Root Cause Analysis

Root Cause Analysis

- Root Cause Analysis is a method that is used to address a problem or non-conformance, in order to get to the “root cause” of the problem. It is used so we can correct or eliminate the cause, and prevent the problem from recurring.
- Traditional applications of Root Cause Analysis
  - Resolution of customer complaints and returns.
  - Disposition of non-conforming material (Scrap and Repair) via the Material Review process.
  - Corrective action plans resulting from internal and customer audits.

Objective

- Through this training course, you will:
  - Understand the meaning of “Root Cause”
  - Know the steps used to identify the root cause of problems.

What is Root Cause?

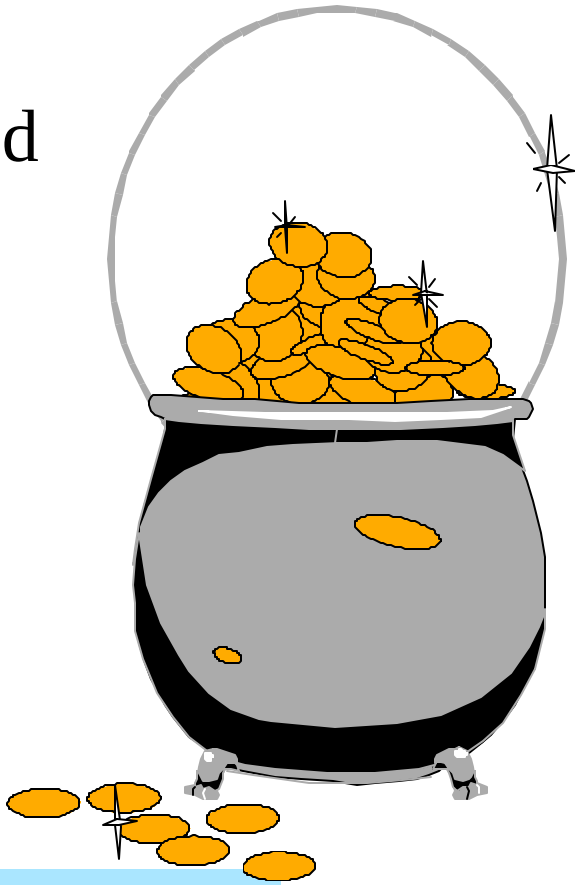
- ***Root Cause*** is the fundamental breakdown or failure of a process which, when resolved, prevents a recurrence of the problem.

Or, in other words

- For a particular product problem, ***Root Cause*** is the factor that, when you fix it, the problem goes away and doesn't come back.
- ***Root Cause Analysis*** is a systematic approach to get to the true root causes of our process problems.

Philosophy of Root Cause Analysis

- Each problem is an opportunity ("golden nugget") because it can tell a story about why and how it occurred.
- It is critical that everyone take a personal and active role in improving quality.
- The ***"true"*** problem must be understood ***before*** action is taken.
  - Problems are often masked for a variety of reasons
- To do this well, we must be
  - Both focused and open-minded
  - Both patient and quick
  - Above all, we must be ***relentless***



We Perform Root Cause Analysis to Prevent Turnbacks and Customer Escapes from Recurring

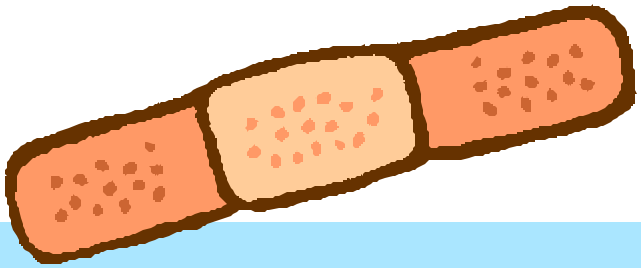
Defects found at:	Own Process Step	Next Process Step	Later Process Step	Before Reaching Customer	Found By Customer
Cost:					
	$1	$10	$100	$1,000	$10,000
Impact:	Very Minor	Minor Delay	Rework Re-schedule of Work	Significant Rework Delay in Delivery Additional Inspection	Warranty Cost Admin. Cost Reputation Loss of Market Share

Symptom Approach vs. Root Cause

- If we do a poor job of identifying the root causes of our problems, we will waste time and resources putting bandaids on the ***symptoms*** of the problem.

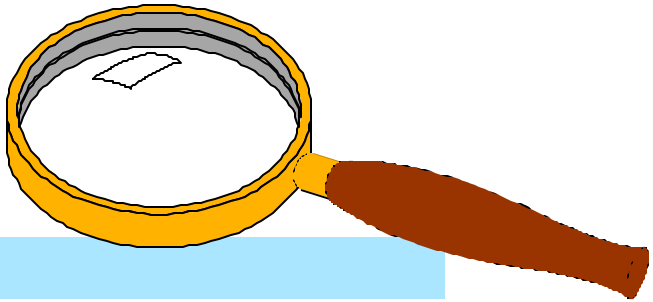
Symptom Approach

- "Errors are often a result of worker carelessness."
- "We need to train and motivate workers to be more careful."
- "We don't have the time or resources to really get to the bottom of this problem."



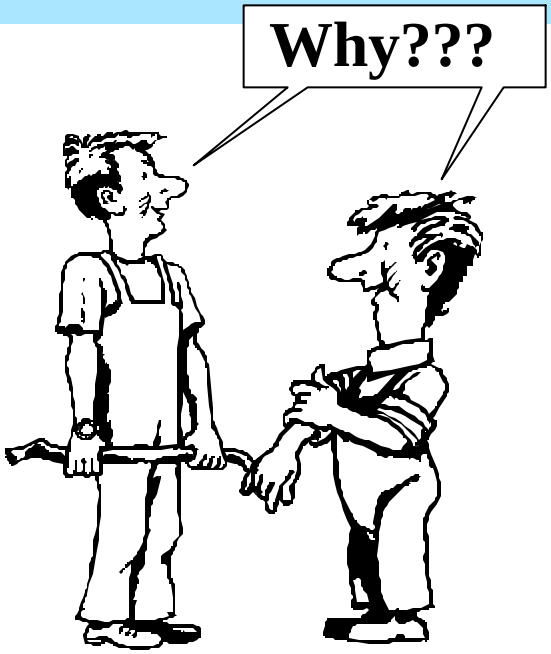
Root Cause

- "Errors are the result of defects in the system. People are only part of the process."
- "We need to find out why this is happening, and implement mistake-proofs so it won't happen again."
- "This is critical. We need to fix it for good, or it will come back and burn us."



How do we do Root Cause Analysis?

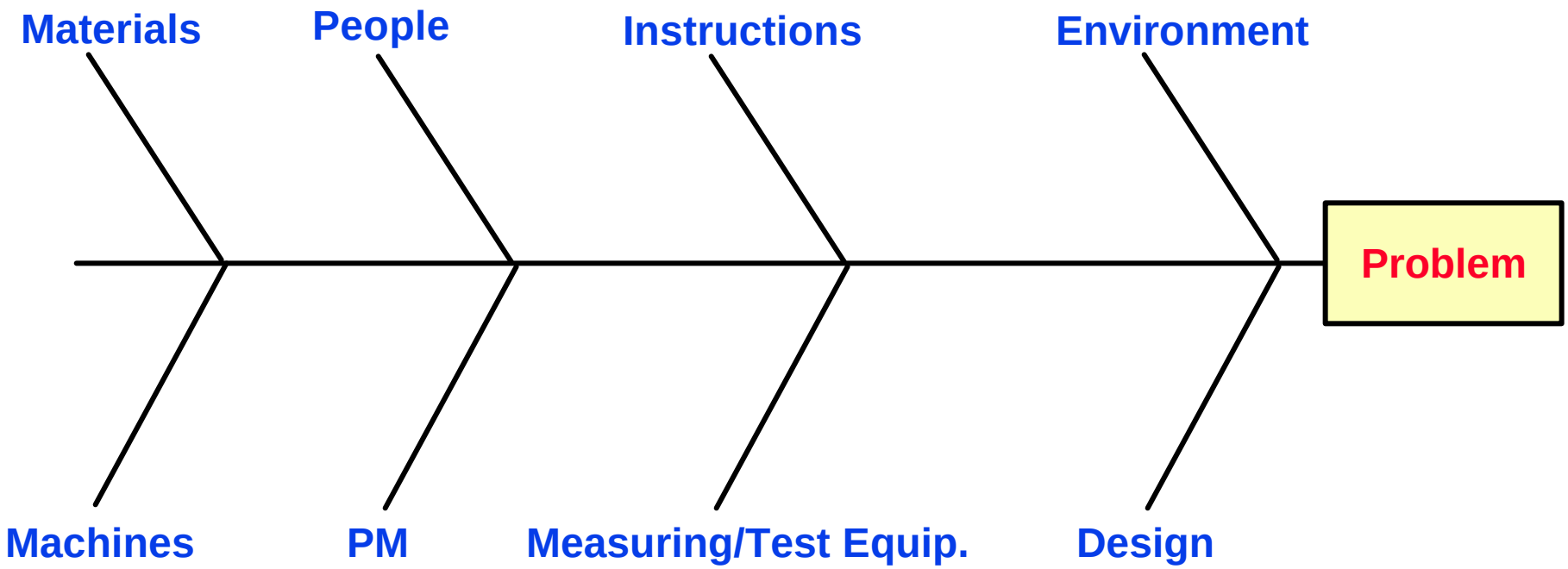
- Said simply, Root Cause Analysis is asking ***why*** the problem occurred, and then continuing to ask why ***that*** happened until we reach the fundamental process element that failed.



- The following example illustrates the basics of Root Cause Analysis.

Fishbone Diagram - A Useful Tool

- Using a fishbone diagram while brainstorming possible *causes* helps you to focus on the various *possibilities*. Some useful categories:



Example: The Washing Machine

Problem Description

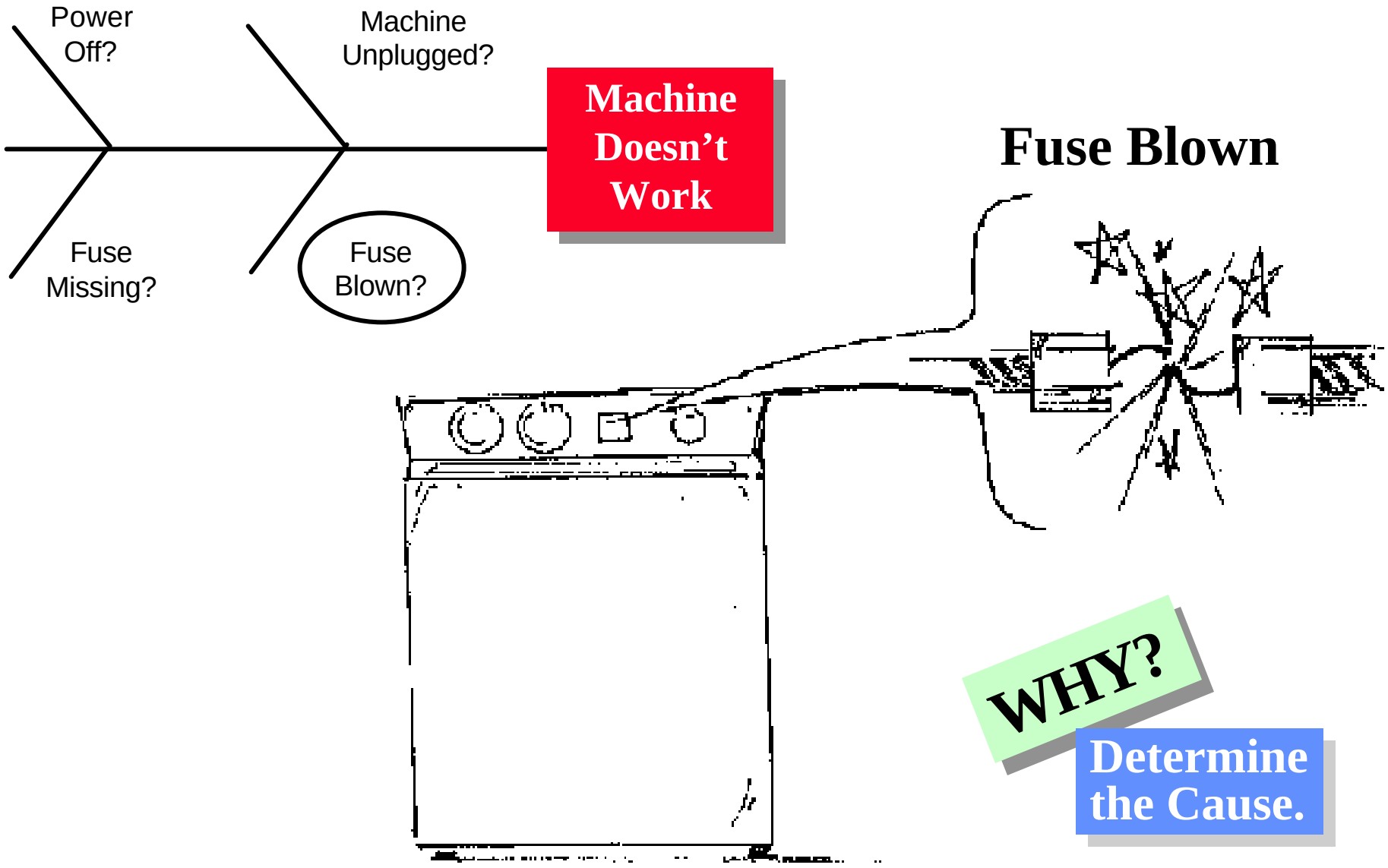
"Machine is 2 weeks old (Serial #2345017). When doing the fourth load of clothes, I heard a loud noise and the machine stopped! It wouldn't re-start."

Verify the Complaint

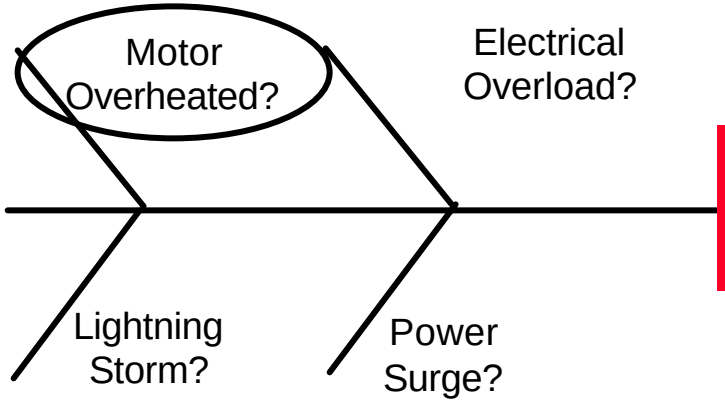
Problem Verification

Service technician checks washing machine operation to test procedure (#8496). The machine does not operate.

Investigate Why

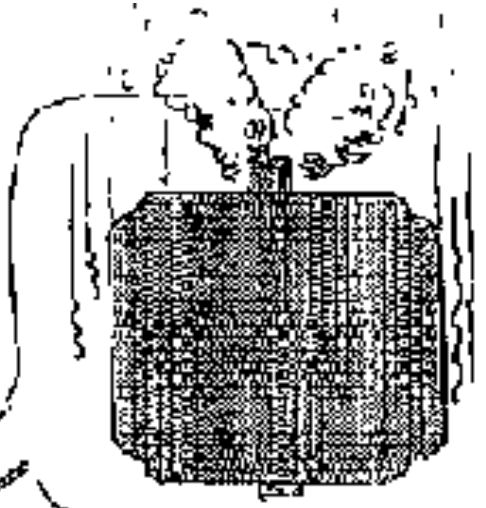


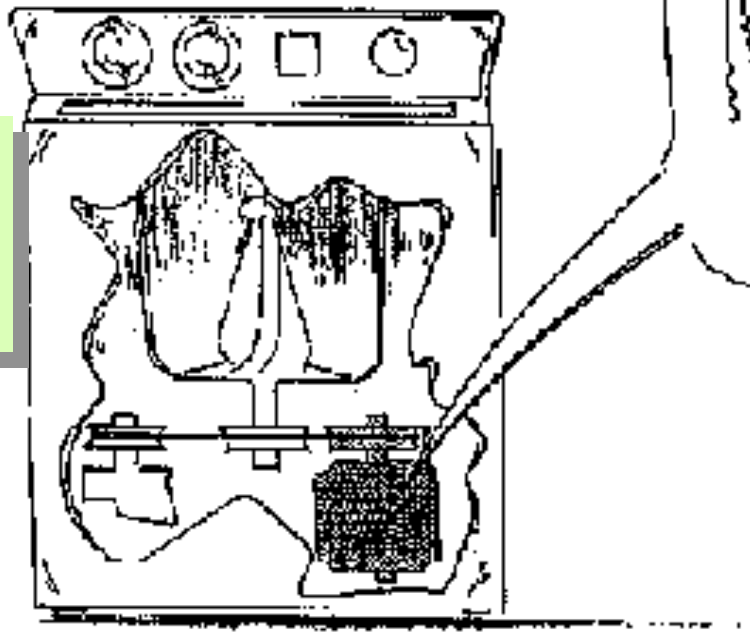
Investigate Why



Fuse Blown

Motor Overheated



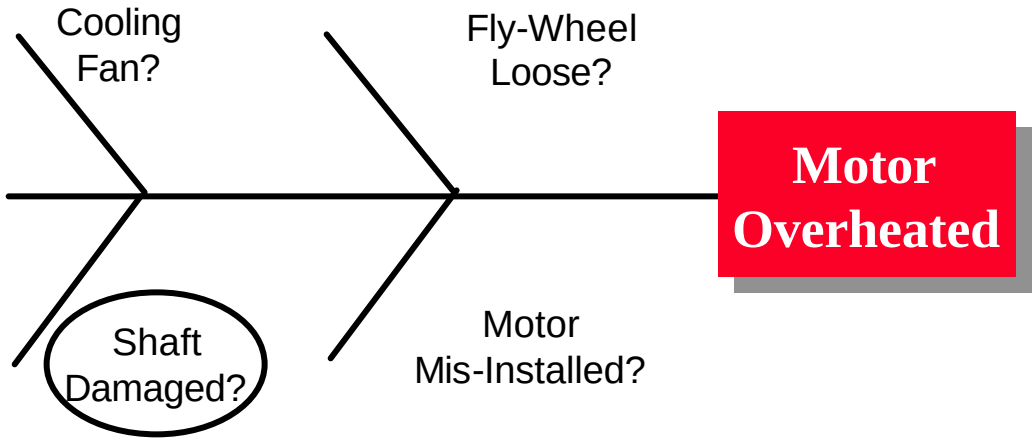


Corrective Action for Specific Deficiency:
Replace the Fuse

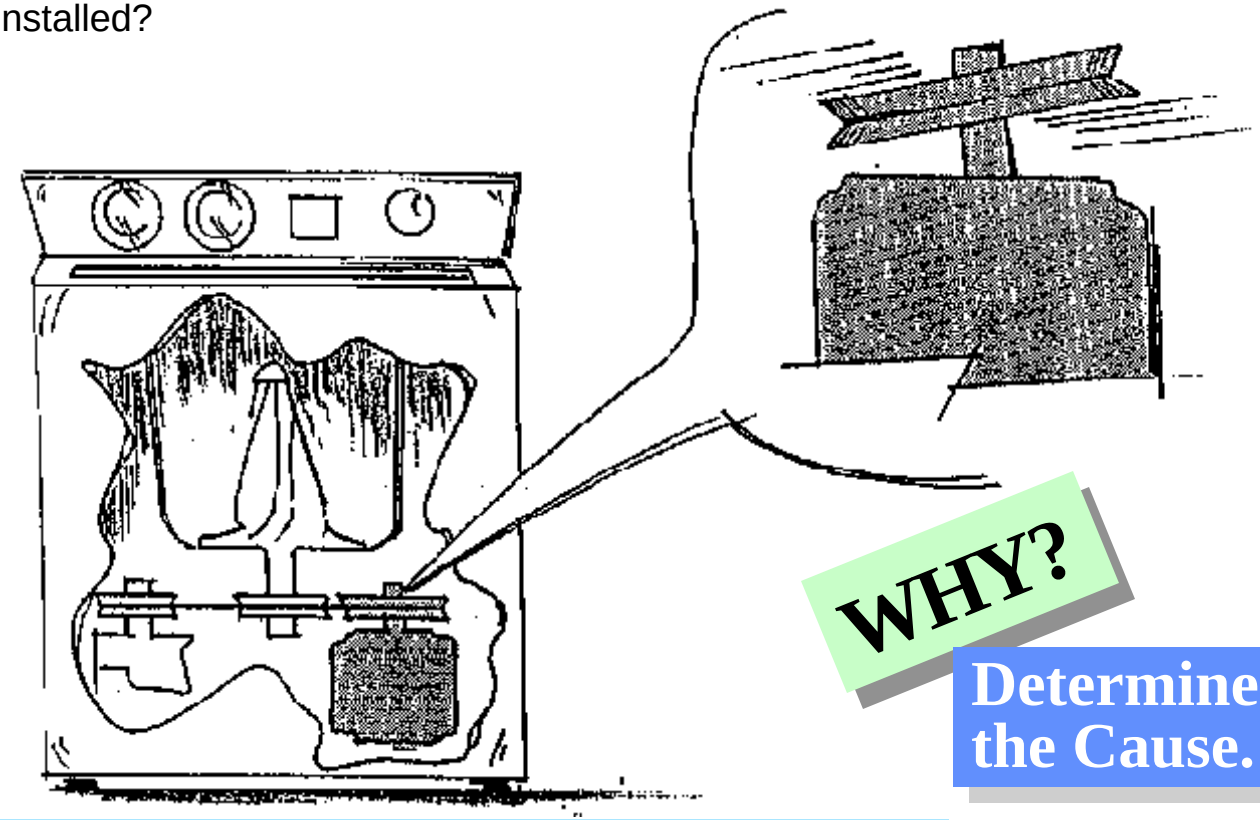
WHY?

Determine the Cause.

Investigate Why



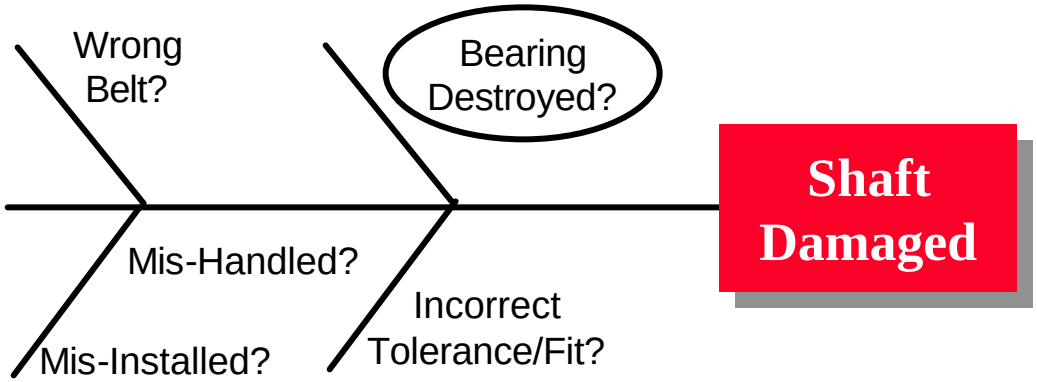
Shaft Damaged



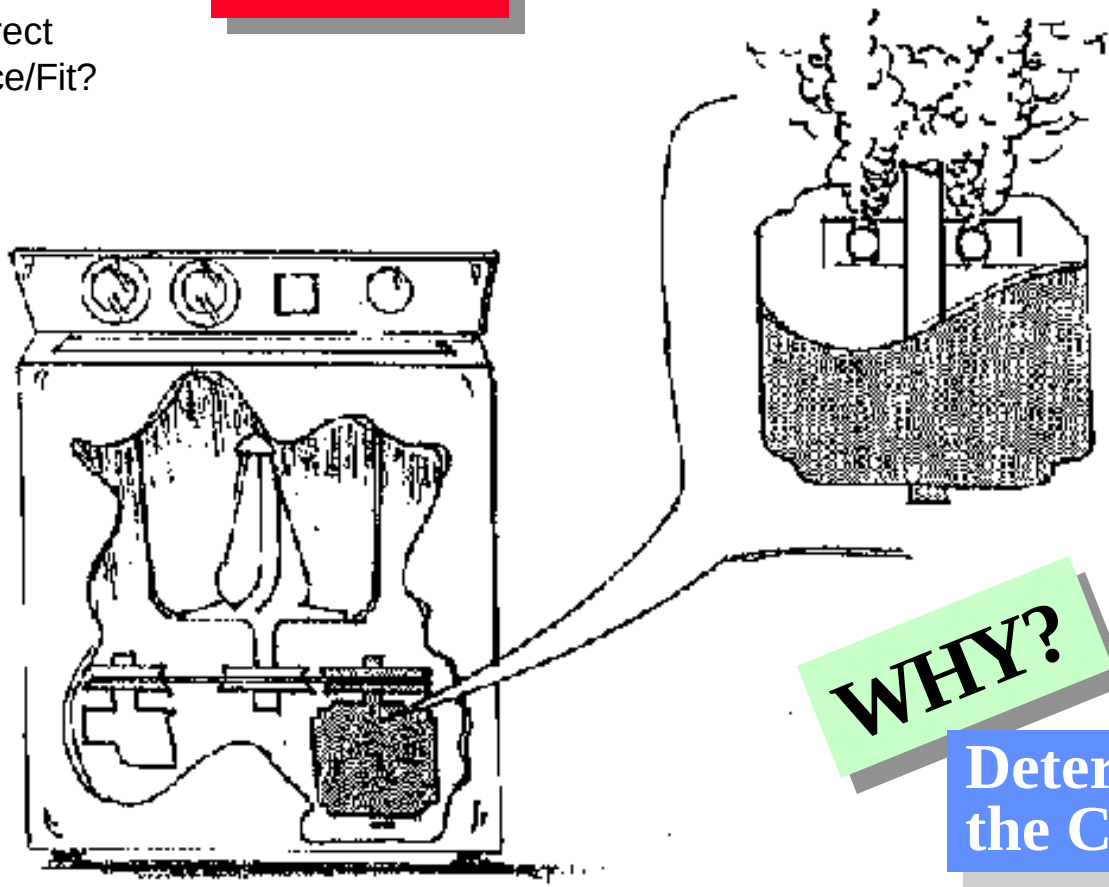
WHY?

Determine the Cause.

Investigate Why



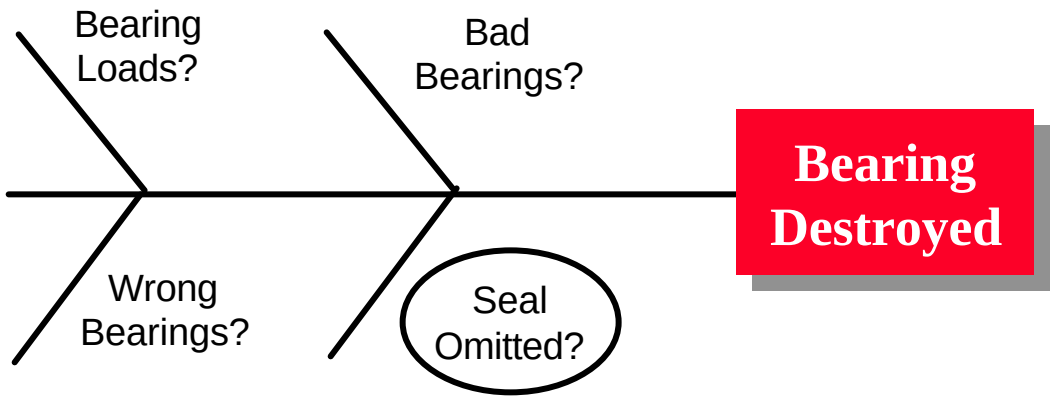
Bearing Destroyed



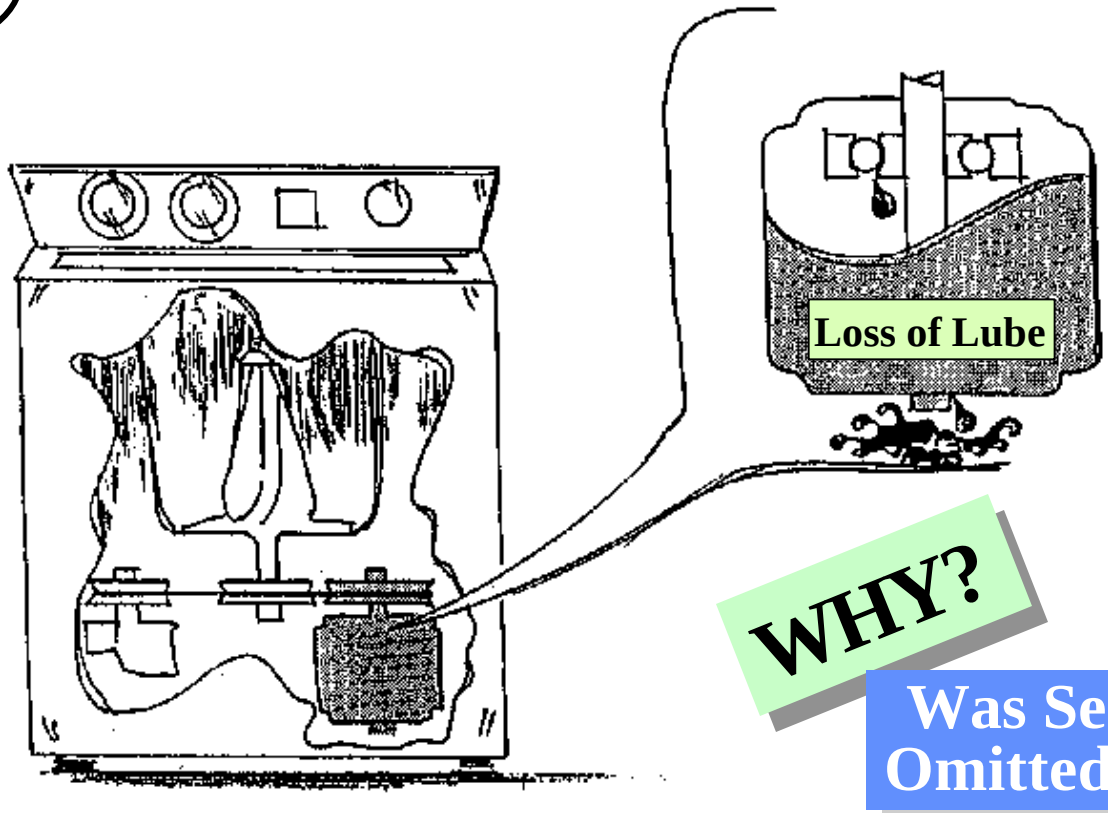
WHY?

Determine the Cause.

Investigate Why



Cause of Failure: Seal Omitted

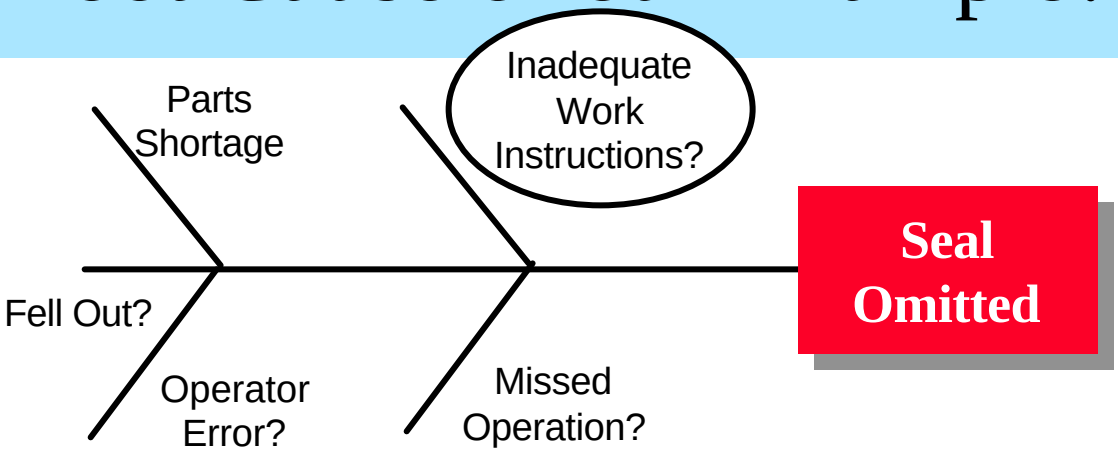


Corrective Action for Specific Deficiency:
Replace the Motor

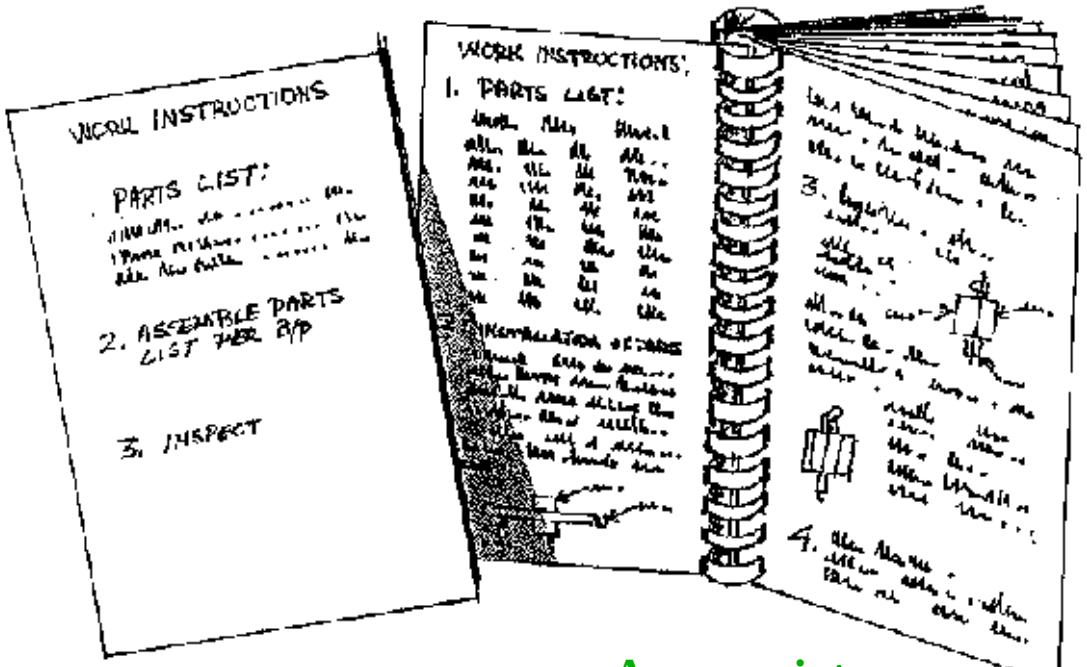
WHY?

Was Seal Omitted??

Root Cause of our Example?



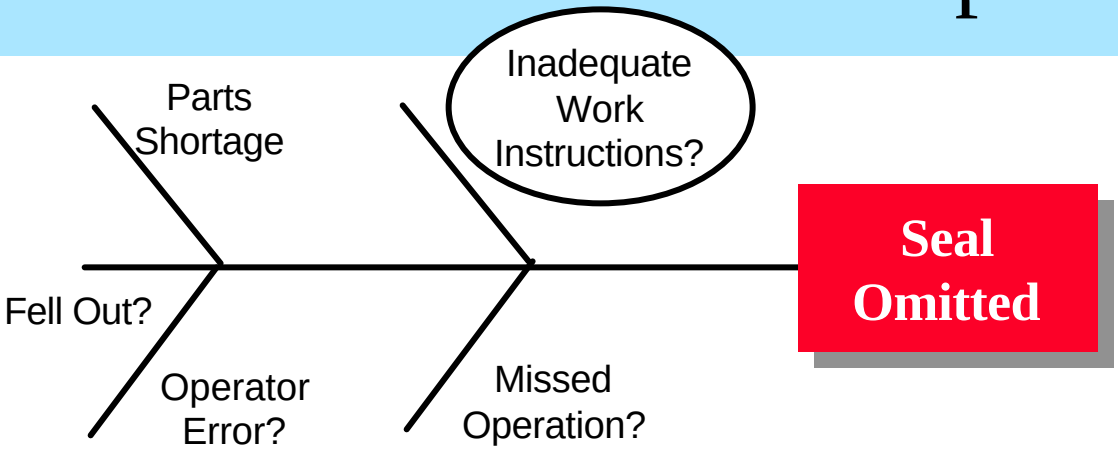
Root Cause - Inadequate Work Instructions



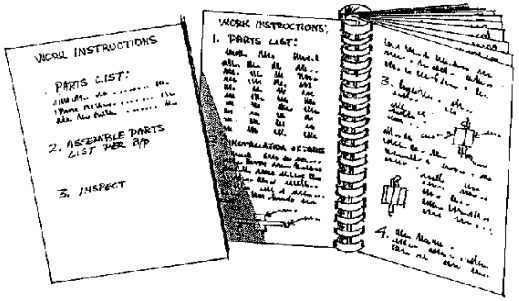
Inadequate **Appropriate**

But..... is it?

Root Cause of our Example?



Root Cause - Inadequate Work Instructions



Inadequate

Appropriate

But..... is it?

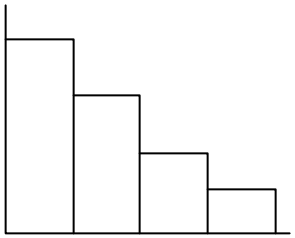
Can the design be changed to eliminate the need for a seal?

Can the design be changed to make it impossible to omit the seal?

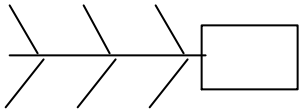
Can a fixture be made to make it impossible to omit the seal?

Tools Used in Root Cause Analysis

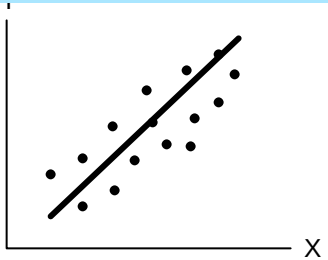
BRAINSTORMING



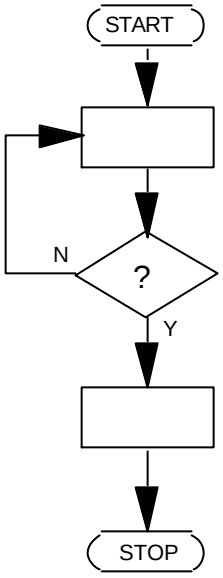
PARETO CHART



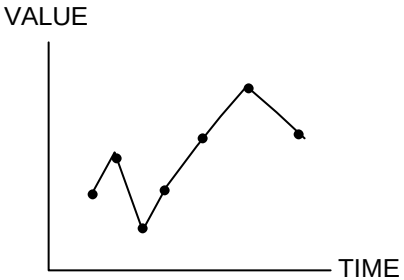
FISHBONE DIAGRAM



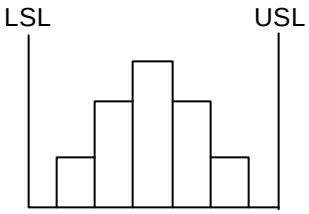
SCATTER DIAGRAM



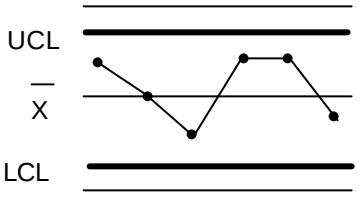
FLOWCHART



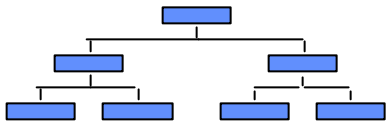
RUN CHART



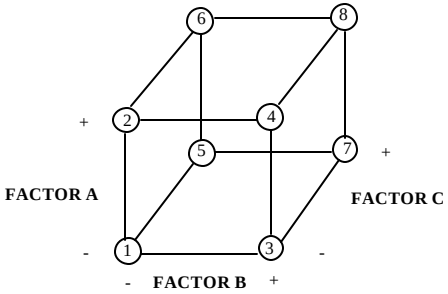
HISTOGRAM



CONTROL CHARTS



TREE DIAGRAM



DESIGN OF EXPERIMENTS

Brainstorming

WHAT IS IT?

Brainstorming is a process in which a group quickly generates as many ideas as it can on a particular problem and/or subject.

WHY IS IT USEFUL?

Brainstorming is useful because it can help a group of people utilize its collective brainpower to generate many ideas in a short period of time.
It stimulates creativity and promotes involvement and participation.

WHEN IS IT USED?

To help clarify mutual expectations and devise ground rules related to a team's way of operating.

HOW IS IT DONE?

•Identify a topic, problem or issue and make sure there is mutual understanding of the task and objective. Write the topic on a flip chart.
•Each person presents one idea going in sequence (Round Robin). If a person doesn't have an idea, pass and move on to the next person.
•All ideas are recorded on a flipchart.
•There is no evaluation or discussion during the session.
•Focus is on quantity of ideas, not the quality.
•When all ideas are exhausted, take a break. When you come back, people may have more ideas to add to the list.
•Keep the idea generation separate from the evaluation or analysis of ideas.

BRAINSTORMING GUIDELINES:

•Generate as many ideas as possible.
•Encourage free-wheeling.
•No criticism is allowed, either positive or negative.
•Equal opportunity to participate.
•Record all ideas.
•Let the ideas incubate.

During analysis ideas should be evaluated, further analyzed and refined prior to taking further action.

Fishbone Diagram

WHAT IS IT?

The Fishbone Diagram (also known as the Cause & Effect Diagram) is a technique to graphically identify and organize many possible causes
of a problem (effect).

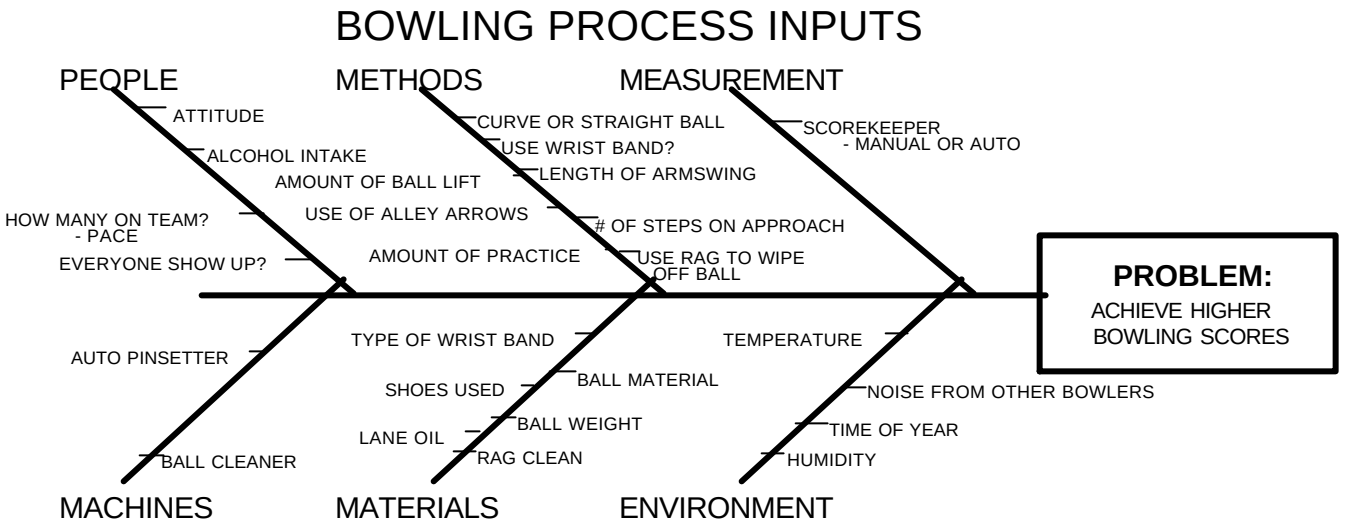
WHY IS IT USEFUL?

Fishbone Diagrams help identify the most likely ROOT CAUSES of a problem. They can also help teach a team to reach a common understanding of the problem. This tool can help focus problem solving and reduce subjective decision making.

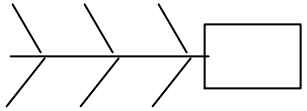
WHEN IS IT USED?

When the need exists to display and explore many possible causes of a specific problem or condition. This diagram allows the team to systematically analyze cause & effect relationships. It can also help with the identification of ROOT CAUSES.

WHAT DOES IT LOOK LIKE?



Fishbone Diagram (cont.)



HOW IS IT DONE?

•Name the effect; determine the specific problem to be analyzed. Draw the diagram with a process arrow to the effect and draw a box around it.

•Decide what the major categories of the causes are (i.e., people, machines, measurement, materials, methods, environment, policies, etc.).

•Label categories important to your situation. Make it work for you.

•Brainstorm all possible causes and label each cause under the appropriate category.

•Post the diagram where others can add causes to it (i.e., experts, affected people, process owners, etc..).

•Analyze causes and eliminate trivial and/or frivolous ideas.

•Rank causes and circle the most likely ones for further consideration and study.

•Investigate the circled causes. Use other techniques to gather data and prioritize findings.

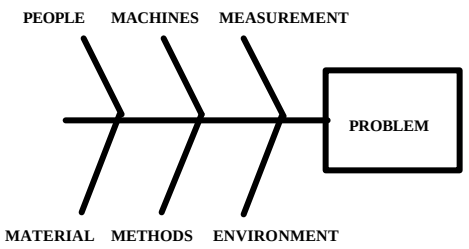
GUIDELINES

•Try not to go beyond the span of control of the group.

•Promote participation by everyone concerned.

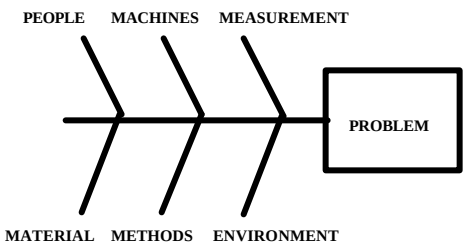
•Keep chart up to date so it can be used throughout the improvement cycle.

Questions to Ask When Performing RCA



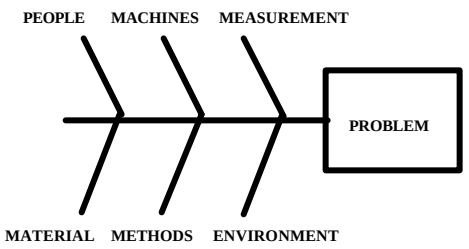
- ***PEOPLE***
  - Was the document properly interpreted?
  - Was the information properly disseminated?
  - Did the recipient understand the information?
  - Was the proper training to perform the task administered to the person?
  - Was too much judgment required to perform the task?
  - Were guidelines for judgment available?
  - Did the environment influence the actions of the individual?
  - Are there distractions in the workplace?
  - Is fatigue a mitigating factor?
  - How much experience does the individual have in performing this task?
- ***MACHINES***
  - Was the correct tool used?
  - Is the equipment affected by the environment?
  - Is the equipment being properly maintained (i.e., daily/weekly/monthly preventative maintenance schedule)
  - Was the machine properly programmed?
  - Is the tooling/fixturing adequate for the job?
  - Does the machine have an adequate guard?
  - Was the tooling used within its capabilities and limitations?
  - Are all controls including emergency stop button clearly labeled and/or color coded or size differentiated?
  - Is the machine the right application for the given job?

Questions to Ask When Performing RCA



- ***MEASUREMENT***
  - Does the gage have a valid calibration date?
  - Was the proper gage used to measure the part, process, chemical, compound, etc.?
  - Was a gage capability study ever performed?
    - Do measurements vary significantly from operator to operator?
    - Do operators have a tough time using the prescribed gage?
    - Is the gage fixturing adequate?
  - Does the gage have proper measurement resolution?
  - Did the environment influence the measurements taken?
- ***MATERIAL***
  - Is a Material Safety Data Sheet (MSDS) readily available?
  - Was the material properly tested?
  - Was the material substituted?
  - Is the supplier's process defined and controlled?
  - Were quality requirements adequate for part function?
  - Was the material contaminated?
  - Was the material handled properly (stored, dispensed, used & disposed)?
- ***ENVIRONMENT***
  - Is the process affected by temperature changes over the course of a day?
  - Is the process affected by humidity, vibration, noise, lighting, etc.?
  - Does the process run in a controlled environment?

Questions to Ask When Performing RCA



- ***METHODS***
  - Was the canister, barrel, etc. labeled properly?
  - Were the workers trained properly in the procedure?
  - Was the testing performed statistically significant?
  - Have I tested for true root cause data?
  - How many “if necessary” and “approximately” phrases are found in this process?
  - Was this a process generated by an Integrated Product Development (IPD) Team?
  - Was the IPD Team properly represented?
  - Did the IPD Team employ Design for Environmental (DFE) principles?
  - Has a capability study ever been performed for this process?
  - Is the process under Statistical Process Control (SPC)?
  - Are the work instructions clearly written?
  - Are mistake-proofing devices/techniques employed?
  - Are the work instructions complete?
  - Is the tooling adequately designed and controlled?
  - Is handling/packaging adequately specified?
  - Was the process changed?
  - Was the design changed?
  - Was a process Failure Modes Effects Analysis (FMEA) ever performed?
  - Was adequate sampling done?
  - Are features of the process critical to safety clearly spelled out to the Operator?

Fishbone Diagram Exercise

PEOPLE **METHODS** **MEASUREMENT**

MACHINES **MATERIALS** **ENVIRONMENT**

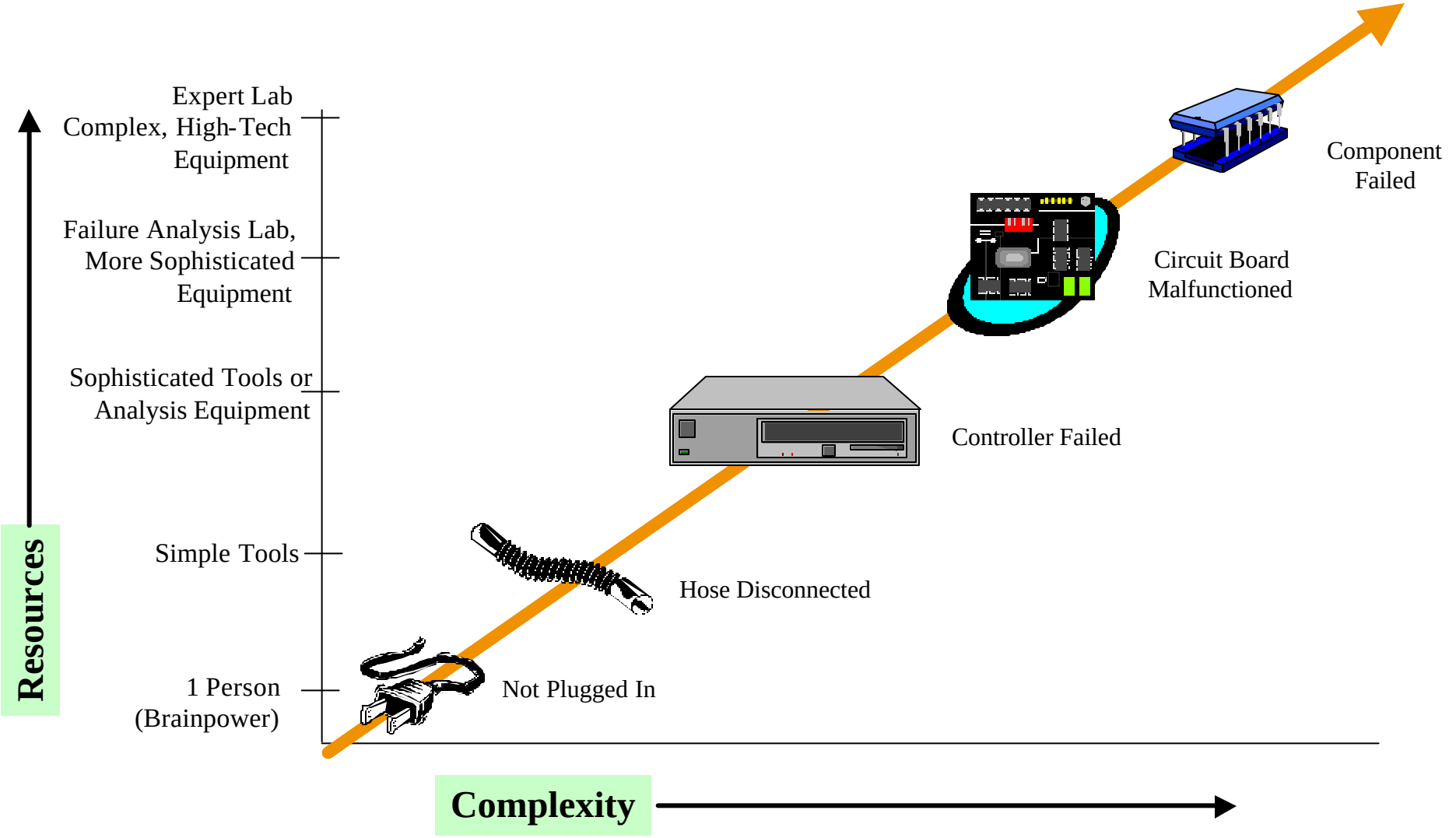
CHALLENGE:

HIT CONSISTENTLY
A FASTBALL BETWEEN
85-95 MPH.

Q.) What are the factors that drive hitting a baseball?

Asking Why: sometimes Simple, sometimes Complex

Root Cause Analysis sometimes requires the additional resources.



Summary

- Root Cause Analysis is a method to focus our efforts on the true “Root Causes” of escapes, so that we truly prevent their reoccurrence.
- Root Cause Analysis helps us reduce turnbacks and frustration, maintain customer satisfaction, and reduce costs significantly.
- Each problem is an opportunity. It contains the information needed to eliminate the problem. But to identify the root cause, we have to ask “Why?” over and over, until we reach it.