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Application of Problem Solving Tools

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Application of Problem Solving Tools

Contents

- Introduction
- Problem solving process
- Troubleshooting tools
- Summary
- Appendix

Introduction

Introduction

What is a problem?

- Do we have a deviation?
- Is the cause unknown?
- Do we need to know the cause?

Yes to all 3 = Problem

What is problem solving?

A process for identifying and finding the cause of deviations and correcting them.

Problem Solving Process

Overview

Generally the problem solving process looks like this:

1. Define your problem
2. Create a team
3. Gather and collect data
4. Develop cause and effect

Step 1: Define Your Problem

The Problem Statement needs to ultimately arrive at ***one object, and one defect***

Rotomolding example:

GOOD EXAMPLE	BAD EXAMPLE
30% of Product X are failing impact testing	Product X is not acceptable
Characteristic: • Specific defect and number • Includes the problem • Includes the subject or object	Characteristic: • Not specific with respect to either object, defect, degree, scope, etc.

Step 2: Create a Team

Most effective way to solve problems

Typical team structure:

- Team leader
- Person or people who first identified the problem
- Subject matter experts (SMEs)

Team members will also be involved with implementing corrective actions

Step 3: Gather and Collect Data

This is the planned search for clues and changes that extend our basic understanding of the problem

- Key facts create a complete picture of what happened
- Also includes key boundary data
- Collaboration is the key. The rotomolder can play a very helpful role here by:
  - Communicating the problem in a timely manner. The information should include a description of the problem, including when and where it appears.
  - Identifying who first saw the problem
  - Collecting samples of the deviation, and a control sample
  - Communicating the scope and breadth of the problem

Step 4: Determine Cause and Effect

1. Develop a list of possible root causes
   Remember - correlation does not equal causation
2. Prioritize possible root causes using a set of criteria to help rank them
3. Test the causes against the problem information
4. Develop an implementation plan
   Get buy-in from key stakeholders
5. Monitor the outcome of the corrective action in measureable terms

Troubleshooting Tools

Troubleshooting Tools

The key to problem solving is *good data*.

Techniques for data gathering:

- **Brainstorming**
- **5 Whys**
- **Cause-effect (fishbone) diagrams**
- Flow diagram
- Recurring problem data sheets (timeline)
- Checklist
- Check sheets
- Data sheets
- Quality control charts

Please see Appendix

Brainstorming

Why use it?

- Team technique that encourages generation of new ideas
- Promotes creative thinking

When do you use it?

- Typically used to develop as many viable theories or causes as possible

How do you interpret it?

- When you have finished your brainstorming exercise, use quantitative problem solving tools to obtain hard data

5 Whys

Why use them?

- The 5 Whys process will cause the questioner to seek an “I don’t know” type answer. This eliminates solving many “effect” problems before arriving at the root of the problem

When do you use them?

- When you want to identify the root of the problem quickly

How do you use them?

- List the problem statement
- Keep asking “why?” until you reach an actionable root cause
  - When the answer to the next “why” is: “I don’t know”
- Arrive at the root cause

How do you interpret them?

- When additional questions do not provide any new information, you should have identified the root cause

5 Whys

Customer Complaint Example

Customer is unhappy with our company's service. (Problem Statement)
Why is our customer unhappy?

Because we did not deliver their new products when we said we would
Why could we not meet the agreed schedule?

Because the production took longer than originally planned
Why did the production take longer?

Because we underestimated the complexity of the work
Why did we underestimate the complexity of this work?

Because we made a quick estimate of the time needed to produce the parts
Why did we not review the production requirements more thoroughly?

Because we had not established standard estimation and specification procedures for new products
(Root Cause)

Cause-Effect (Fishbone) Diagrams

Why use them?

- Cause-effect diagrams display the potential root causes of a problem

When do you use them?

- Use them to visually represent a complicated array of causes, including inter-relationships

How do you use them?

1. Draw the central spine and the effect/symptom box
2. Brainstorm the general causes, start with four M's
3. Add smaller lines showing specific causes. Add subsidiary lines, continuing until you reach a root cause
4. Check the logical validity of your causal chains

How do you interpret them?

- The fishbone diagram yields a list of theoretical causes for a problem, not necessarily the root cause

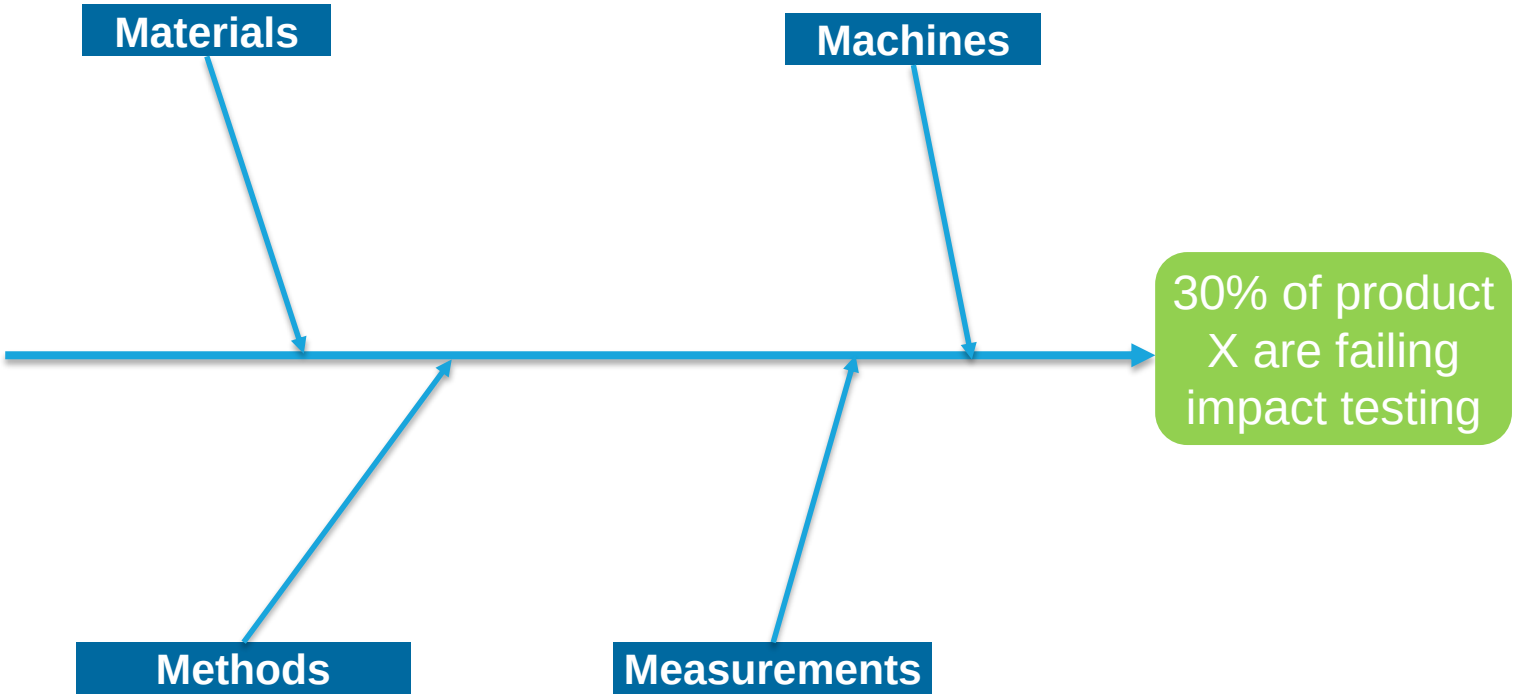
Cause-Effect (Fishbone) Diagrams

Example: Poor impact strength cause-effect diagram

Cause-Effect (Fishbone) Diagrams

Example: Poor impact strength cause-effect diagram

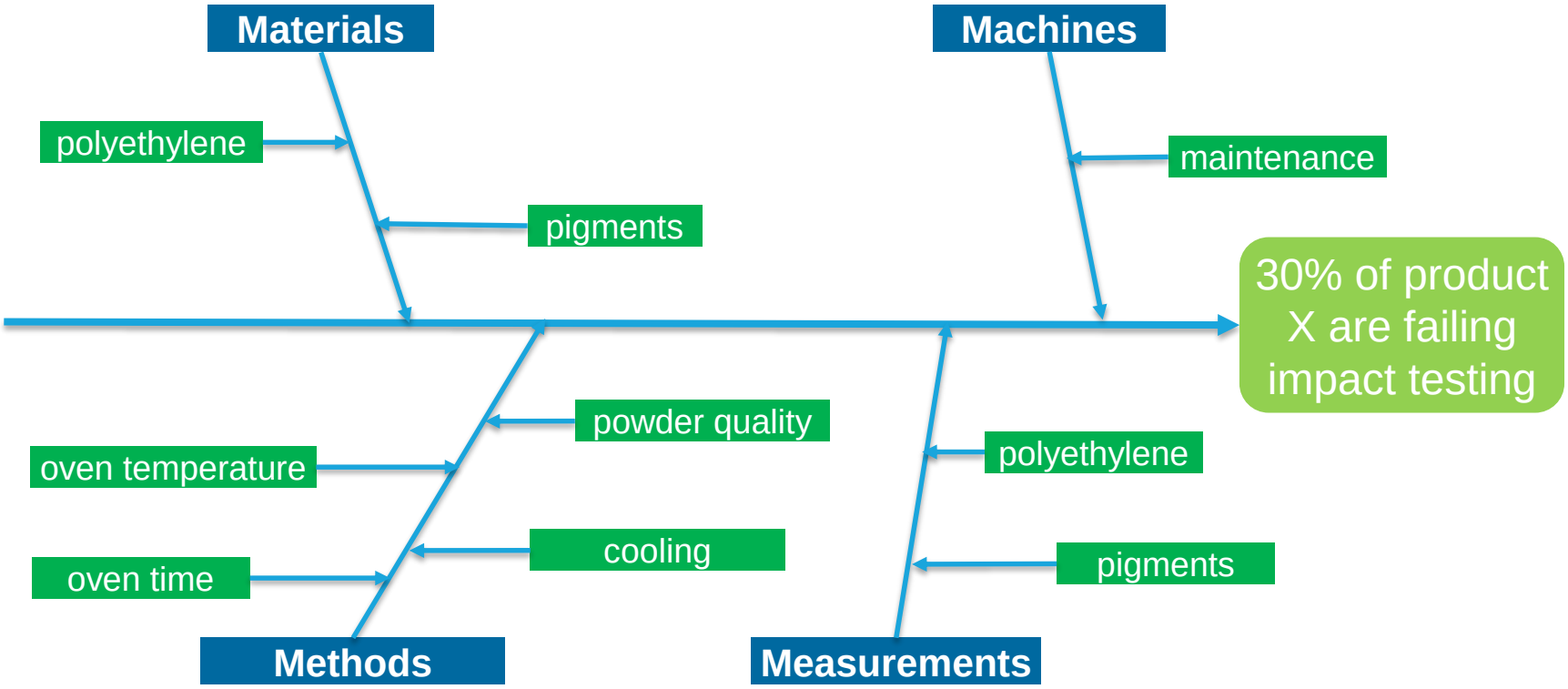
4M's – Methods, Measurements, Materials and Machines



Cause-Effect (Fishbone) Diagrams

Example: Poor impact strength cause-effect diagram

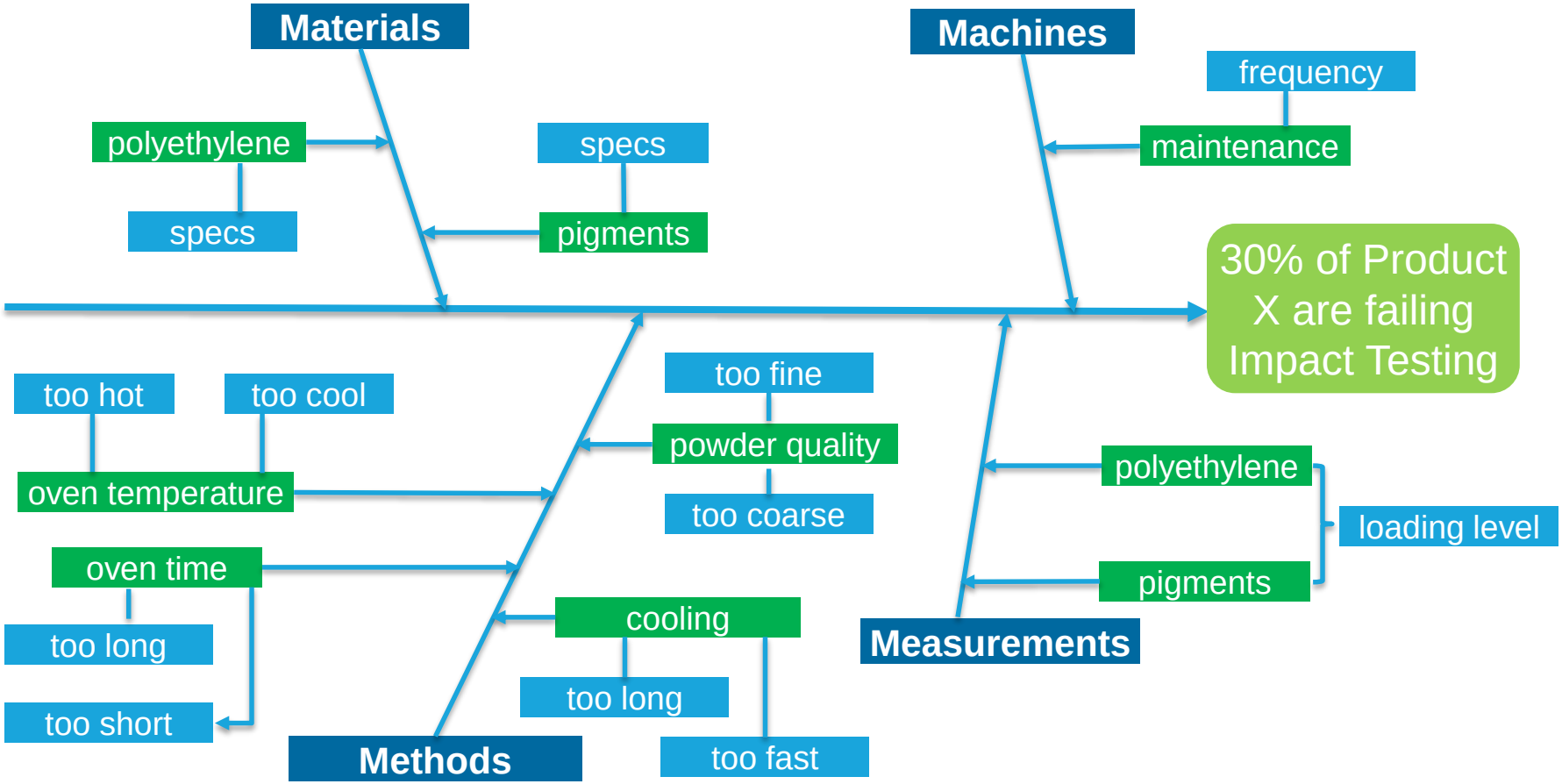
Peel back the layer by asking What and Why?



Cause-Effect (Fishbone) Diagrams

Example: Poor impact strength cause-effect diagram

Asking Why? again …



Summary

Summary

The problem solving process includes these main steps:

1. Define the problem
2. Create the team
3. Gather and collect data
4. Develop cause and effect

A number of troubleshooting methods have been discussed

Typically used troubleshooting tools are:

1. Brainstorming
2. 5 Whys
3. Cause-Effect Diagrams (Fishbone)

Appendix

Step 1 Recognize the Problem

Deliverables:

- Define and scope the problem; determine project objectives and benefits

Tasks:

- Have a monitoring program in place; create and use customer surveys; conduct risk reviews of a process or system

Tools and Techniques:

- Process monitoring trends, customer surveys and key performance indicators (KPI’s)

Step 1 Recognize the Problem

Typically requires a set of questions to be posed and answered.

What is the problem to be solved?

How did the problem become identified?

What checking has been done to verify the existence of the problem?

What, if any, action(s) has already been taken to address the problem?

When is an answer required?

What do you want the solution to achieve?

- Corrective
- Interim
- Adaptive

What would happen if the problem is not solved?

Who has information to help solve it?

Who needs to be involved in the problem solving?

When will you get started?

Step 2 Plan for Solving

Deliverables:

- Select personnel for the team, define the problem, define the ‘current’ process or “As-Is”

Tasks:

- Develop a problem statement and define the problem

Tools and Techniques:

- Formal troubleshooting tools, graphs, flow diagrams, Pareto diagrams

Step 3 Try a Successful Past Fix

Deliverables:

- Remove or reduce the impact of the problem

Tasks:

- Identify from past experience possible fixes used for similar problems
  - Execute a risk review of possible fixes
  - Execute the risk

Tools and Techniques:

- Flow diagrams, process trending and Pareto diagrams

Step 4 Identify Root Cause or Causes

Deliverables:

- List potential root causes; test root causes against the problem definition; identify one or more root causes

Tasks:

- Identify, test and prioritize potential root causes
  - Test your theories to prove the actual root cause

Tools and Techniques:

- Brainstorming, cause-effect diagrams, check sheets, control charts, flow diagrams, Pareto diagrams, graphical representations

Step 5 Select the Best Solution

Deliverables:

- Identify potential solutions; evaluate the feasibility and risks; plan for implementation of the best solution

Tasks:

- Define success, brainstorm and evaluate potential corrective actions, develop an implementation contingency plan

Tools and Techniques:

- Brainstorming, cause-effect diagrams, check sheets, control charts, flow diagrams, Pareto diagrams, graphical representations

Step 6 Implement Corrective Action

Deliverables:

- Solve the original problem; finalize the transition to the corrective action (for example, procedural changes, specification changes, personnel training)

Tasks:

- Develop a plan to assess your corrective actions, monitor the outcomes, compare results with the problem definition

Tools and Techniques:

- Brainstorming, cause-effect diagrams, check sheets, control charts, flow diagrams, Pareto diagrams, graphical representations

Step 7 Validate the Correct Solution

Deliverables:

- Ensure that the root cause has been eliminated; implement a continuous monitoring program.

Tasks:

- Select metrics, monitoring frequency and control limits (if required); ensure that monitoring is in place; random check the solution.

Tools and Techniques:

- Graphical representations, check sheets, control charts, flow diagrams, Pareto diagrams

Flow Diagrams

- Flow diagrams are pictorial representations of the series of steps that must be performed to produce some output (for example, a physical product, service, information or a combination of the two).
- When do you use them?
  - When you want to develop a common understanding of an overall process, uncover potential problems, bottlenecks, and/or unnecessary steps
- How do you use them?
  1. Familiarize yourself with the symbols used in flow diagrams
  2. Arrange the steps from start to finish
  3. Create a high-level flow diagram
  4. Construct a detailed diagram for each block
- How do you interpret them?
  - Use a series of questions: Who? What? When? Where? Why? How?

Recurring Problem Data Sheets (Timeline)

- Why use them?
  - This tool generates information around a problem that may be used to establish ***patterns*** and possible causes.
- When do you use them?
  - Use this tool when dealing with a problem where the root cause is unknown;
  - The problem comes and goes frequently.
- How do you use them?
  1. List the problem statement
  2. Whenever the event occurs, collect information around the ***time*** that it starts and ends
  3. Create an extensive list of observations, tests and outcomes for a given event
  4. Use data processing tools to demonstrate patterns and identify probable causes
- How do you interpret them?
  - Identifies the symptoms rather than the causes for a problem
  - Investigate the symptoms and test them empirically

Checklist

- Why use them?
  - Contains items that are important or relevant to a specific action or event
  - Provides instructions or steps for a process
  - By checking each completed item, the user ensures that no steps have been omitted and that steps are performed in the appropriate sequence
- When do you use them?
  - Use checklists under operational conditions to ensure that all important steps or actions have been completed
  - Primary purpose is for guiding operations, not for data gathering
- How do you use them?
  - Design simple columnar checklists
  - Select and train collectors who are unbiased
- How do you interpret them?
  - Ensure that all critical steps have been checked
  - If one or more steps have not been checked, ask:
    - Are all steps necessary?
    - Has this process and the importance of its steps been communicated effectively

Check Sheets

- Why use them?
  - A check sheet is a simple data recording form that has been specifically designed so that the results can be interpreted from the form itself
- When do you use them?
  - Use when you want to analyze the data immediately as it is collected
- How do you use them?
  - Design simple columnar data sheets
  - Select and train collectors
- How do you interpret them?
  - Examine the data and look for any variations and determine if any patterns exist

Check Sheets

Rotational Molded Part Inspection Check Sheet

Type of defect	#	Total
Warpage	IIII	4
Gloss	0	0
Pigment swirl	I	1
Black Specks	0	0

Data Sheets

- Why use them?
  - They differ from check sheets in that observations are recorded in a simple table format as specific numerical values (instead of a tally)
- When do you use them?
  - Use data sheets if you plan to analyze the data with a variety of tools (histograms, bar graphs, scatter plots, etc.)
- How do you use them?
  1. Design simple tables:
     - Easy to check completed tasks
     - Reduce potential for errors in either recording or interpreting
     - Capture data for future analysis, reference and traceability
  2. Select and train collectors
- How do you interpret them?
  - Look for missing or unusual observations and variations within and between particular time periods
  - Use appropriate data processing tools for analysis

Control Charts

- Why use them?
  - Control charts are run charts that include statistically determined upper and lower control limits. Remember these are not the same as specification limits.
  - When data points fall outside those limits or form unusual patterns, the process is said to be “out of control”. These variations must be eliminated before you can consider the process to be in “in control”.
- When do you use them?
  - When you need to determine how much of the variability in a process is random and how much is the result of unique events or actions.
- How do you use them?
  - Be sure to select the right type of control chart and keep data in the precise sequence in which it was gathered
- How do you interpret them?
  - Look for process shift or trends, such as:
    - Six points in a row on one side of the average; or
    - Six points in a row that are increasing or decreasing

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