

AQS 200

ROOT CAUSE INVESTIGATION

This material is based upon work supported
by the National Science Foundation under
Grant No. 1304474



Developed as part of NSF AQS Grant #1304474

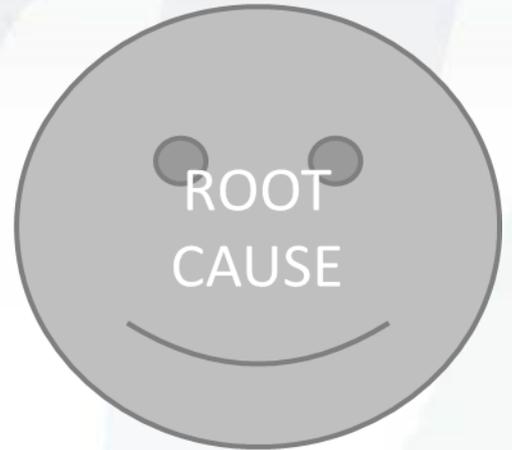
Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

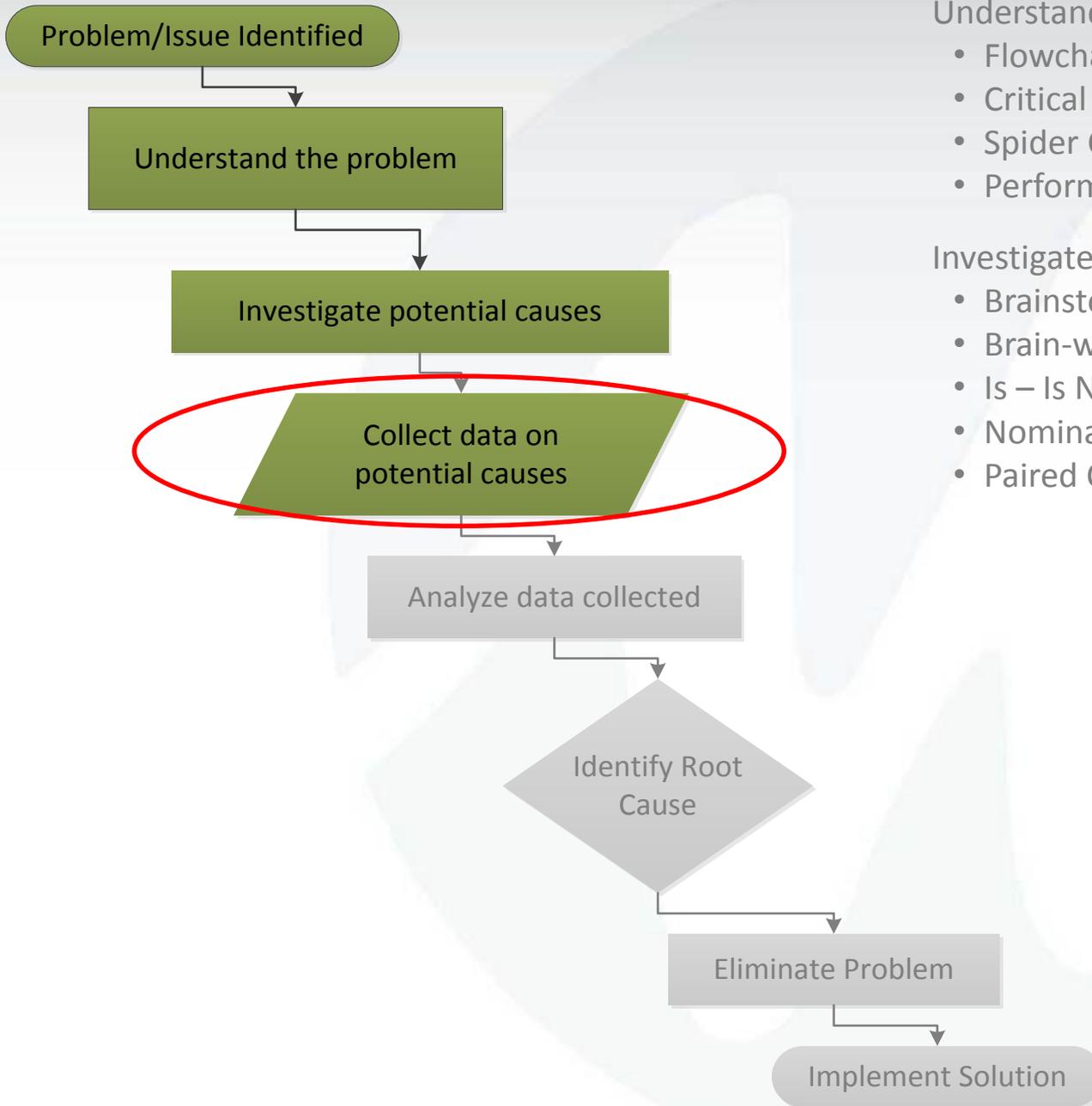
Lecture 7

Tools for Data Collection

- Sampling
- Surveys
- Check Sheets







Understanding the problem

- Flowchart
- Critical Incident
- Spider Chart
- Performance Matrix

Investigate Potential Causes

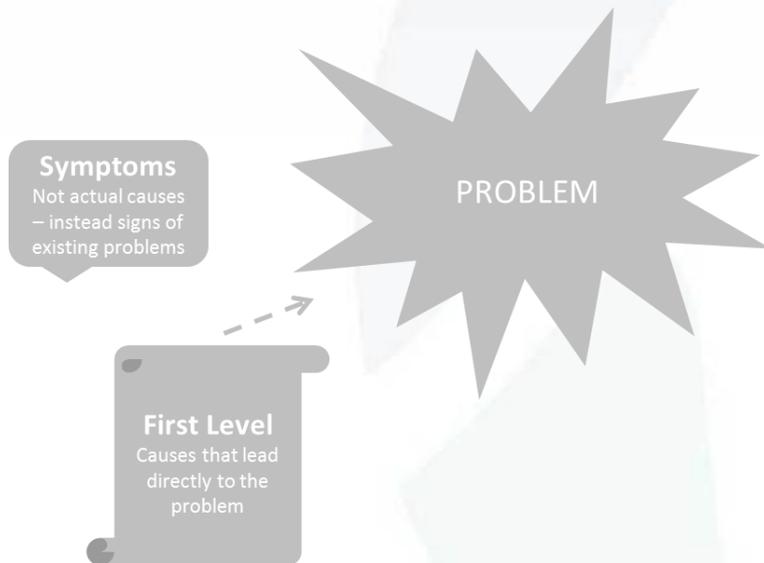
- Brainstorming
- Brain-writing
- Is – Is Not Matrix
- Nominal Group Technique
- Paired Comparison

CAUSE INVESTIGATION

- Root Cause – The fundamental (true) reason a product or process nonconformance occurred.

- Define the issue
- Understand scope of investigation
- Generate ideas and reach agreement for potential causes

Data collection – verify ideas
gather new information



Tools for Data Collection

- **Sampling**
- Surveys
- Check Sheets

SAMPLING

- Purpose

To draw conclusions about a larger group based on a smaller sample, as long as you are aware of the sample's limitations.

- Application

*Effectively collect data about problem/causes
Increase knowledge/understanding*

Sampling - TYPES

Random sampling

Systematic sampling

Stratified sampling

Cluster sampling

Sampling - TYPES

➤ **Random Sampling**

- ✓ *All aspects of the population have a chance to be selected*
 - ✓ *Random numbers (generated)*
 - ✓ *Select lot numbers from list*
 - ✓ *Alternate months/days/weeks*

*Examples: pull customer files from cabinet
select lots based on list presented*

Sampling - TYPES

- Random Sampling
 - ✓ All aspects of the population have a chance to be selected
- **Systematic Sampling**
 - ✓ *Fixed intervals – patterned selection*
 - ✓ *Monthly for records*
 - ✓ *Hourly for production run*

EXAMPLE: *send product samples to lab every 2 hours
select first-time customers only
interview only A-shift workers*

Sampling - TYPES

- Random Sampling
 - ✓ All aspects of the population have a chance to be selected
- Systematic Sampling
 - ✓ Fixed intervals – patterned selection
- ***Stratified Sampling***
 - ✓ *Select from categories / levels*
 - ✓ *Ensure representation of each*

Example:

Sampling - TYPES

- Random Sampling
 - ✓ All aspects of the population have a chance to be selected
- Systematic Sampling
 - ✓ Fixed intervals – patterned selection
- Stratified Sampling
 - ✓ Select from categories / levels
 - ✓ Ensure representation of each
- **Clustered Sampling**
 - ✓ *A group taken to represent the whole*
 - ✓ *Population MUST be stable and without variation*

Example: samples pulled first day of five day run represent the entire lot

Sampling - STEPS

- Not one way, not always the same
 - Dependent on problem/causes
 - Type of data needed
 - Interviews
 - Numerical
 - Physical product/parts/components

Sampling - STEPS

- Not one way, not always the same
 - Dependent on data needed
- Considerations
 - Assess nature of population to be sampled
 - Homogeneity, availability, etc.
 - Statistics (i.e. average) available to test reasonableness
 - Use flow chart, Is-Is Not diagram, etc.
 - Approach to be used (random, systematic, etc.)
 - How many? (Sample size)
 - Expected Level of variation
 - Consequences of inaccurate samples

**Ensure SAMPLE represents
ALL potential aspects being studied**

Sampling – ASPECTS

- Data needed – type
 - Discrete
 - Yes/no, pass/fail
 - Continuous
 - Measurable, numerical
- Data availability
 - Scope of issue/problem (size of population)
 - Can it be collected?
 - Is there cost associated?

Tools for Problem Cause Data Collection

Sampling

Exercise 7a

Develop Sampling Plan

Tools for Data Collection

- Sampling
- **Surveys**
- Check Sheets

SURVEYS

- Purpose: To collect data from respondents
- Application(s)
 - Customer satisfaction data
 - Determine Customer need /expectations
- Surveys are a structured set of pre-defined questions designed to collect data
 - Written
 - Oral

NOTE: Unbiased surveys are difficult to create. Beware of asking questions that lead the interviewee to a predetermined conclusion

Surveys – HOW TO

1. Clearly define the objective of the survey and how the data will be collected.
2. Determine what information is required to achieve this objective.
3. Decide how the survey will be conducted:
 - Written (mail, fax, email, internet..)
 - Verbal (phone, in person...)

Surveys – HOW TO

4. Develop the questionnaire, keeping in mind
 - type and sequence of questions
 - Language and understandability
 - Question grouping
 - Survey Length (timing), etc.
5. Test the questionnaire
 - are questions easy to understand
 - measure what they are intended to
6. Identify the samples of respondents.
7. Perform the survey according to the chosen approach.

EXERCISE

Tools for Data Collection

- Sampling
- Surveys
- **Check Sheets**

CHECK SHEETS

- Purpose: ensure all data is collected
- Application
 - Registering (counting) how often something occurs; this includes frequency
- Data Collection
 - Data = input
 - (collection of facts from which conclusions may be drawn)*

Examples:

events that occur
frequency of events
errors detected (products/services)
task timing
costs

CHECK SHEETS

- Purpose: ensure all data is collected
- Application
 - Registering (counting) how often something occurs; this includes frequency
- Data Collection

EXAMPLE(s):
Telephone interruption

Example

Telephone Interruptions

Reason	Day					
	Mon	Tues	Wed	Thurs	Fri	Total
Wrong number						20
Info request						10
Boss						19
Total	12	6	10	8	13	49

CHECK SHEETS

- Purpose: ensure all data is collected
- Application
 - Registering (counting) how often something occurs; this includes frequency

EXAMPLE(s):

Telephone interruption

Motor Assembly Defects

EXAMPLE

Motor Assembly Check Sheet								
Name of Data Recorder:								
Location:								
Date of Data Record:								
Defect Types/ Event Occurrence	Dates							TOTAL
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Supplied parts rusted		III- III	III	III-	II			20
Misaligned weld			III			II		5
Inappropriate test procedure				II				3
Wrong part issued		I		II	II			7
Film on parts								0
Voids in casting								0
Wrong dimensions						II		2
Adhesive failure								0
Insufficient masking					I			1
Spray Failure			III					4
Total	0	10	12	11	6	4	0	

CHECK SHEETS

- Purpose: ensure all data is collected
- Application
 - Registering (counting) how often something occurs; this includes frequency

EXAMPLE(s):

Telephone interruption

Motor Assembly Task

Door Paint Checklist

EXAMPLE

Door paint check sheet

Sheet number 243

Paint robot number: B32A6

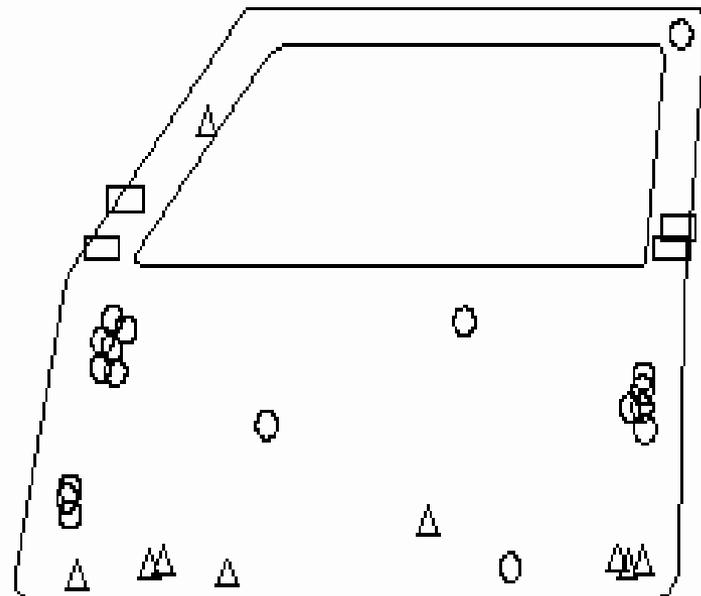
Date: 12th Oct

Paint batch number: A12583

Paint operator: Jon Wilkins

Doors painted: HHH HHH

Defect type	symbol	count...
bubble	○	<u>HHH HHH HHH </u>
run	△	<u>HHH </u>
scuff	□	<u> </u>



Check Sheets – HOW TO

1. Clearly define what to record
 - Add a category of “other”
2. Define the period / intervals for collection
3. Design for use
 - allocating space for recording
 - summarizing within the intervals / entirety
 - Use existing when available
4. Perform collection
 - Ensure understanding of tasks/events/timing, etc.
5. Analyze

EXERCISE

Data Collection Tools - Summary

- Sampling
- Survey
- Check Sheet

