Chapter 3
Root Cause Analysis

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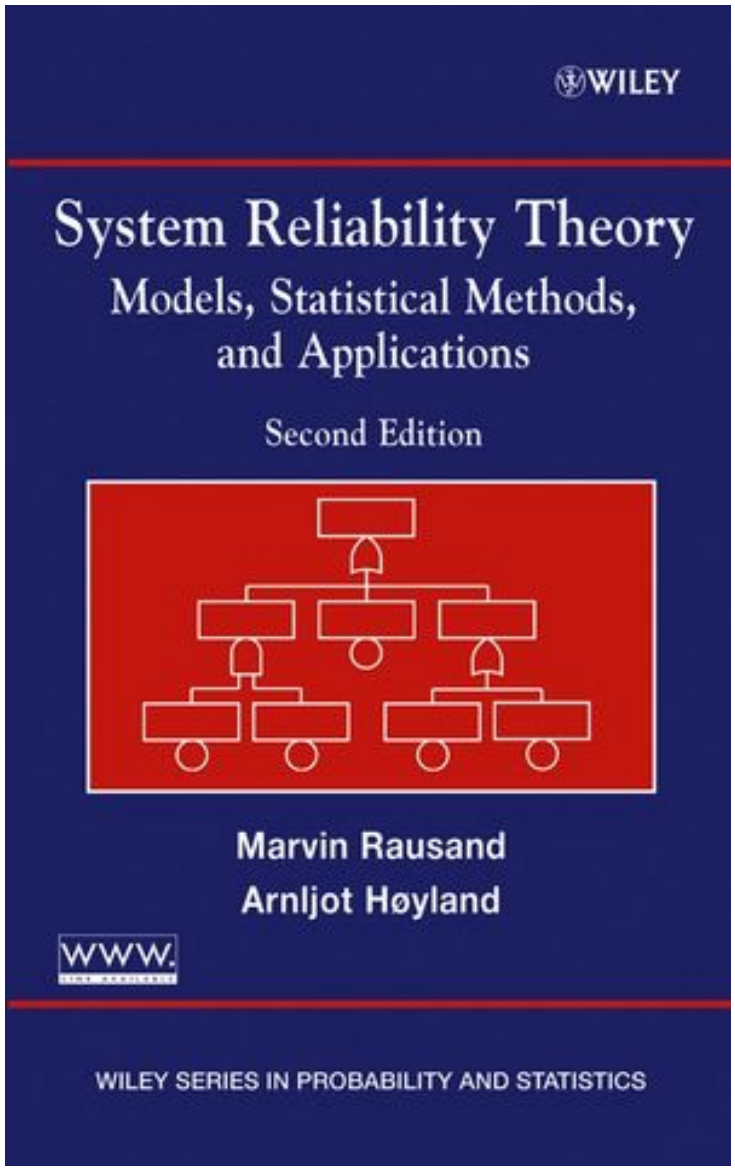
Slides related to the book

System Reliability Theory
Models, Statistical Methods, and Applications

Wiley, 2004

Homepage of the book:
http://www.ntnu.edu/ross/books/srt



Purpose of root cause analysis

- In a stressful work environment, we often fix problems or symptoms of problems without regard to the actual causes – usually leading to the recurrence of the same or similar problems.

- Root cause analysis – on the other hand – is a structured and thorough analysis of the problem that will identify and verify the real cause(s) of the problem, such that when the problem is fixed, the problem will not recur.

Some definitions

Related to root cause analysis

- Cause (or causal factor): A condition or event that results in a problem
- Direct cause: A cause that directly resulted in the occurrence of a problem
- Contributing cause: A cause that contributed to the occurrence, but by itself would not have caused the occurrence
- Proximate cause: The cause closest to, or immediately responsible for the problem
- Root cause: The cause that, if corrected,, would prevent recurrence of this and similar problems

Root cause analysis

☞ Root cause analysis: An in-depth process or technique to identify the most basic factor(s) underlying a given problem (often deviation from an accepted performance).

A root cause analysis is a "reactive" analysis that is carried out after the problem has occurred.

- The focus of the analysis is on systems and processes.
- The focus in not on individuals.

Objective of root cause analysis - 1

- Prevent problems from recurring
- Reduce possible injury to personnel
- Reduce rework and scrap
- Increase competitiveness
- Promote happy customers and stockholders
- Ultimately, reduce cost and save money

Objective of root cause analysis - 2

- Why did the incident, failure or breakdown occur?
- How can future failures can be eliminated by:
  - changes to procedures
  - changes to operation
  - training of staff
  - design modifications
  - verification that new or rebuilt equipment is free of defects which may shorten life
  - repair and reinstallation is performed to acceptance standards -
  - identification of any factors adversely affecting service life and implementation of mitigating actions

Problem definition - 1

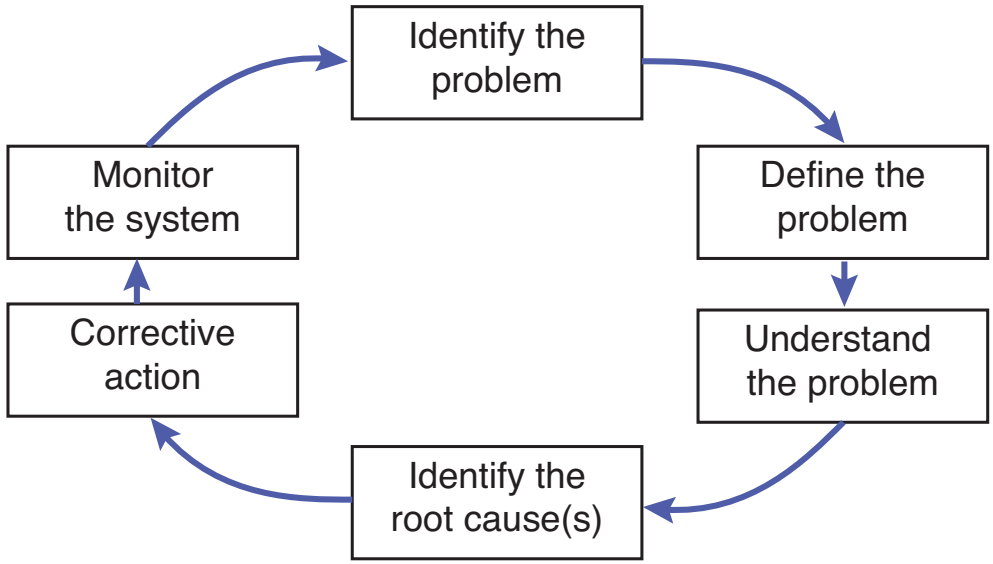
- What
  - What happened?
  - In many cases, only symptoms have been identified.
- When
  - When did it occur?
- Where
  - Where did it occur?
- To what extent?
  - What is the significance of the problem?

Problem definition - 2

- Understanding the environment surrounding a problem is essential to ensure that all conditions are addressed when determining the cause
- The timing and the location are important to identify because they may be critical to the actual cause

Analysis procedure

1. Identify and delimit the problem.
2. Define, describe, and understand the problem.
3. Identify the root cause(s)
4. Suggest and implement required corrective actions
5. Monitor the system



Useful methods

- The “five whys”
- Pareto analysis (Vital few, trivial many)
- Brainstorming
- Flowcharts / process mapping
- Cause and effect diagrams
- Tree diagrams (e.g., cause-effect trees)
- Barrier analysis

Why use a formal method?

- Because none of us can think of all the “why” -questions relevant to complex systems on our own
- Because each of us bring our own personal knowledge and biases to the table
- Why reinvent the wheel every time?

Common errors

- Looking for a single cause – problems will often have two or three interacting (root) causes
- Ending the analysis at a symptomatic cause
- Assigning as the cause of the problem the “why” event that preceded the real cause

Types of root cause analysis - 1

1. Safety-based root cause analysis.
   - Investigate accidents and events related to occupational safety and health.
   - Root causes: Unidentified hazards, or inadequate safety engineering, missing safety barriers.

2. Production-based root cause analysis
   - Quality control for industrial manufacturing.
   - Root causes: Non-conformance, such as malfunctioning steps in the production line.

Types of root cause analysis - 2

1. Process-based root cause analysis.
   - Extension of the production-based root cause analysis.
   - Includes business processes also.
   - Root causes: Individual process failures

2. System-based root cause analysis
   - Hybrid of the previous types
   - New concepts include: Change management, systems thinking, and risk management.
   - Root causes: Organizational culture and strategic management.

Happy ending

Successful application of the analysis and determination of the root cause should result in elimination of the problem!