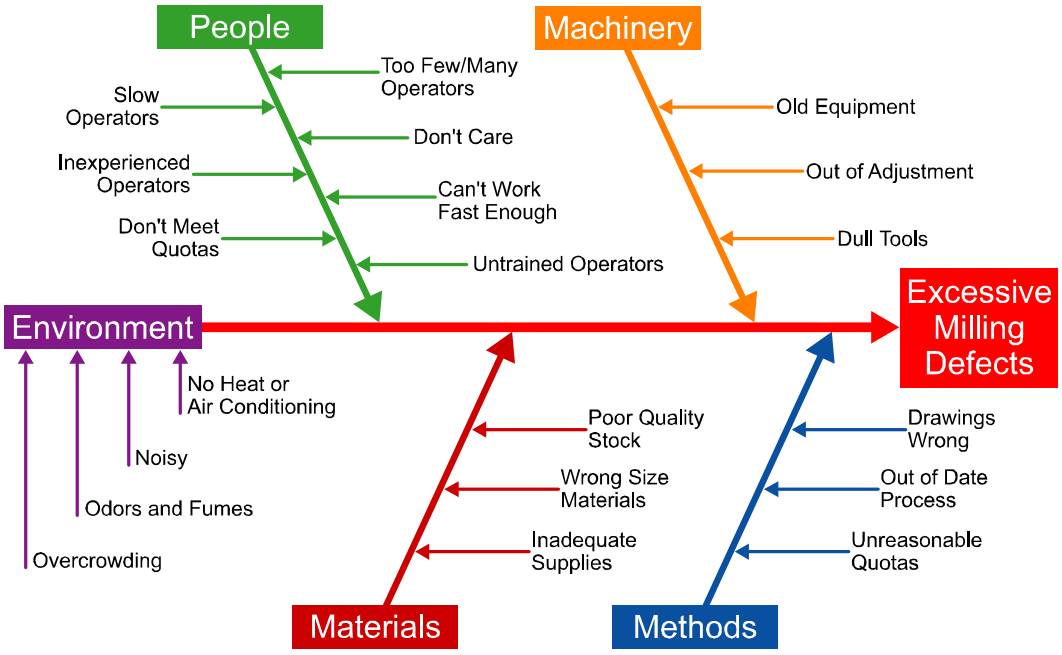
1st Week	Rejects	2nd Week	Rejects	3rd Week	Rejects	4th Week	Rejects
Day 1	23	Day 6	19	Day 11	27	Day 16	17
Day 2	21	Day 7	20	Day 12	16	Day 17	23
Day 3	23	Day 8	18	Day 13	21	Day 18	21
Day 4	25	Day 9	25	Day 14	27	Day 19	22
Day 5	23	Day 10	30	Day 15	24	Day 20	20

(Run Charts will be covered in more detail in the class: "Statistical Process Control.")

Cause and Effect Diagrams

So far, the data that we collected did not say what was causing the problem; only that it existed. Cause and Effect Diagrams are tools used to identify, explore, and display the possible causes of a specific problem or condition. These diagrams are also called fish bone diagrams or Ishikawa Diagrams for the man who invented them.

In Cause and Effect Diagrams, the "effect" is the problem being investigated. The "causes" are possible reasons for the problem that have been divided into categories.



Custom Milling Cause and Effect Diagram

When attempting to get to the root cause, a rule of thumb includes asking, "Why?" five times.

Example:

A big pharmaceutical company developed a new brand of detergent. They did market research and developed this special brand of detergent for clothes. After a big advertising campaign, the detergent sold like crazy. But shortly thereafter sales subsided drastically. The company went out and did additional market research, reformulated the product, etc. but sales never did pick up again. Finally after much time and money, the company went to their customers. They asked why five times. It ended up that the measuring cup for the detergent sank to the bottom of the box; customers were not going to dump out all the soap just to get to the scoop so they stopped buying the product. Notice that now most detergents, especially those sold in liquid form, have the scoop as a cap to the detergent bottle.

Example of asking "Why?" five times:

I stopped using this new brand of detergent.

1. Why?

   It was giving me inconsistent results.

2. Why?

   The number of loads washed per container were inconsistent.

3. Why?

   I never seemed to have a measuring cup handy.

4. Why?

   The one they provided was not available.

5. Why?

   It was in the bottom of the container.

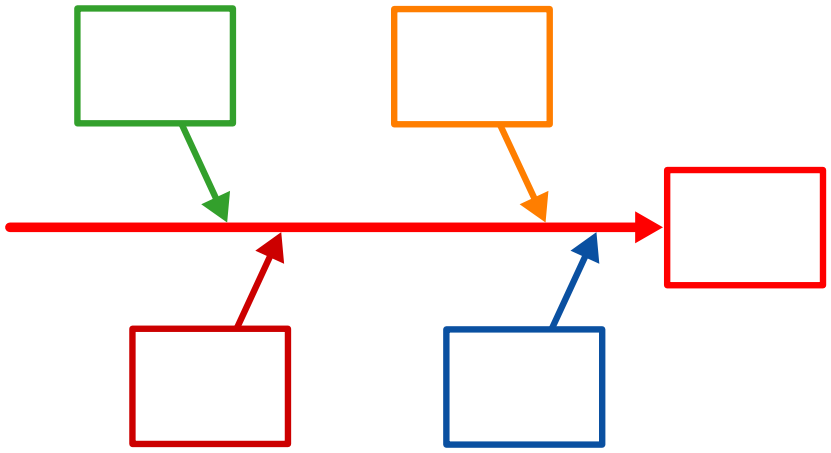
Steps in Preparing a Cause and Effect Diagram

1. Identify the problem or effect.
2. Record the problem or effect statement.
3. Draw and label the main "bones" of the diagram skeleton.
4. Brainstorm all possible causes.
5. Identify the most likely causes.

Activity: Cause and Effect Diagram

Large Group Cause and Effect Diagram

Work together as a group to draw a Cause and Effect diagram illustrating the reasons for production fluctuation. Use data collected from Run Chart created in previous activity.



Draw the diagram on a flip chart that will include the following primary input categories:

- Materials
- Methods
- Machines
- Manpower
- Environment

Brainstorm all possible causes.

Small Group Cause and Effect Diagram

Work in small groups of 4 or 5. Complete the cause and effect diagram started by the class.

When problems are specified and their causes are identified, you are ready to research possible solutions.

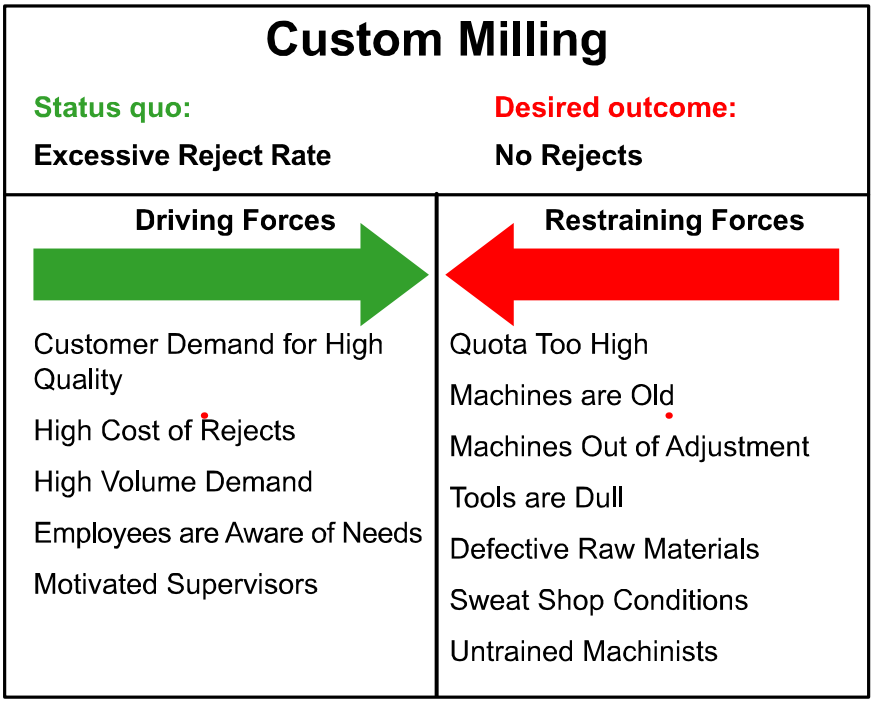
Force Field Analysis

A Force Field Analysis is a tool used to analyze the reasons a change may be necessary (driving forces) and the reasons that make the change difficult to accomplish (restraining forces).

A Force Field Analysis is used when a change is expected to be difficult. Driving Forces move a situation toward change and Restraining Forces hinder change. If the Restraining Forces are more powerful, change will not occur. Change can only occur when these opposing forces have been modified.

Steps in Preparing a Force Field Analysis

1. Define the desired change or action.
2. Draw a force field chart (a large "T") and write the current situation at the top of the chart (above the "T").
3. Brainstorm the "driving forces" (pushing you toward what you want) and list them on the left side of the chart.
4. Brainstorm the "restraining forces" (preventing you from getting what you want) and list them on the right side of the chart.
5. Discuss the chart and determine which items could be altered to increase the chances for success.
6. Develop an action plan to alter the forces.



Sample Analysis

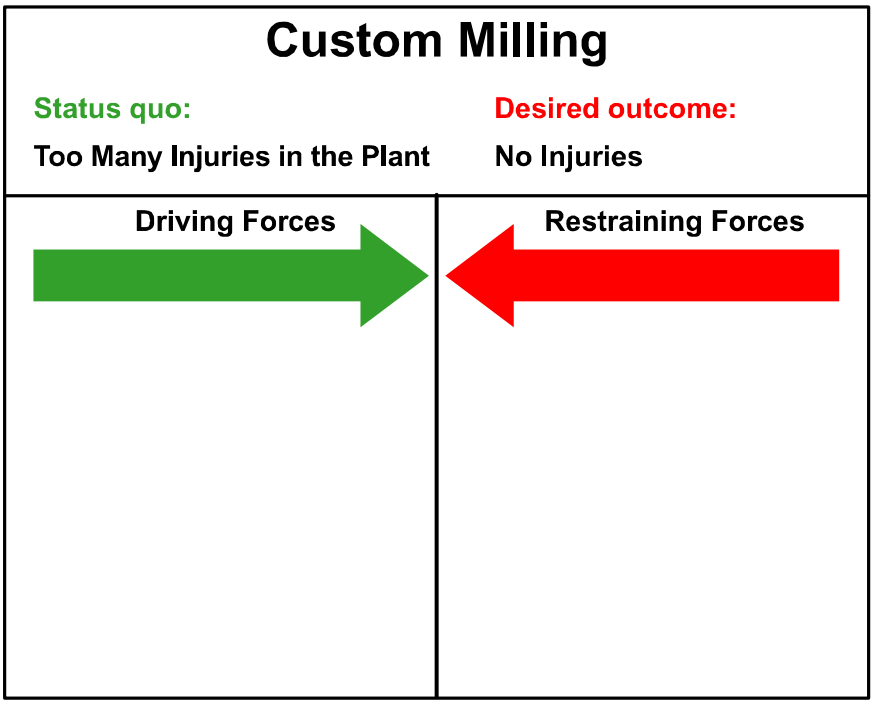
Activity: Force Field Analysis

Large Group Force Field Analysis

Work together as a group to develop a Force Field Analysis investigating the large number of injuries at the plant.

Select a volunteer to facilitate and draw the "T" chart on a flip chart and to label the change or problem statement, as well as label the columns "Driving Forces" and "Restraining Forces."

Use Brainstorming as a tool to seek ideas for the "Driving Forces" and the Restraining Forces."

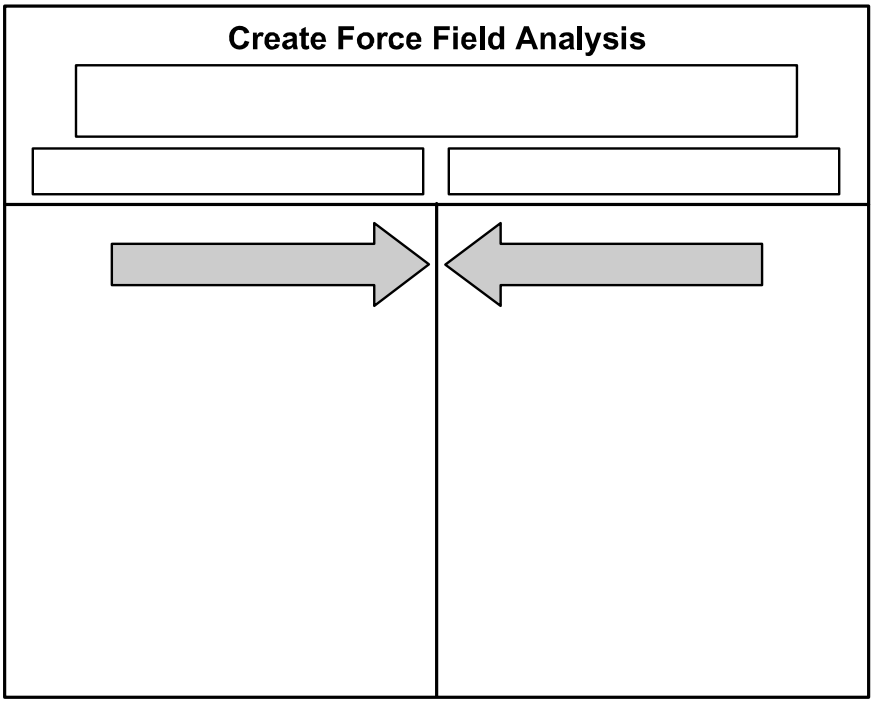


Small Group Force Field Analysis

Work in small groups of 4 or 5. Select a new facilitator and new spokesperson. As a group, complete the Force Field Diagram to reduce rejects and list the restrains that keep the rejects problem from being resolved.

In summary, tools used to solve problems, help:

- Specify the problem
- Identify the causes
- Analyze the reasons a solution is necessary



Create Force Field Analysis

Action Plans

Action Plans identify:

- What needs to be done
- Who is responsible for each task
- When each task must be completed

Action Plans keep track of the "to do's" decided upon during the problem solving sessions.

Action Plan			
Improvement Project			
Objective:			

Sample Action Plan

Summary

Problem solving is a skill that requires critical thinking. The "Problem Solving Model" provides a systematic approach that allows difficult situations to be handled more efficiently and effectively.

Step 1 of the "Six Steps to Problem Solving" is to define the problem. This step includes listing possible problem areas, collecting data, selecting an area to work on, focusing on the facts, then simplifying the problem.

In Step 2, Investigate, the problem is broken down in order to find the root cause. The root cause is the single and original cause of the problem. If only the symptoms of the problem are addressed, the problem will continue to recur.

Solutions are produced in the third step of the problem solving process. Generating and clarifying possible solutions are important elements of Step 3. It is here that options beyond the obvious are considered.

Once several possible solutions have been generated, it is time to select the best. Evaluation criteria may be developed to identify possible solutions. All the possible alternatives as well as the pros and cons of each will need to be identified before an implementation plan can be developed.

Once the plan is put into action, implementation should be monitored and contingency plans developed as needed. Finally, the solution should be evaluated. This is done by collecting data and comparing it with the desired state that was identified in Step 1. If the problem still has not been resolved, the problem solving process must begin again. If the problem has been resolved, it is important to take time to reflect on what can be learned from it and how the entire organization can benefit. Future problems can be prevented using the experience and information attained from the problem as well as from the process of solving the problem.

Review

During the review, you may use your Participant Guide and/or the information on the flip charts posted around the room.

Brainstorming

What is used to set the framework for brainstorming?

What is the purpose of brainstorming?

What are the rules for brainstorming?

Flowcharting

What is the value in drawing a flowchart for a process?

What symbols are used in flowcharting and what do they mean?

Tally Sheet

What is the purpose of a Tally Sheet?

What needs to be done before observing and tallying data?

What value or information can be deduced from a Tally Sheet?

Pareto Chart

What is the value of a properly constructed Pareto Chart?

What are the steps in creating a Pareto Chart?

Run Chart

What is a Run Chart?

How is it used?

Cause and Effect Diagram

What is the purpose of the Cause and Effect Diagram?

What are the 5 major "bones" on the *Fishbone* diagram?

What is at the head of the diagram?

How many time should you ask *"Why?"* to get at the root cause?

Field Force Diagram

What does the Field Force Diagram show?

How can the diagram be used to solve a problem?"

What do you do next?

Problem Solving Tools

Which tools can be used to accomplish the first step of the Six Step Process discussed in the first section: Define the problem?

Which tools can be used to accomplish the second step: Investigate the facts?

Which tools can be used to accomplish the third step: Produce solutions?

Which tools can be used to accomplish the fourth step: Select the best?

Which tools can be used to accomplish the fifth step: Try it?

Which tools can be used to accomplish the sixth and final step: Evaluate results?