

Root Cause and Corrective Actions

The Key to improving Products and Processes

ASQ Section 626

07APRIL2016

The Rule of 10

Process
Owner



Very Minor
Throw away

Next
Process



Short/Minor
Delay

End of
Line



Rework
Repair
Re-schedule

Final
Inspection



Major Rework
Delivery Delay
Additional
Inspection

Customer



Warranty
Recall
Reputation
Market Share

To Root Cause or not to Root Cause?

- How many times does the same problem have to occur before action is taken?
- Is action dependent on the cost of the part?
- Why is it important to treat each problem like a golden nugget?
- Is best-in-class or simply beating your competitor's quality level good enough?

Types of Problems

- Good Problems
- Bad Problems
- Really bad problems

Good Problems

- Improvements of established processes
 - Quality
 - Quantity
 - Delivery
 - Cost reduction
- New developments
 - New markets
 - New products

Bad Problems

- Reduction in performance
 - Quality (rework, repair, scrap)
 - Quantity
 - Delivery (delays)
 - Cost increase (well, it was bound to happen)
- Chronic issues
- Sporadic/seasonal occurrences

Really bad problems

- Field failures
- Loss of market share
- Bad reputation
-

Looking at problems

- A burden
- Fire fighting
- Ignore them
- Opportunities

Where does RCA fall in?

- Issue (nonconformance) – the “IS”
- Why is it an issue? – The “SHOULD BE”
- Containment Action
- Immediate Corrective Action
- **Root Cause Analysis (RCA)**
- Long Term Corrective Action
- Verification of effectiveness

What is Not Root Cause Analysis

- Prescribed method to eliminate and prevent origins of problems.
 - At ABC Widgets we use 5-Whys to deal with nonconforming product to analyze and take action to eliminate detected nonconformities.
 - 8D is the method used by Widgets, Inc. to formulate solutions to our problems.

Roadblocks to effective RCA^[4]

- Lack of time
- Lack of ownership – not my problem
- Lack of recognition
- It is a way of life
- Ignorance of the importance of RCA
- Believe that no-one can do anything
- Poor balance between schedule, cost, & quality
- People who try to protect themselves
- Head hunting

Elements of Root Cause Analysis

- Classify the problem
- Define the problem
- Collect Data
- Identify Possible Causal Factors
- Identify the Root Cause(s)
- Recommend and Implement Solutions
- Verify root cause is removed (collect more data)
- Standardize the process
- Broadcast success and celebrate

Elements of Root Cause Analysis

- Classify the problem
- Define the problem

PLAN

- Collect Data
- Identify Possible Causes and Factors
- Identify the Root Cause(s)

DO

- Recommend and Implement Solutions
- Verify root cause is removed (collect more data)

Check

- Standardize the process
- Broadcast success and celebrate

Act

Elements of Root Cause Analysis

- Classify the problem
- Define the problem

Define

- Collect Data

Measure

- Identify Possible Causal Factors
- Identify the Root Cause(s)

Analyze

- Recommend and Implement Solutions

Improve

- Verify root cause is removed (collect more data)
- Standardize the process

Control

- Broadcast success and celebrate

Wait! What does it look like?

- Define
- Measure
- Analyze
- Improve
- Control

6σ

Classify the Problem

- Collect initial information about problem
 - What do you see happening?
 - What are the specific symptoms?
- Recognize and classify problem according to its type.
 - Occasional or Seasonal Problem
 - New Problem
 - Chronic Problem
 - Systemic problem
 - Seasonal problem

Define the problem

- What happened?
- When did it happen?
- Where did it happen?
- How did it happen?
- What is the implication of the problem?

The problem definition is not...

- Who?
 - Usually looks for blame
- Why?
 - Leave this for the analysis

Collect Data

- What proof do you have that the problem exists?
- How long has the problem existed?
- What is the impact of the problem?
- CATWOE^[6]
 - Customers
 - Actors
 - Transformation process
 - World View
 - Owner
 - Environmental constraints

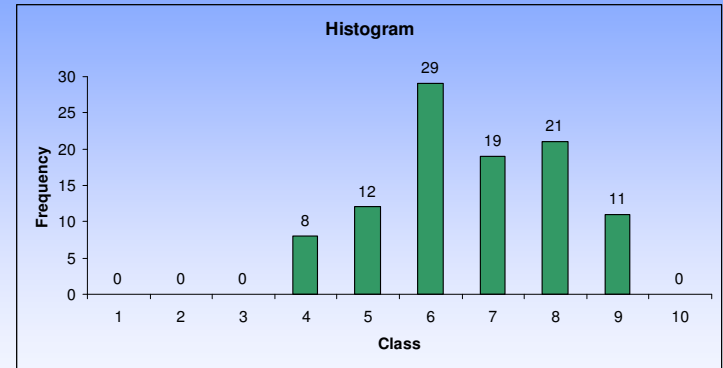
Data Collection Tools

- Check Sheets
 - Up-to-date data
- Historical Data
 - Histograms
 - Pareto Charts
 - Run Charts
 - Scatter Plots
 - Value Stream Mapping

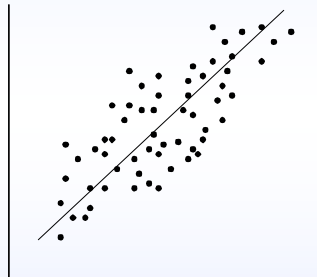
Definition/Data Collection Tools

Mistakes	September-01			Total
	1	2	3	
Centering				8
Spelling				23
Punctuation				40
Missed Paragraph				4
Wrong Numbers				10
Wrong Page Numbers				4
Tables				13
Totals	34	35	33	102

Check Sheets

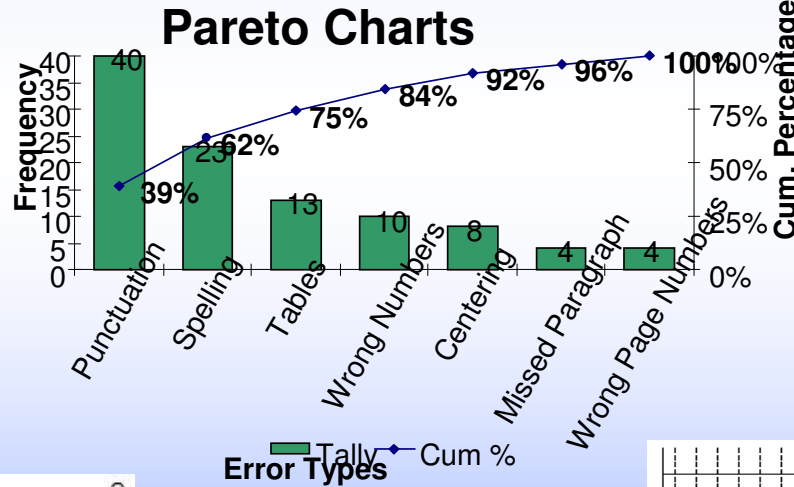


Histograms



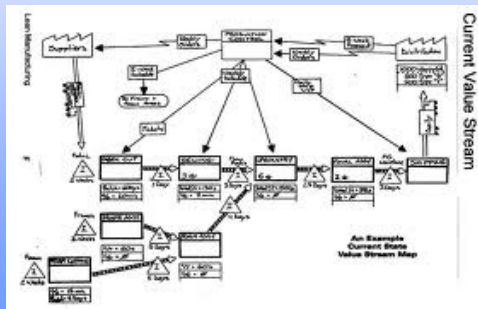
Positive Correlation

Scatter Plots

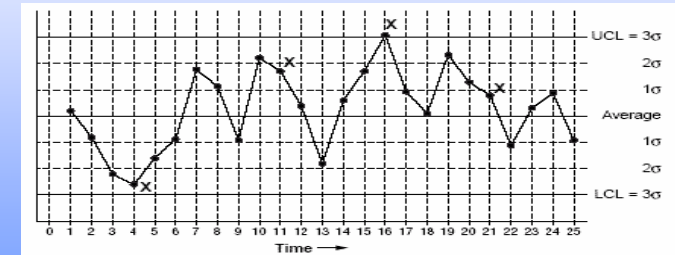


Pareto Charts

Error Types



Value Stream Mapping



Run/Trend Charts

Identify possible causal factors

What sequence of events lead to the problem?

- What conditions allowed the problem to occur?
- What other problems, noise, or symptoms surrounded the occurrence of the central problem?

Tools to help identify causal factors

- Appreciation
 - Use the facts and ask “So What?”
- Brainstorming sessions
 - Crawford Slip
- Nominal Group Techniques
- 5 Whys
 - Ask Why? (>5 times if needed)
- Cause and Effect Diagram
- Apollo Root Cause Analysis

...more tools...

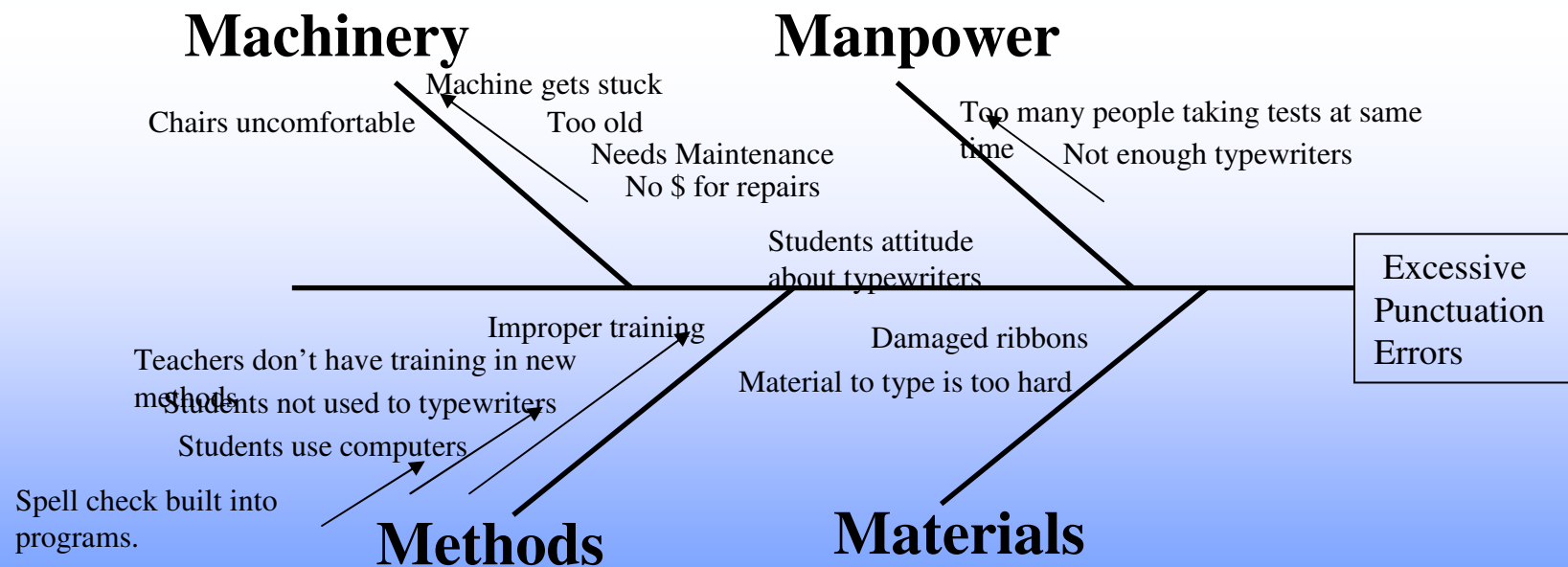
- Statistical Analysis
- Prioritization Matrix
- Design Of Experiments
- SIPOC Analysis
 - Supplier-Input-Process-Output-Customer
- Review FMEA (Design/Process) if available
- Mind Mapping, Analogies
- Tree Diagrams

...and more tools

- Multivoting
- Lateral Thinking
- TRIZ
 - *Russian –The Theory of the Solution of Inventive Problems*
- SCAMPER
 - **S**ubstitute, **C**ombine, **A**dapt, **M**odify, **P**ut to other uses, **E**liminated, **R**eversed (**R**earranged)
- Storyboard

Cause and Effect Diagram

- List effects on one side and ask (brainstorm) possible causes based on People, Methods, Machine, Materials. Then analyse each one for possible root cause



Common Elements in RCA

- **Manpower**
 - Inadequate capability
 - Lack of Knowledge
 - Lack of skill
 - Stress
 - Improper motivation
- **Methods**
 - No or poor procedures
 - Practices are not the same as written procedures
 - Poor communication
- **Machine/Equipment**
 - Incorrect tool selection
 - Poor maintenance or design
 - Poor equipment or tool placement
 - Defective equipment or tool
- **Material**
 - Defective raw material
 - Wrong type for job
 - Lack of raw material

The other elements

- Measuring System
 - Wrong measuring equipment
 - Not calibrated
 - Too tight/loose tolerances
- Mother Nature
 - Orderly workplace
 - Job design or layout of work
 - Surfaces poorly maintained
 - Physical demands of the task
 - Temperature, humidity, wind, etc
- Management
 - Lacking training or education
 - Poor employee involvement
 - Poor recognition of problems
 - Previously identified problems were not eliminated
 - Lack of investment
 - Driven by (wrong) numbers

Tools for problem Analysis

- Measurement System Analysis (Gage R&R)
- Risk Analysis (FMEA)
- Sampling Plans
- Descriptive Statistics (average, standard deviation, etc.)
- Regression analysis (predicting outcomes)
- Design of Experiments
- Capability Analysis (C_p , C_{pk} , statistical tolerance)
- Statistical Process Control

Identify the Root Cause(s)

- Why does the causal factor exist?
- What is the real reason the problem occurred?

Recommend & Implement Solutions

- What can you do to prevent the problem from happening again?
- How will the solution be implemented?
- Who will be responsible for it?
- What are the risks of implementing the solution?

Verify Root Cause is removed

- Did the solution really solve the problem?
- Did solution cause a new problem?
- Are there new effects from the implementation?

Causes of Variation

- **Common- and special-causes** are the two distinct origins of variation in a process, as defined in the statistical thinking and methods of Walter A. Shewhart and W. Edwards Deming. Briefly,
 - "common-cause" is the usual, historical, quantifiable variation in a system, while
 - "special-causes" are unusual, not previously observed, non-quantifiable variation.

Common causes

- Inappropriate procedures
- Poor design/Implementation
- Poor maintenance of machines
- Lack of clearly defined standing operating procedures
- Poor working conditions, e.g. lighting, noise, dirt, temperature, ventilation
- Substandard raw materials
- Assurance error
- Quality control error
- Vibration in industrial processes
- Ambient temperature and humidity
- Normal wear and tear
- Variability in settings
- Computer response time

Special causes

- Poor adjustment of equipment
- Operator falls asleep
- Faulty controllers
- Machine malfunction
- Computer crashes
- Poor batch of raw material
- Power surges
- High healthcare demand from elderly people
- Abnormal traffic (click-fraud) on web ads^[5]
- Extremely long lab testing turnover time due to switching to a new computer system
- Operator absent^[6]

Top 5 Reasons for Failed Root Cause Analysis

- Wrong basis
- Bad solutions
- Poor execution
- Lessons forgotten
- Other changes

Common Errors of RCA

- Use pure intuition
- No system or process in place
- Act on bad/incomplete information/data
- Find someone to blame (fire him!)
- Jump to conclusions
- Quick fix (stop looking for causes)
- Scrap material and start over

More Errors of RCA^[3]

- Consensus – majority rules!
- Groupthink
- Experts
- Parochial mindset
- Programmatic Barrier
- Denial
- Time as a cause

Like a famous player^[7] said:

“You can observe a lot by watching” so you do not end up saying “It’s like déjà vu all over again” because “we made too many wrong mistakes”

The future ain’t what it used to be.

We need to get better at running our business, otherwise our competition will.

Credits

1. *Root Cause Analysis and Quantitative Methods – Yin and Yang?*, Brett Portwood, FAA Los Angeles Aircraft Certification Office, Los Angeles, USA and Larry Reising, FAA Transport Standards Staff, Renton Washington, USA
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3. *Apollo Root Cause Analysis*, Dean L. Gano
4. *The Improvement Process, How America's Leading Companies Improve Quality*, H. James Harrington
5. *Root Cause Analysis, Tracing a problem to its origins*, MindTools, Toolkit (http://www.mindtools.com/pages/article/newTMC_80.htm)
6. *Creating Minds, CATWOE*, <http://creatingminds.org/tools/catwoe.htm>
7. *The Yogi Book*, Yogi Berra, 1998

Additional Material Consulted

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- *The Certified Six Sigma Black Belt Handbook*, Second edition, T.M. Kubiak and Donald W. Bendow
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- *The Certified Quality Process Analyst Handbook*, Eldon H. Christensen, Kathleen M. Coombes-Betz, Marilyn S. Stein
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