Lean Construction Institute

Provider Number H561

Root Cause Analysis

20151013RCA

Dan Fauchier, The ReAlignment Group of California, LLC

October 13, 2015

Root Cause Analysis

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Root Cause Analysis

Course Description

"5 Why" is a common tool in problem solving, but 5 Why only gets to one root cause - often there are multiple root causes to a project organizational problem. For this we need a more robust methodology: Root Cause Analysis. This session will help participants learn deep problem solving skills. Participants will get hands on experience doing a Root Cause Analysis on a real problem in their professional life.

Root Cause Analysis

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Learning Objectives

At the end of the this course, participants will be able to:

1. Participants will learn how to define a significant project or organization problem by describing the current condition. Participants will learn the general principles of Root Cause Analysis (RCA)
2. Participants will learn how to combine active facilitation and 5 Why questioning to achieve identification and evaluation of multiple root causes.
3. Participants will learn how to move from root cause to mitigation measures (without jumping to "solutions" too early)
4. Participants will learn how RCA can move owner-designer-contractor-trades teams to friendly collaboration.

CONTINUING EDUCATION AIA

Root Cause Analysis

Dan Fauchier, CMF

October 13, 2015

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Root Cause Analysis

- “No problem can be solved from the same level of consciousness that created it.” – Albert Einstein

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OBJECTIVE

Root Cause Analysis

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- Problem solving requires a **creative mind shift**.

- One **barrier** is that the **person** who needs to solve the problem may be **caught up in the firefighting** that occurs when a problem explodes.

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Root Cause Analysis

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- The objective of this session is to teach you how to:
  - quickly identify a problem,
  - quickly solve the problem using 5 Why, or
  - immediately swarm it using Root Cause Analysis,
- and devise and test countermeasures to achieve a Target Condition.

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Introductions

Name, Role,

Experience in Problem Solving

(including What's Not Working)

RESULTS

Root Cause Analysis

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At the conclusion of this session, attendees will:

- Know how to distinguish between a problem that can be quickly resolved and one that requires deeper analysis
- Know how better to clearly define and state “the problem”
- Know how to employ a method called “5 Why”
- Understand how to employ methods to dig deeper beyond the problem’s symptoms to discover true causes
- Know how to develop and test mitigation measures to solve defined problems
- Know how to employ a method called “Root Cause Analysis” using the fishbone analysis technique.

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Root Cause Analysis

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- Find problem
- Fix problem

then

- Find root cause
- Fix process

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High Velocity Edge

Steven J. Spear

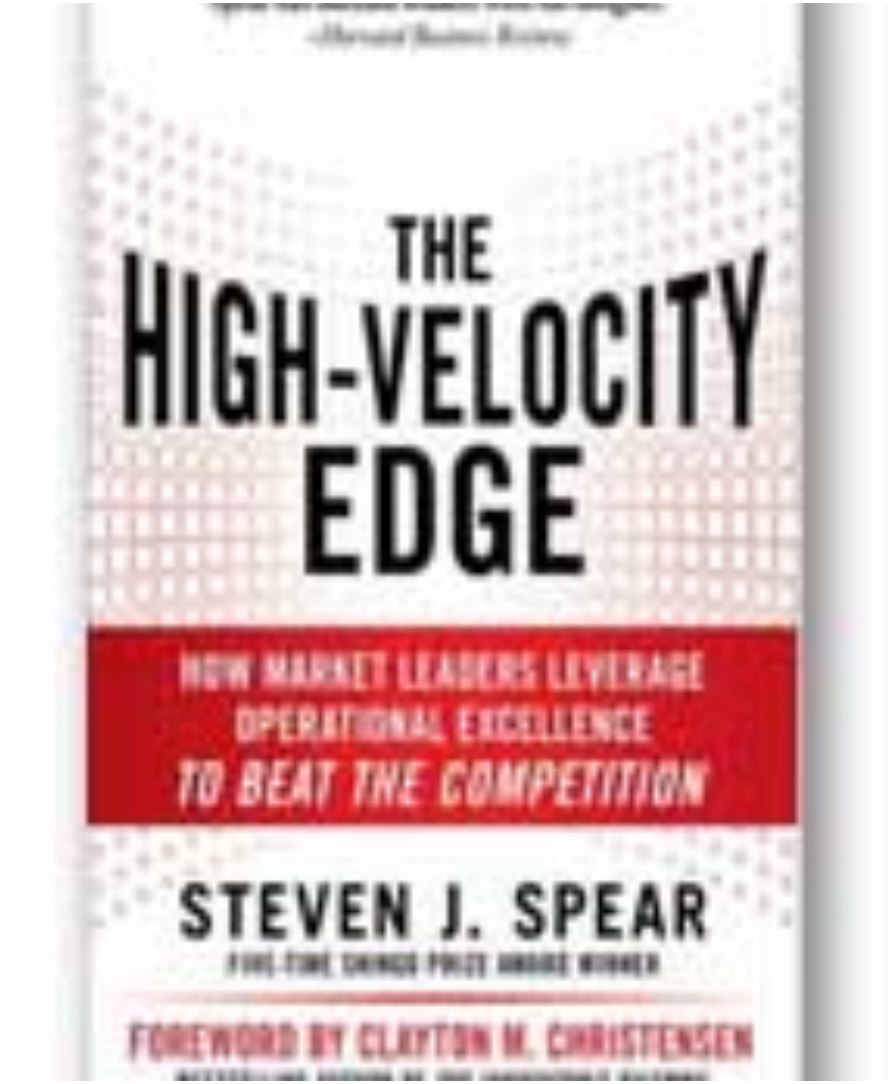
Root Cause Analysis

What does Spear say?

- Toyota's people discussed the design and operation of **all processes** in a **patterned way**

- Thus, a "Problem Solving Discipline" had been developed … a "template"

Root Cause Analysis



- Problem Solving Template
  - Background
  - Current Condition
  - Root-Cause Analysis(Diagnosis)
  - Countermeasure Treatments
  - Target Condition
  - Actual Outcomes
  - Gap Analysis

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Problem Solving Template

- **Background**
  - Why are we concerned about this situation?
- **Current Condition**
  - How work is being done and what problems (symptoms) are occurring?

- **Background**
- **Current Condition**
- Root-Cause Analysis(Diagnosis)
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Seeing Problems

- How do you "see" a problem on a project?
- What prevents clear vision of a problem?
- What is the role of:
  - Emotion
  - Background static
- How can you quickly identify and flush out a problem from the background static of a project?

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Seeing Problems

At Alcoa, Capability 1:

- **"If you do not see a problem when and where it occurs and swarm it to investigate it, much of the information needed to understand it will perish, spoil, fade and dissipate.**
  - **Once that happens, it becomes impossible to re-create the problem, nail down what caused it, and take corrective measures that will prevent its recurrence."**

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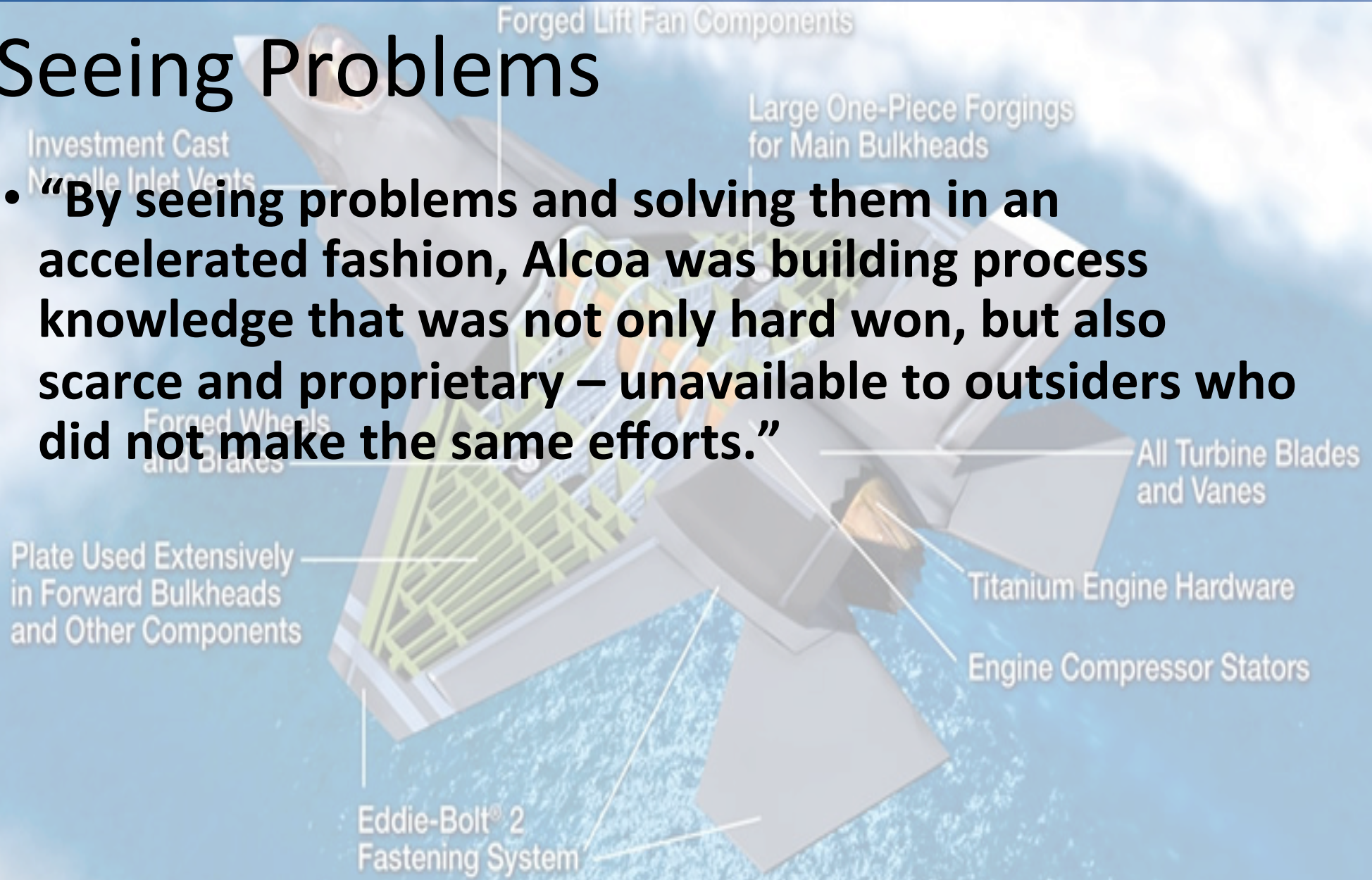
Seeing Problems

- **"By seeing problems and solving them in an accelerated fashion, Alcoa was building process knowledge that was not only hard won, but also scarce and proprietary – unavailable to outsiders who did not make the same efforts."**



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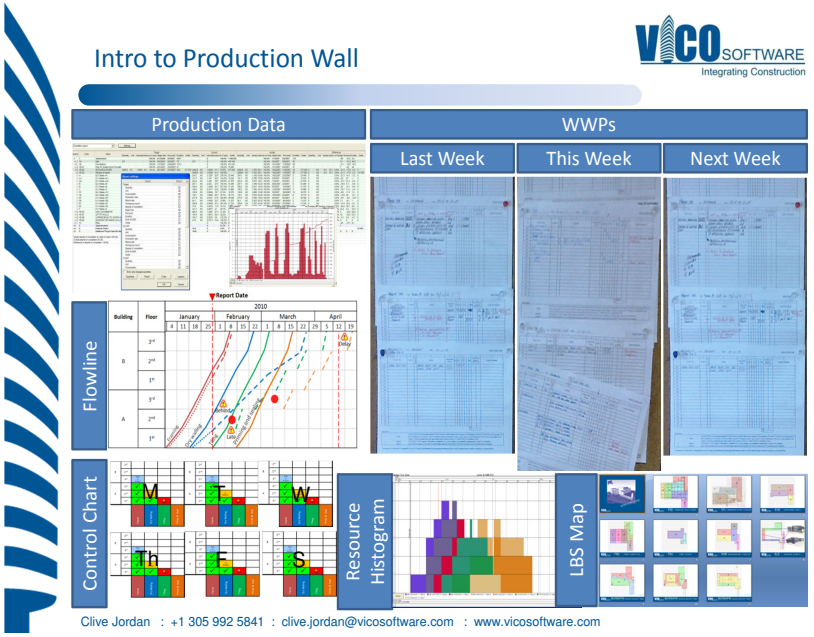
Seeing Problems

"Seeing problems was the prerequisite for the highspeed *kaizen* ('continuous improvement') for which Toyota came to be so highly regarded."

Seeing Problems

- Use Visual Management and Weekly Work Planning to make problems visible early, quickly identifying and addressing even minor deviations from plan.



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Root Cause Analysis

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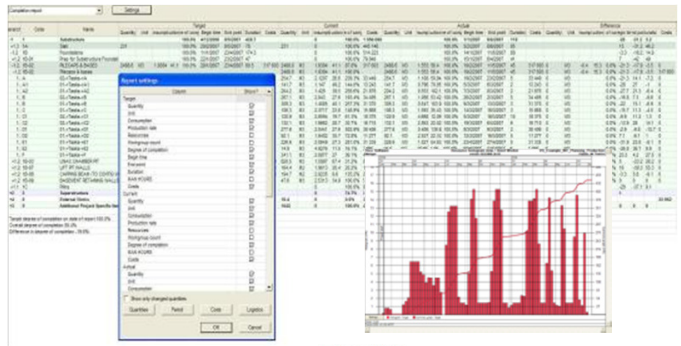
VICO SOFTWARE
Integrating Construction

Intro to Production Wall

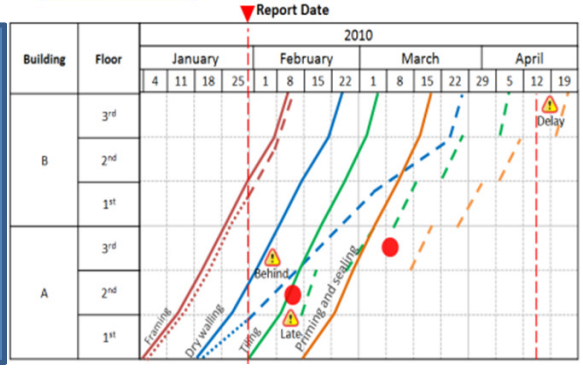
Production Data



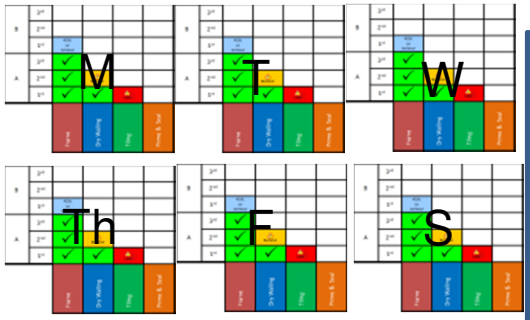
WWPs

Last Week	This Week	Next Week

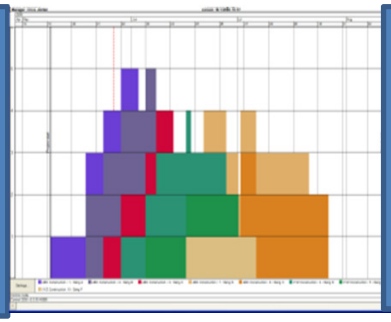
Flowline



Control Chart



Resource Histogram



LBS Map

Clive Jordan : +1 305 992 5841 : clive.jordan@vicosoftware.com : www.vicosoftware.com

Root Cause Analysis

- Problem Definition – water shortage:
  - (1) “We need sufficient water to maintain the current lifestyle”

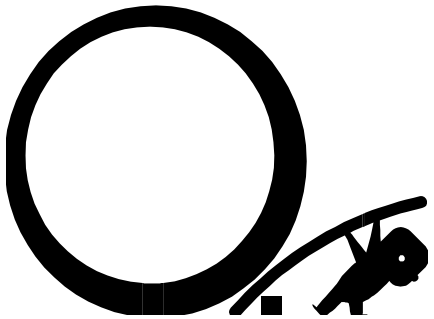
    or
  - (2) “We need to design effective means to curb the potable water shortage”

Root Cause Analysis

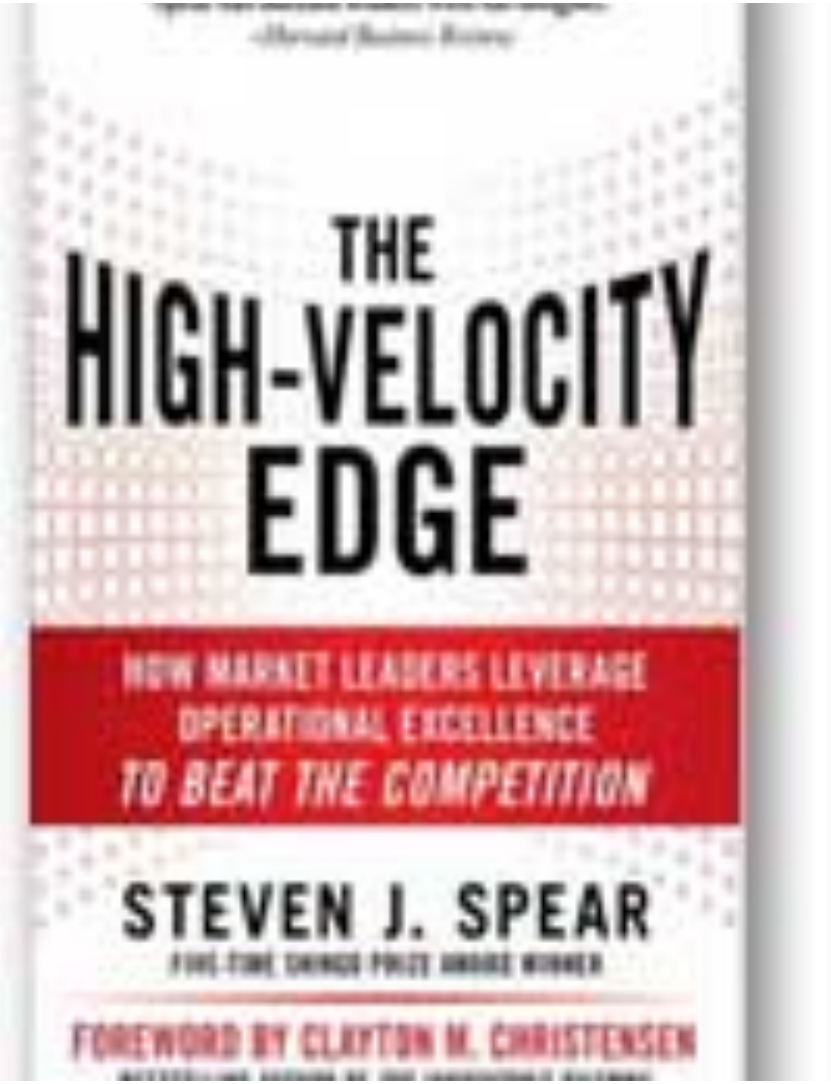
- Problem Definition
  - **(1) "We need more water to maintain the current lifestyle"**
    - Sample solution: design an economical system for converting waste water to potable water
    - **ERGO: Poor definition** – misdirects and narrowly focuses the problem solution search
      - focuses on one solution for supply

Root Cause Analysis

- Problem Definition
  - (2) **"Design effective means to curb the potable water shortage"**
    - Focuses on functional behavior not a specific solution
    - Focuses on the source of the problem
  - **ERGO: Good definition**
    - Leaves open solutions addressing both supply and demand



Root Cause Analysis



- Problem Solving Template
  - Background
  - **Current Condition**
  - Root-Cause Analysis(Diagnosis)
  - Countermeasure Treatments
  - Target Condition
  - Actual Outcomes
  - Gap Analysis

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Current Condition

- What is the value of describing – succinctly – the Current Condition?
  - How work is being done and what problems (symptoms) are occurring?

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Discussion

- How can you distinguish between a problem that can be quickly resolved and one that requires deeper analysis?

- Here's a simple "5 Why" method of problem solving and risks

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5 Why

5 Why

The vehicle will not start. (the problem)

① *Why?* - The battery is dead. (first why)

② *Why?* - The alternator is not functioning. (second why)

③ *Why?* - The alternator belt has broken. (third why)

④ *Why?* - The alternator belt was well beyond its useful service life and not replaced. (fourth why)

⑤ *Why?* - The vehicle was not maintained according to the recommended service schedule. (fifth why, a root cause)

Only 5 Whys ?

⑥ *Why?* - Replacement parts are not available because of the extreme age of the vehicle. (sixth why, optional)

- Start maintaining the vehicle according to the recommended service schedule. (5th Why solution)
- Purchase a different vehicle that is maintainable. (6th Why solution)

Root Cause Analysis

- Risks/Deficiencies in 5 Why
  - 5-Whys tends to allow people to miss multiple causal factors.
    - Tendency for investigators to stop at symptoms rather than going on to lower level root causes.
    - Inability to go beyond the investigator's current knowledge - can't find causes that they don't already know.
    - Lack of support to help the investigator to ask the right "why" questions.

Root Cause Analysis

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- Risks/Deficiencies in 5 Why
  - Results aren't repeatable - different people using 5 Whys come up with different causes for the same problem.
  - Tendency to isolate a single root cause, whereas each question could elicit many different root causes.
- Einstein: “No problem can be solved from the same level of consciousness that created it.”

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Discussion

- How do you use 5 Why now?
- How can you use 5 Why next week?

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Barriers
to Problem Solving

Root Cause Analysis

- Barriers
  - Simplistic thinking: missing multiple causal factors.
  - Stopping at symptoms rather than going on to lower level root causes.
  - Limits of the investigator's current knowledge .
  - Push to hurry up and solve the problem.
  - Addiction to being a “fire fighter”.
  - What else?

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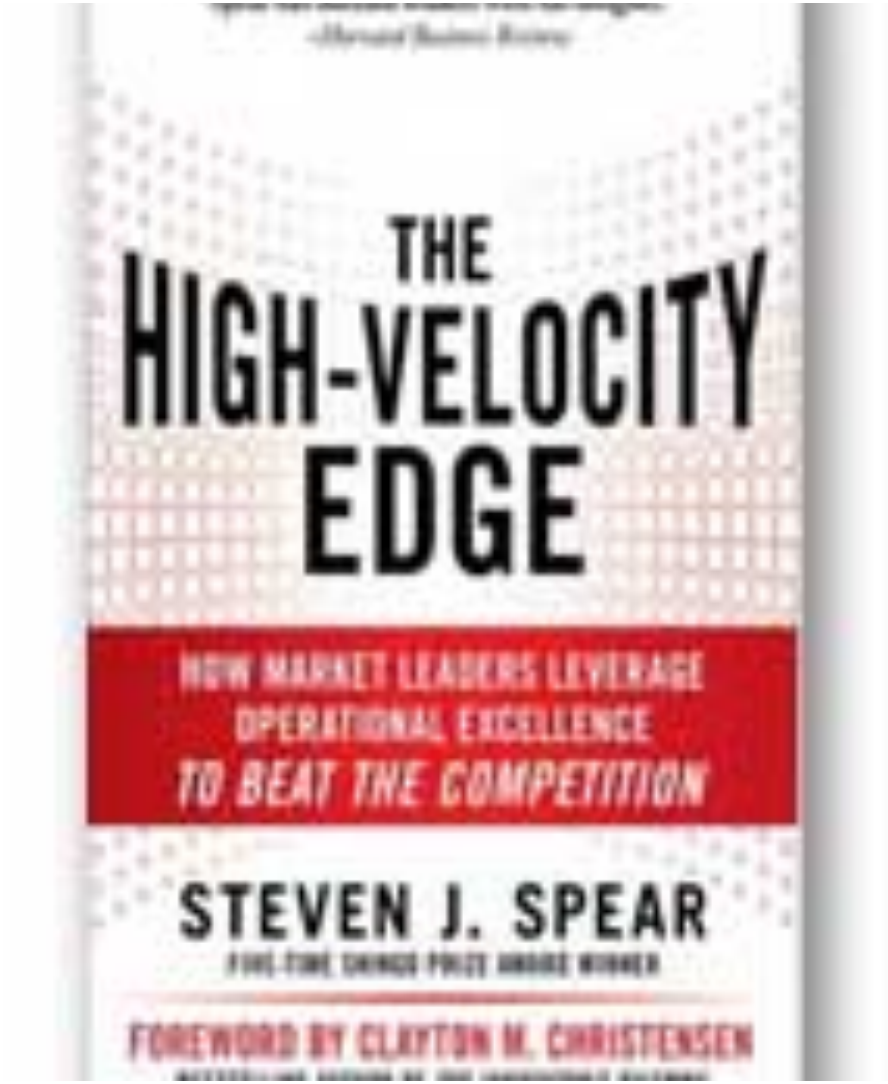
Discussion

"It's not that I'm so smart, it's just that I stay with problems longer…. One should look for what is, and not for what one thinks should be."

– Albert Einstein

Root Cause Analysis



- Problem Solving Template
  - Background
  - Current Condition
  - **Root-Cause Analysis(Diagnosis)**
  - Countermeasure Treatments
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  - Gap Analysis

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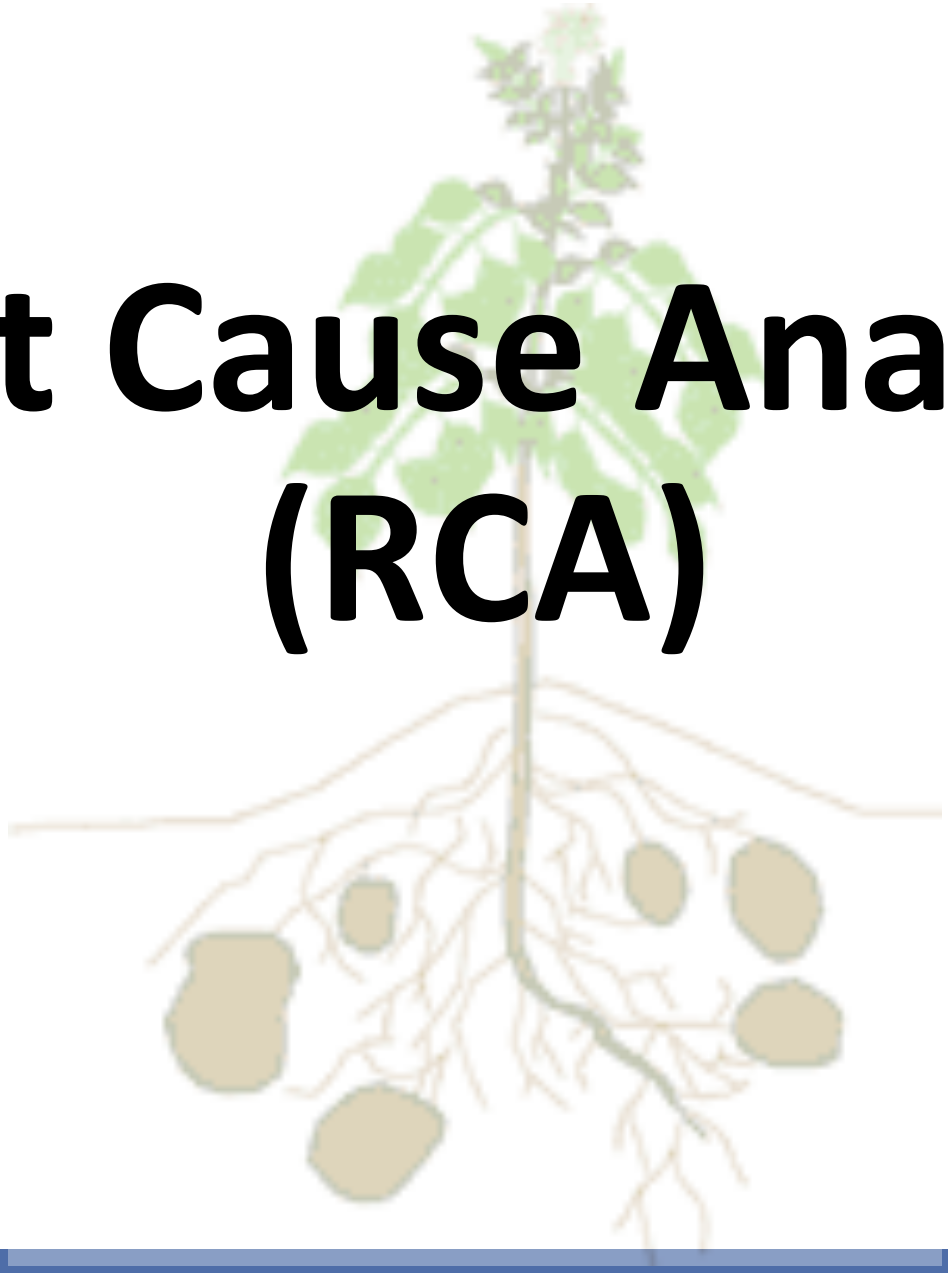
Root Cause Analysis (RCA)



Root Cause Analysis

- Primary aim: to **identify the factors that resulted in**
  - the nature
  - the magnitude
  - the location and
  - the timing
- of the **harmful outcomes** (consequences) of one or more past events.
- Thus to **identify** what
  - behaviors
  - actions
  - inactions or
  - conditions
- that need **to be changed** to prevent recurrence.
- And to identify the **lessons to be learned**.

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Fishbone Diagram (Ishikawa)

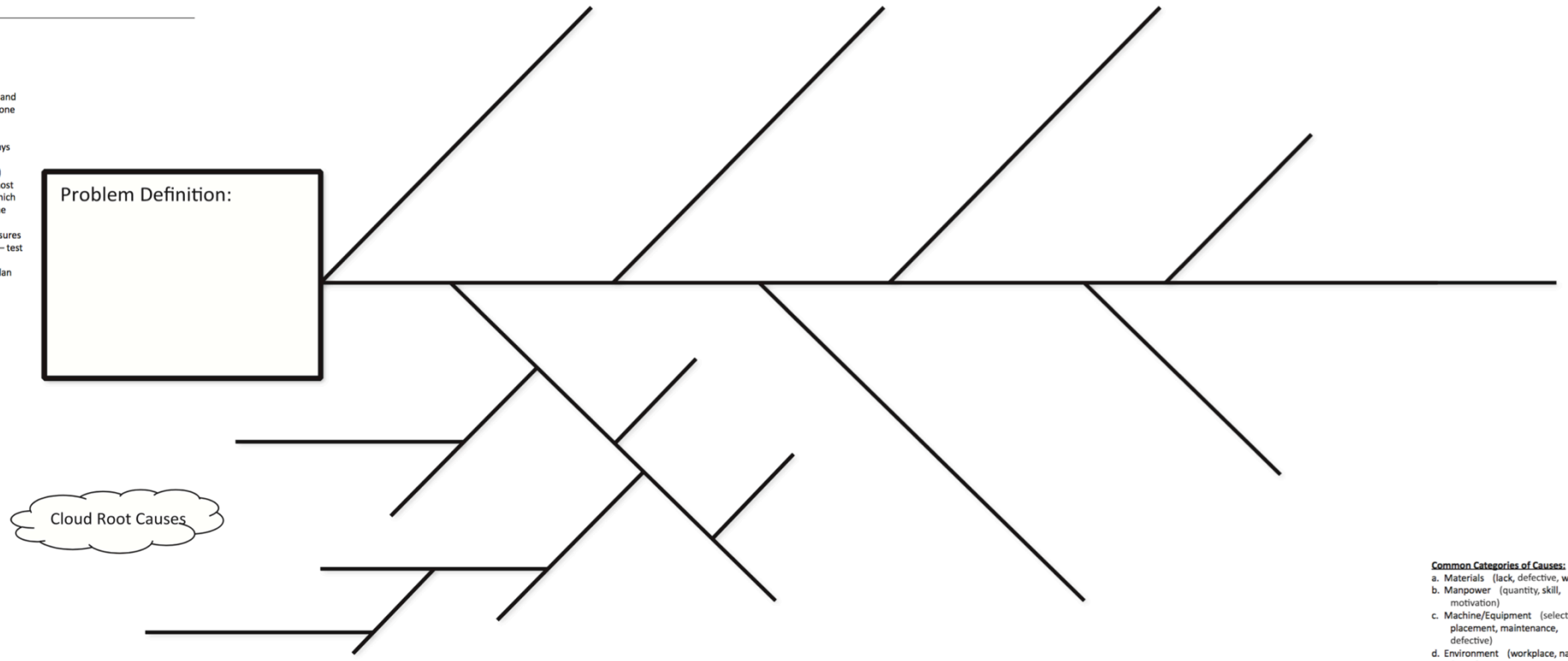
Date: _____

Project: _____

Cause-Effect for Root Cause Analysis (Fishbone Diagram)

Steps to Follow:

1. Define the problem (describe the event)
2. Discuss/Gather data and evidence from everyone involved
3. Brainstorm (using Fishbone) & do 5 Whys
4. Classify causes (see Common Categories)
5. Identify/Cloud the most likely Root Causes which are at the heart of the problem
6. Identify countermeasures & corrective actions – test them, if possible
7. Implement them – Plan Do Check Adjust



Common Categories of Causes:

a. Materials (lack, defective, wrong)
b. Manpower (quantity, skill, motivation)
c. Machine/Equipment (selection, placement, maintenance, defective)
d. Environment (workplace, natural forces)
e. Management (inattention, stress, lack of communication, lack of process)
f. Methods (procedures, practices)
g. Management System (training, recognition of risk/hazard, involvement)

List Countermeasures / Corrective Actions (Responsible Person/When Due):

1. _____ 3. _____
2. _____

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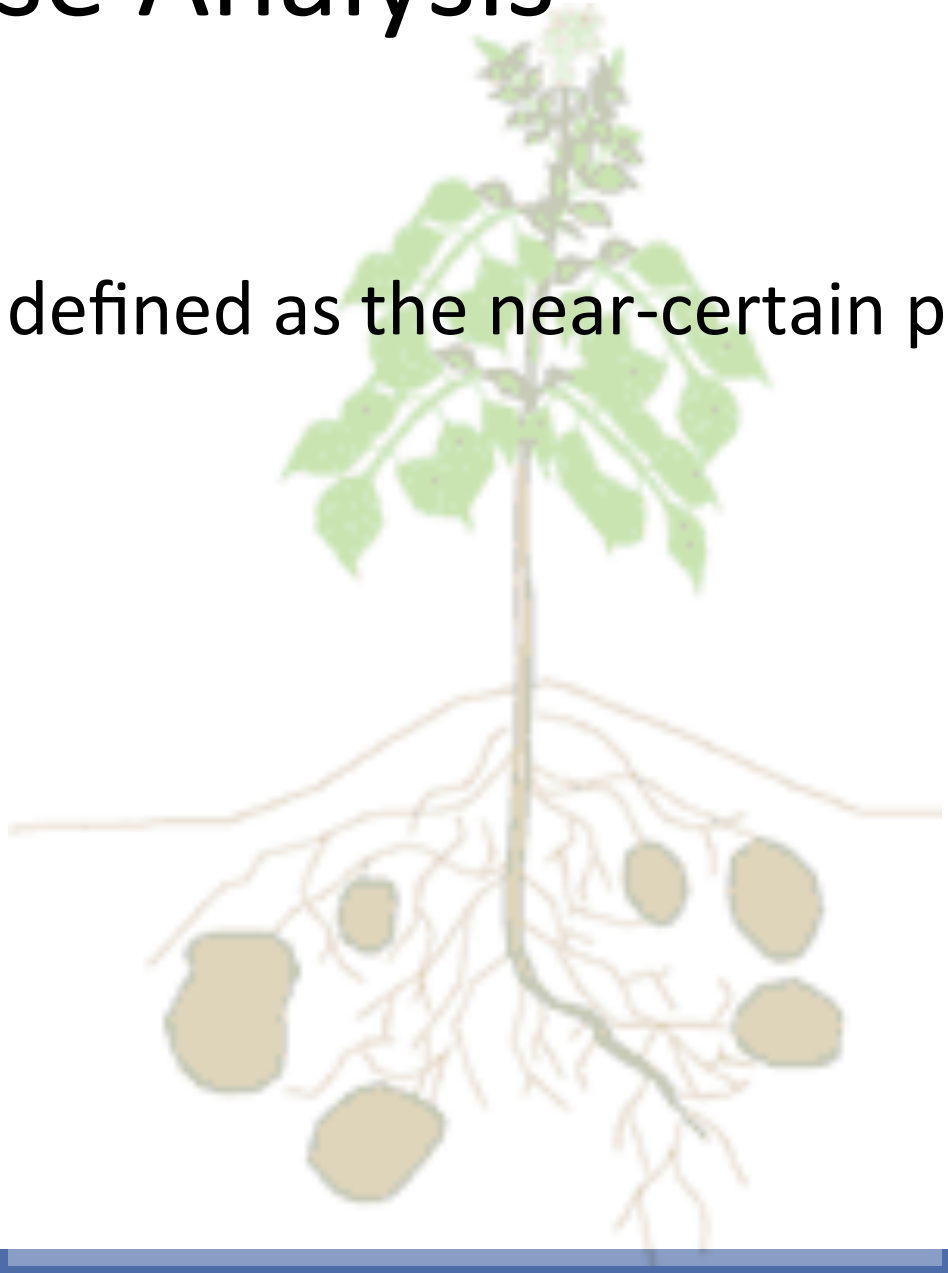
Root Cause Analysis

- "Success" is defined as the near-certain prevention of recurrence.



Root Cause Analysis

- Find problem
- Fix problem
- Find root cause
- Fix process

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Root Cause Analysis

- RCA must be performed **systematically**, usually as part of an **investigation**, with conclusions and root causes identified backed up by **documented evidence**.
- Usually a team effort is required.
- There may be **more than one root cause** for an event or a problem.
- The tough part:
  - **Persistence**
  - **Sustained effort** required to develop them.
  - **Getting people to show up.**

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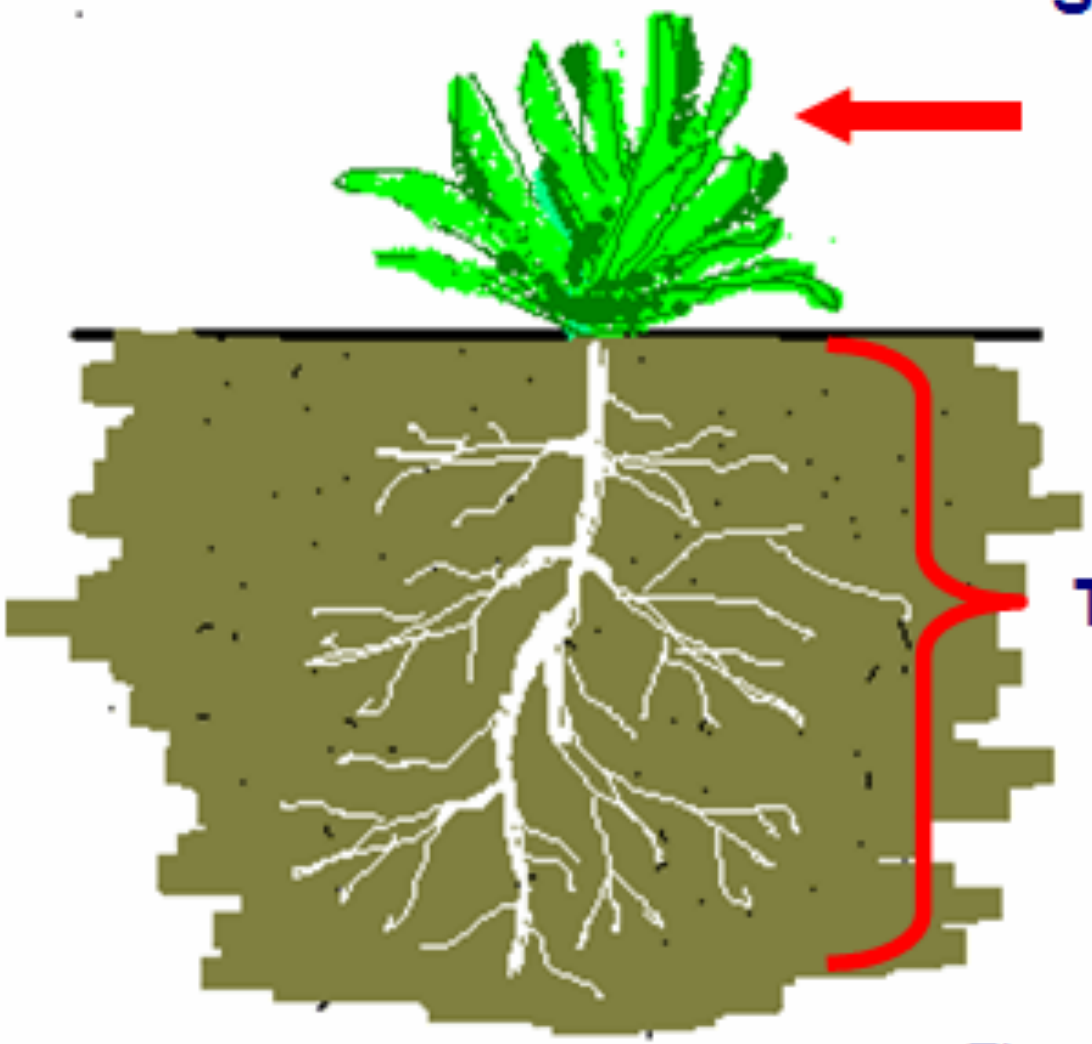
Root Cause Analysis Basics



Symptom of the problem.

"The Weed"

Above the surface
(obvious)

The Underlying Causes

"The Root"

Below the surface

(not obvious)

The word root, in root cause analysis, refers to the underlying causes, not the one cause.

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Root Cause Analysis

- RCA's initial needs:
  - Effective problem statements and event descriptions (as failures, for example)
  - sequence of events or timeline
    - to understand the relationships between contributory (causal) factors, root cause(s) and the defined problem or event to prevent in the future.

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The Process of RCA

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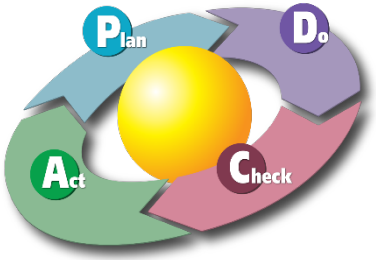
RCA Process Steps

1. Define the problem (describe the event)
2. Gather data and evidence
3. 5 Whys
4. Classify causes into causal factors
5. Reveal multiple root causes
6. Identify all harmful factors (might be causes)
7. Identify corrective actions & solutions
8. Implement them – PDCA



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Root Cause Analysis

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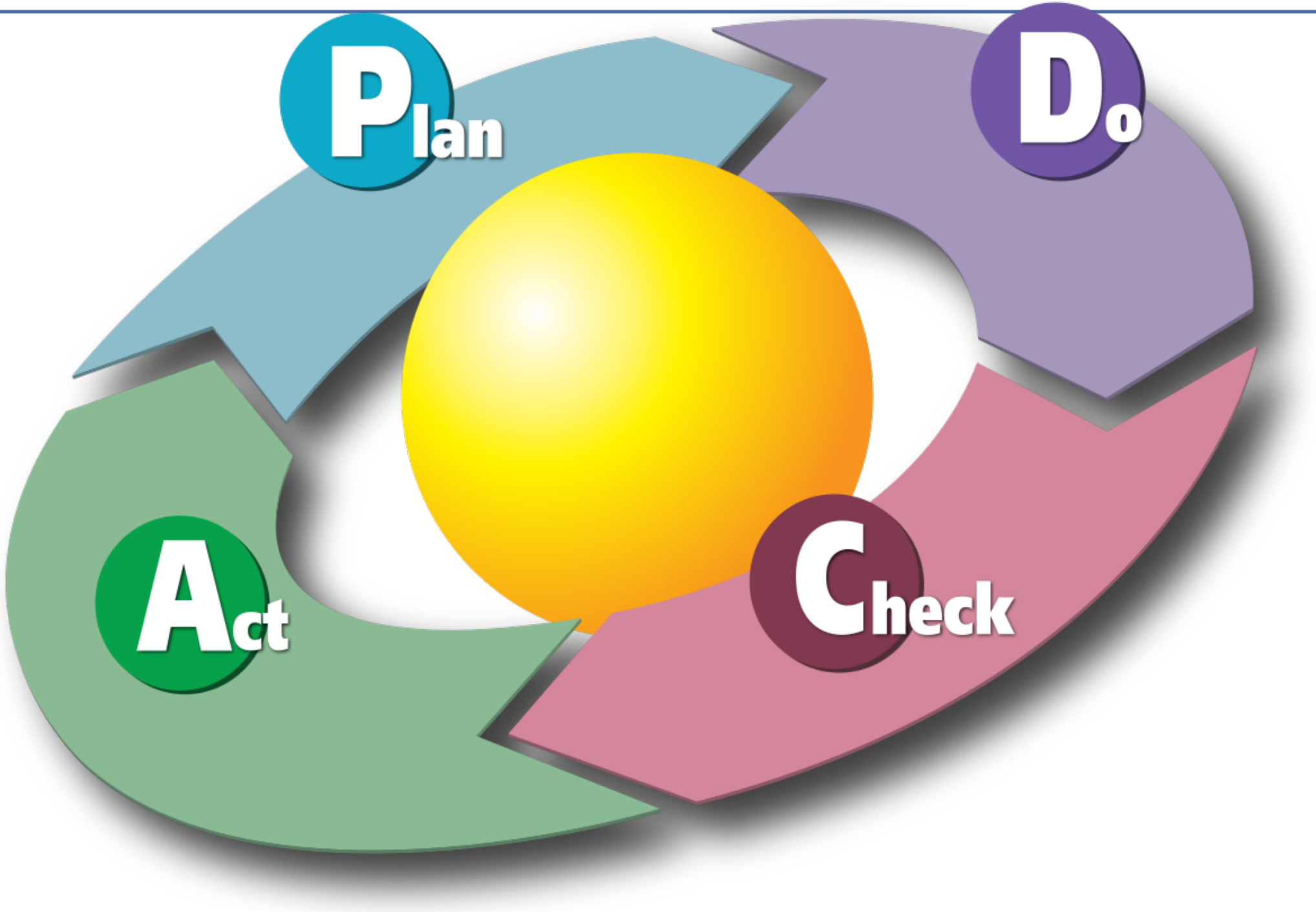

Let's Do It!

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RCA Process Steps

1 Define the problem (describe the event)

2 Gather data and evidence

3 5 Whys

4 Classify causes into causal factors

5 Reveal multiple root causes

6 Identify all harmful factors (might be causes)

7 Identify corrective actions & solutions

8 Implement them – PDCA

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1 - Define the Problem

- Include attributes (properties) of the harmful outcomes, both:
  - Qualitative
  - Quantitative
- This usually includes specifying the
  - Natures
  - Magnitudes
  - Locations
  - Timings

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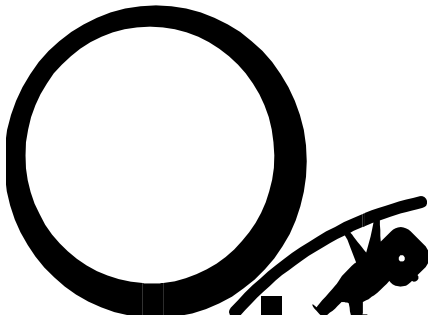
1 - Define the Problem

REMEMBER:

- **A good definition leaves open solutions for addressing the problem**
  - Eg. in our water shortage example: both supply and demand



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RCA Process Steps

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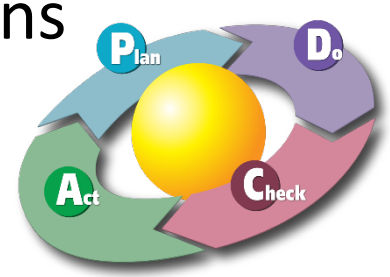

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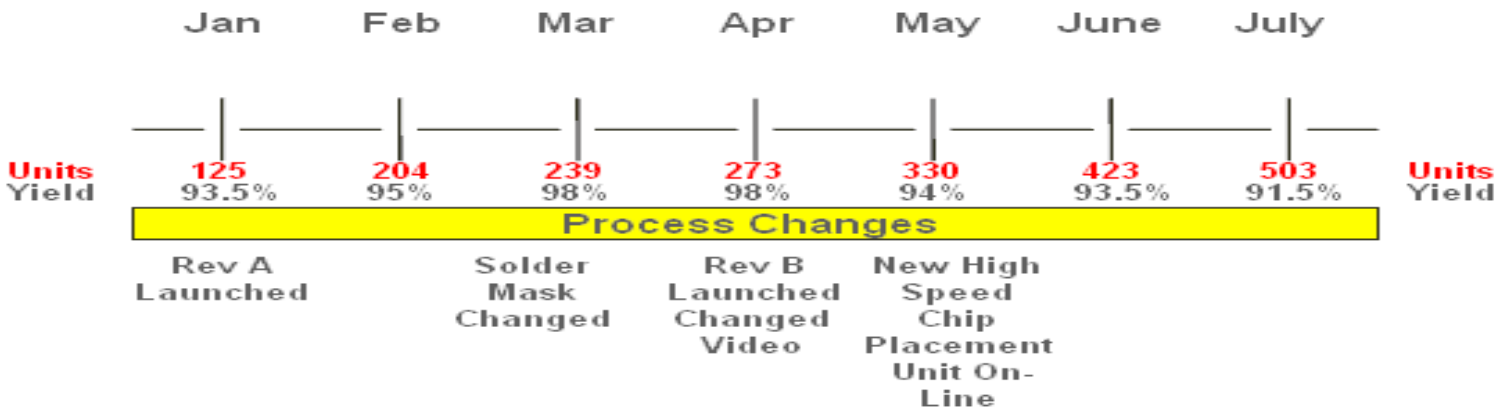
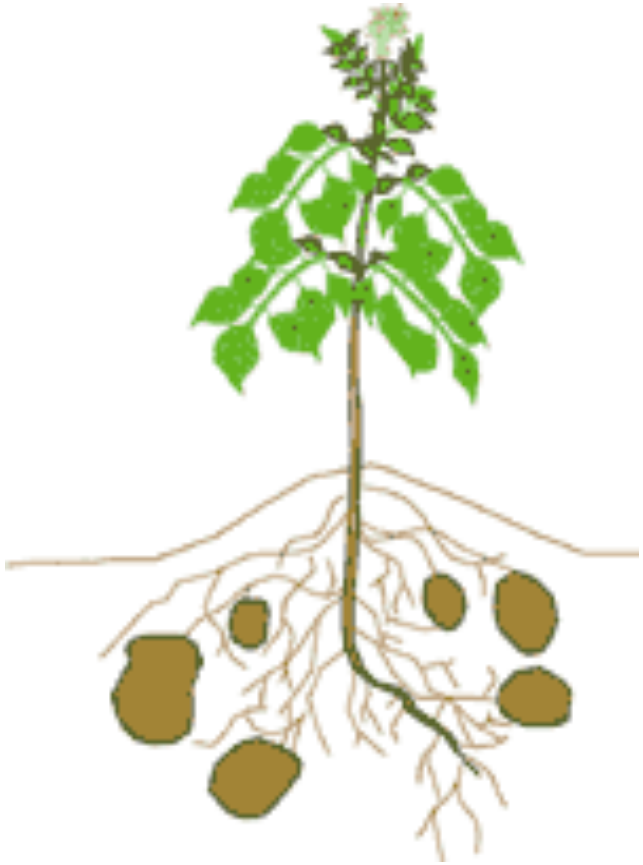
2 – Gather data & evidence

- Along a timeline of events
  - Classify the data and evidence to the final failure or crisis
- Specify in the "timeline" what should have been when it differs from the actual
  - For every behavior, condition, action, and inaction



Elements of Data & Evidence

1. Materials
2. Manpower
3. Machines/Equipment
4. Environment
5. Management
6. Methods
7. Management System



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RCA Process Steps

1 Define the problem (describe the event)

2 Gather data and evidence

3 5 Whys

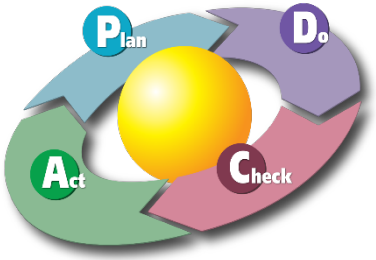
4 Classify causes into causal factors

5 Reveal multiple root causes

6 Identify all harmful factors (might be causes)

7 Identify corrective actions & solutions

8 Implement them – PDCA



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3. 5 Whys

- Ask "why"
  - identify the causes associated with each step in the sequence towards the defined problem or event.
- "Why" is taken to mean
  - "What were the factors that directly resulted in the effect?"

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RCA Process Steps

1 Define the problem (describe the event)
2 Gather data and evidence
3 5 Whys

4 Classify causes into causal factors

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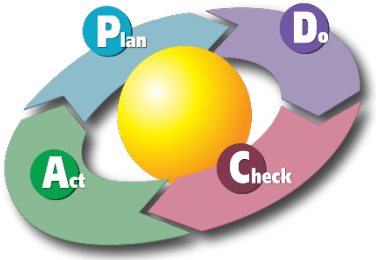

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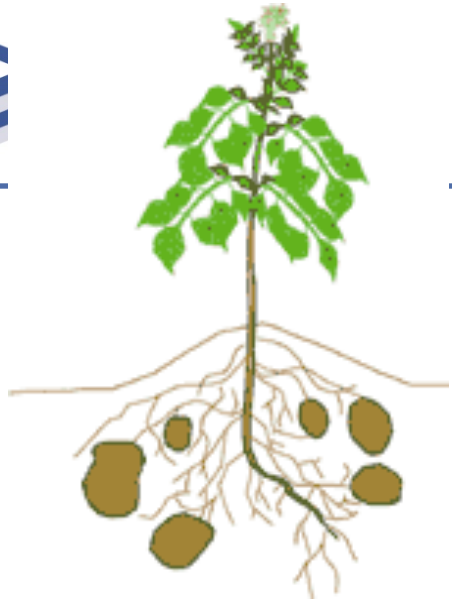

4 - Classify

- Classify causes into causal factors that relate to an event in the sequence, and root causes, that if applied can be agreed to have interrupted that step of the sequence chain.

Level 1 Causes:

1. Materials
2. Manpower
3. Machines/Equipment
4. Environment
5. Management
6. Methods
7. Management System

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Level 2 Causes

Processes for providing a given resource.

A. Research
B. Design/Specify
C. Select
D. Submit
E. Approve
F. Procure/Order
G. Schedule
H. Inspect
I. Train
J. Delivery/Communicate
K. Maintain
L. Store/Handle
M. Release to activity
N. Supervise
O. Improve
P. Install
Q. Execute
R. Motivate/Expedite
S. Other

Level 3 Causes

More specific characteristics of resource breakdowns.

a. Skill
b. Capability
c. Knowledge
d. Amount
e. Defect/Damage
f. Space
g. Access
h. Conditions of Satisfaction
i. Layout
j. Layout information
k. Layout method
l. Procedure
m. Location
n. Ambiguous
o. Safe
p. Stressed
q. Other

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Common Cause

Combination of 2 or 3 levels using numbers and letters.

- B1n – Design/ Specification of the Rebar was Ambiguous
- B4o – Design/ Specification of the concrete pour platform was not not safe
- G2 – Crew was not scheduled
- B6g – Did not Design Access to the work space
- F3d – Did not Order enough Hammers
- J1m – Risers were Delivered to the wrong floor

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Fishbone Analysis

- Fishbone analysis
  - Ishikawa diagram
  - Herringbone diagram
  - Cause-and-effect diagram
  - Fishikawa
- Strongest causes
- Prioritize
- Solutions & Prevention

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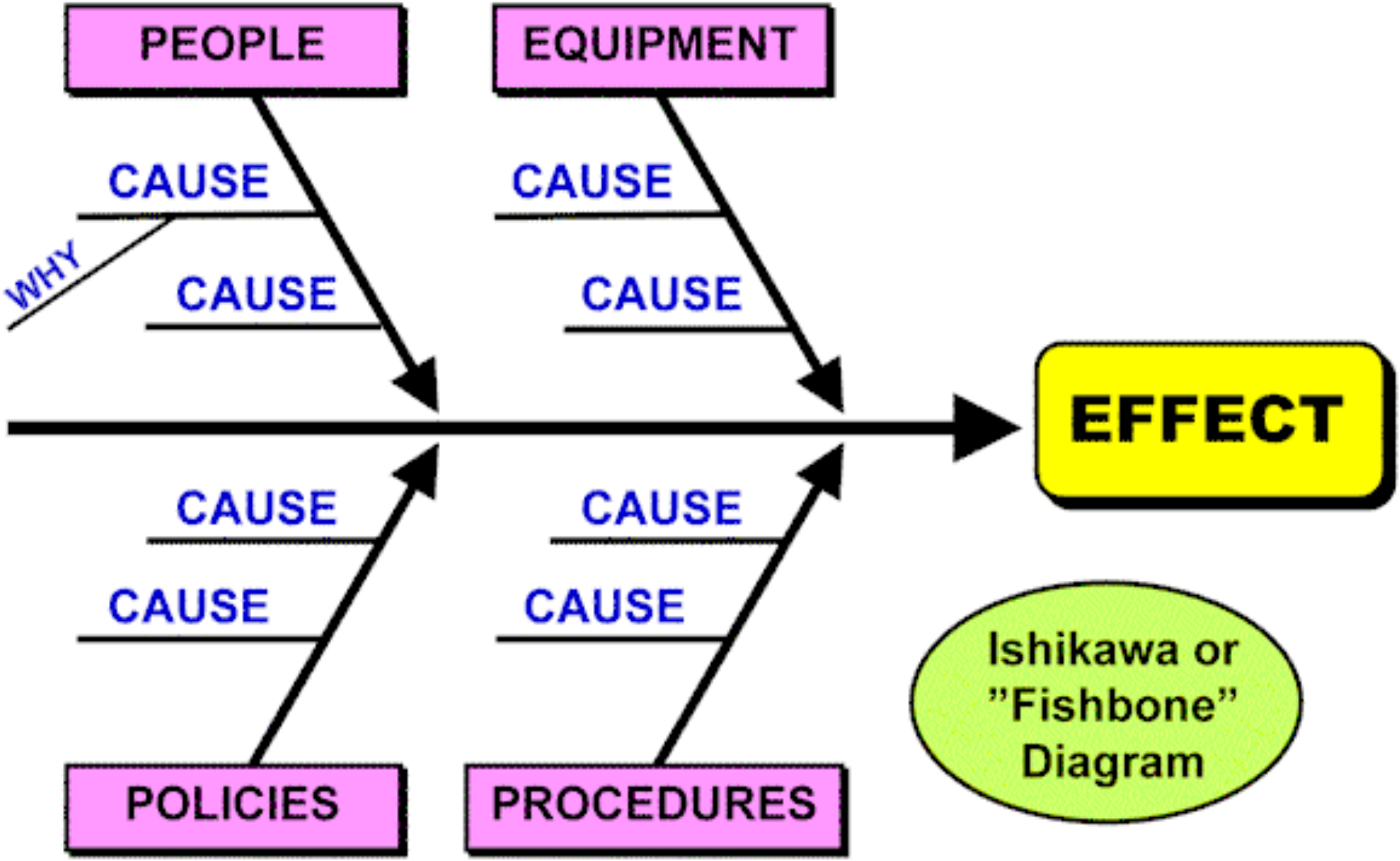
Root Cause Analysis



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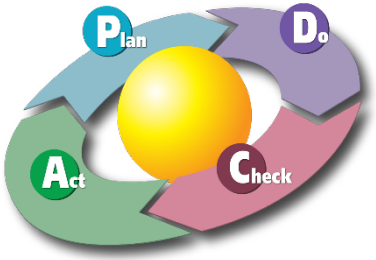
RCA Process Steps

1 Define the problem (describe the event)
2 Gather data and evidence
3 5 Whys
4 Classify causes into causal factors

5 Reveal multiple root causes

6 Identify all harmful factors (might be causes)
7 Identify corrective actions & solutions
8 Implement them – PDCA



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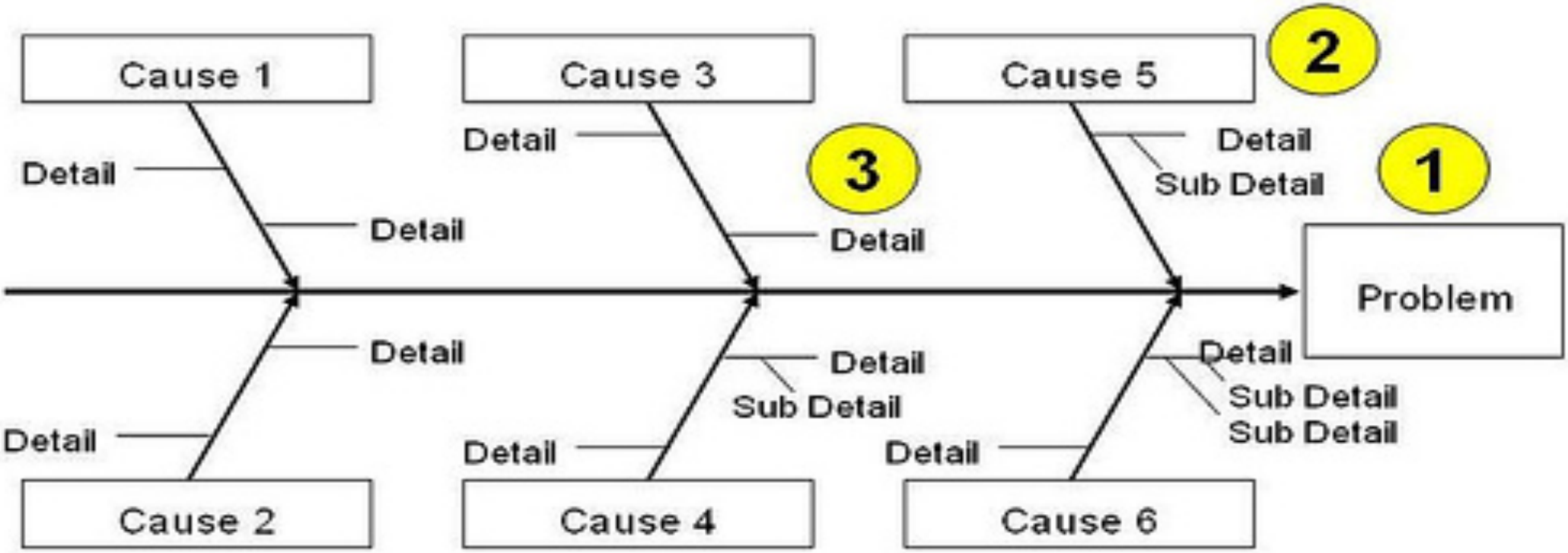
5 – Reveal Multiple Root Causes

- If there are multiple root causes, which is often the case, reveal those clearly for later optimum selection.
- Identify all other harmful factors that have equal or better claim to be called "root causes."



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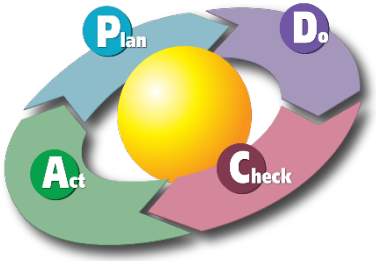

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Common Cause

Combination of 2 or 3 levels using numbers and letters.

- B1n – Design/ Specification of the Rebar was Ambiguous
- B4o – Design/ Specification of the concrete pour platform was not not safe
- G2 – Crew was not scheduled
- B6g – Did not Design Access to the work space
- F3d – Did not Order enough Hammers
- J1m – Risers were Delivered to the wrong floor

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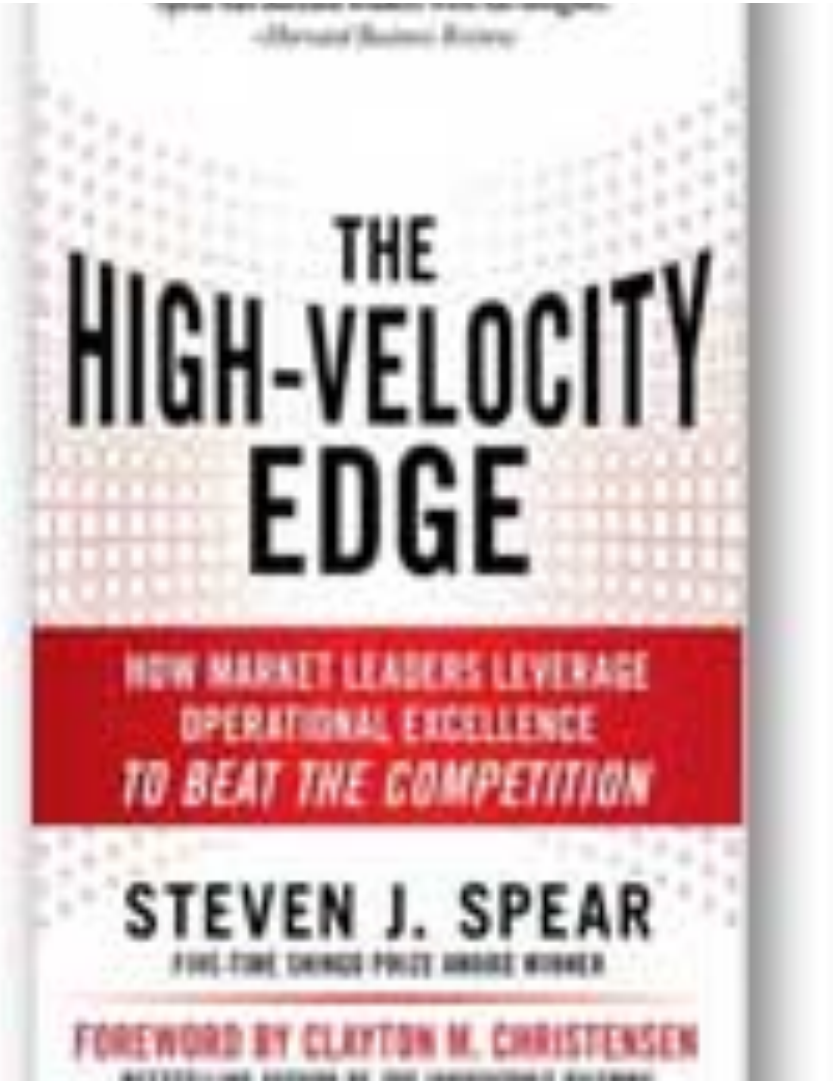
Root Cause Analysis



- Problem Solving Template
  - Background
  - Current Condition
  - Root-Cause Analysis(Diagnosis)
  - **Countermeasure Treatments**
  - Target Condition
  - Actual Outcomes
  - Gap Analysis

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RCA Process Steps

1. Define the problem (describe the event)
2. Gather data and evidence
3. 5 Whys
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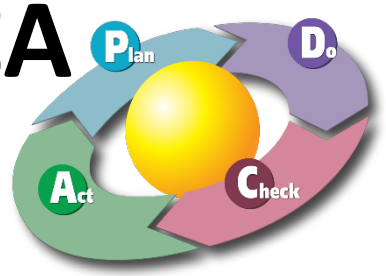
5. Reveal multiple root causes
6. Identify all harmful factors (might be causes)
7. **Identify corrective actions & solutions**
8. **Implement them – PDCA**



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7 – ID corrective actions

- Identify corrective action(s) that will with certainty prevent recurrence of each harmful effect, including outcomes and factors.
- Check that each corrective action would, if pre-implemented before the event, have reduced or prevented specific harmful effects.

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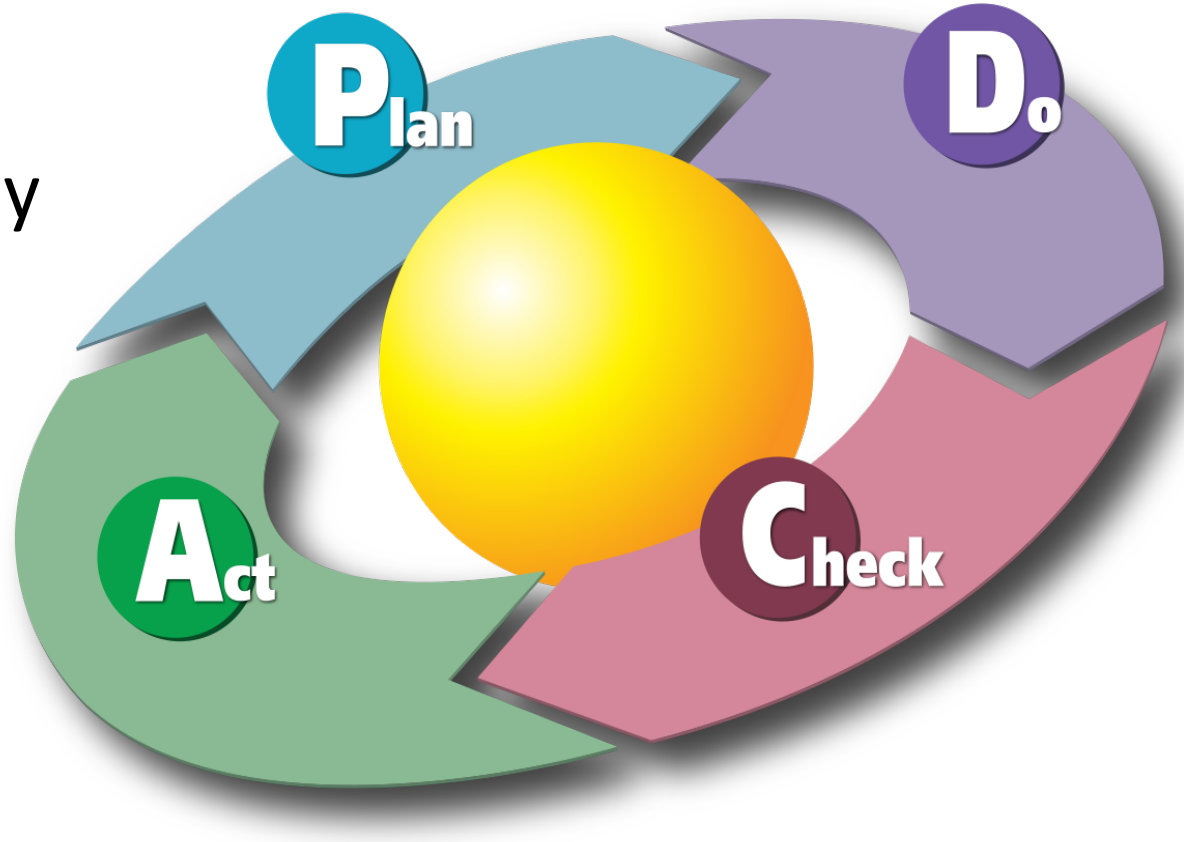
8 – Implement them

- Implement the recommended root cause correction(s).
- Ensure effectiveness by observing the implemented recommendation solutions.
- Evaluate
- Adjust



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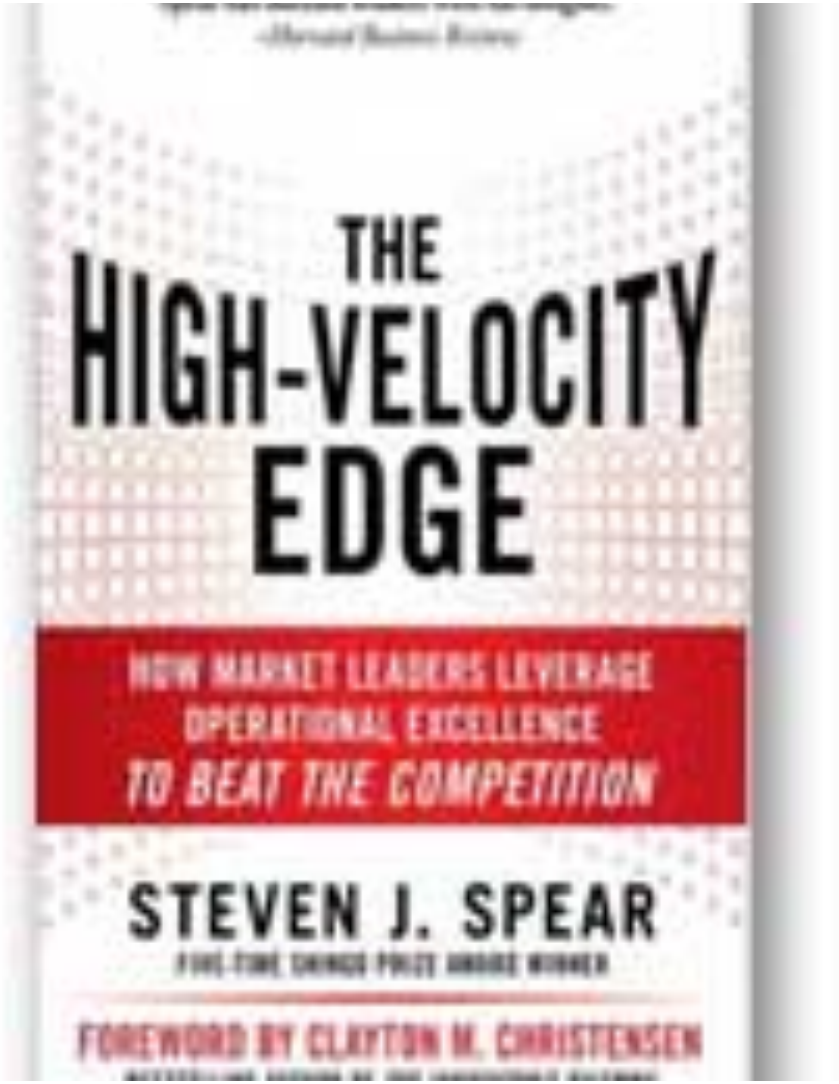
Problem Solving Template



- Background
- Current Condition
- Root-Cause Analysis(Diagnosis)
- Countermeasure Treatments
- **Target Condition**
- **Actual Outcomes**
- **Gap Analysis**

Target Condition

- Target Condition:
  - "How work is expected to proceed with the countermeasures in place and the problems treated."

- Discussion
  - What is the value of defining the Target Condition?
  - How does it compare to Current Condition?
  - When should you define the Target Condition?

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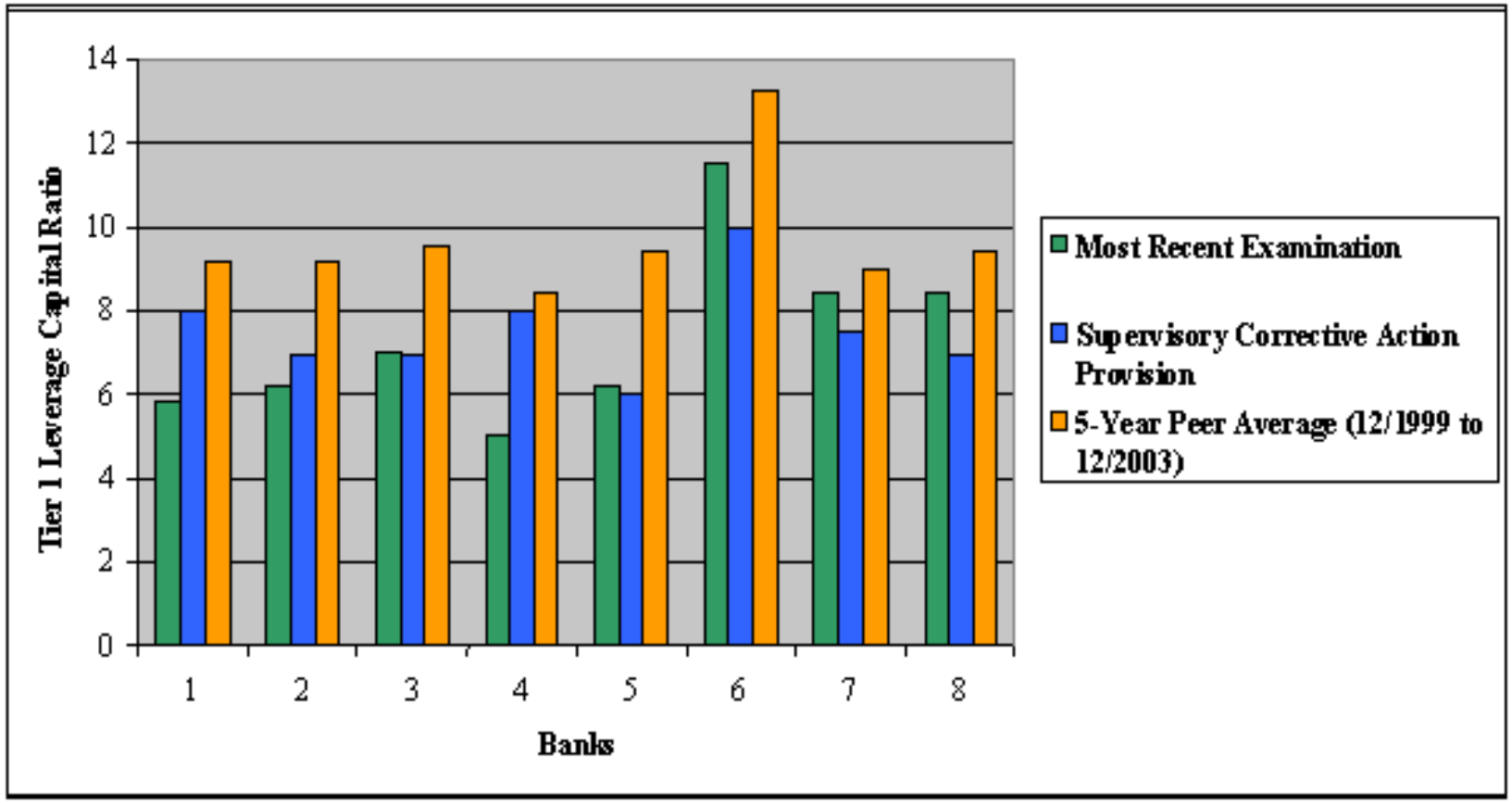
Actual Outcomes

- Monitor and measure the countermeasures, changes and proposed solutions.



Gap Analysis

- Measure the metrics of the "Target Condition" against the "Actual Outcomes"

- Is there a "Gap"?
- Why?
  - 5 times
  - Or update the RCA

- Identify and address the other instances of each harmful outcome and harmful factor.

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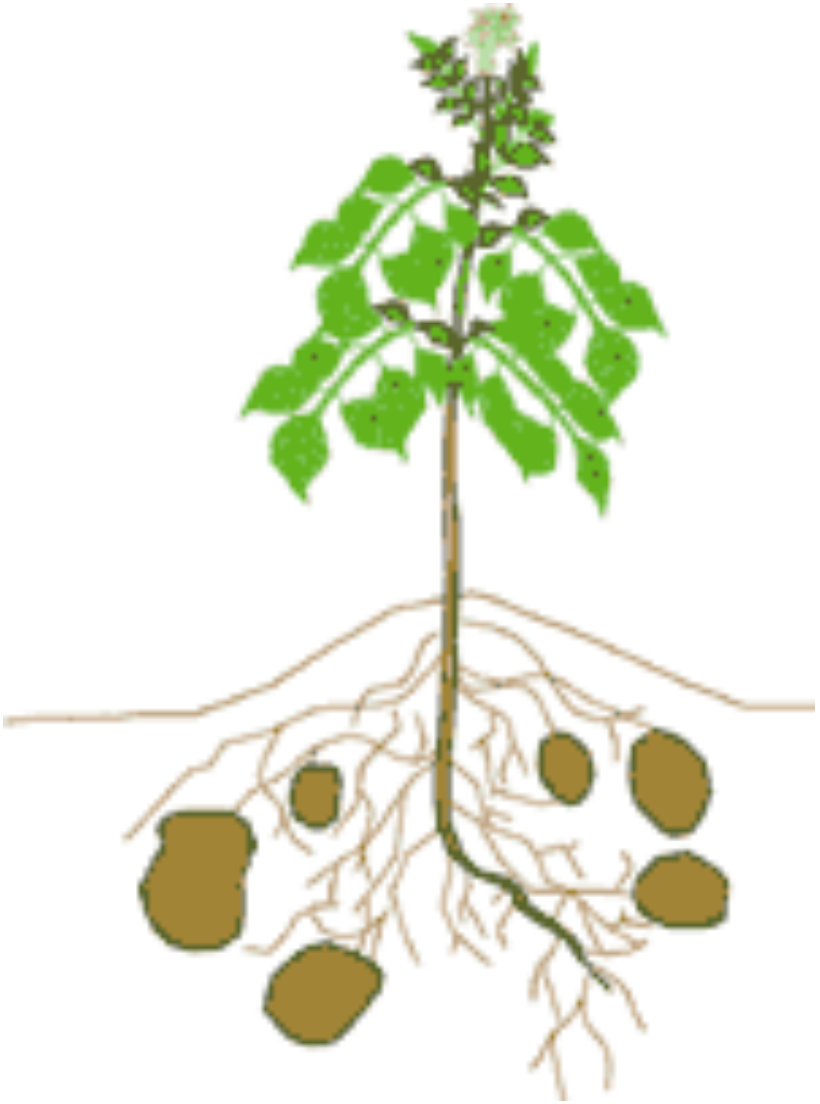
DISCUSSION

- How and when should you track and report on Actual Outcomes and Gap Analysis?



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Final Thoughts

- The purpose of identifying all solutions to a problem is to prevent recurrence at **lowest cost in the simplest way**. If there are alternatives that are equally effective, then the simplest or lowest cost approach is preferred.

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Final Thoughts

- Root cause analysis can help to **transform a reactive culture** (that reacts to problems) into a forward-looking culture that solves problems before they occur or escalate.

- More importantly, it **reduces the frequency of problems** occurring over time within the environment where the RCA process is used.

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Final Thoughts

- RCA is a threat to many cultures and environments. **Threats to cultures often meet with resistance.**
- There may be other forms of management support required to achieve RCA effectiveness and success. For example, a "non-punitive" policy towards problem identifiers may be required.

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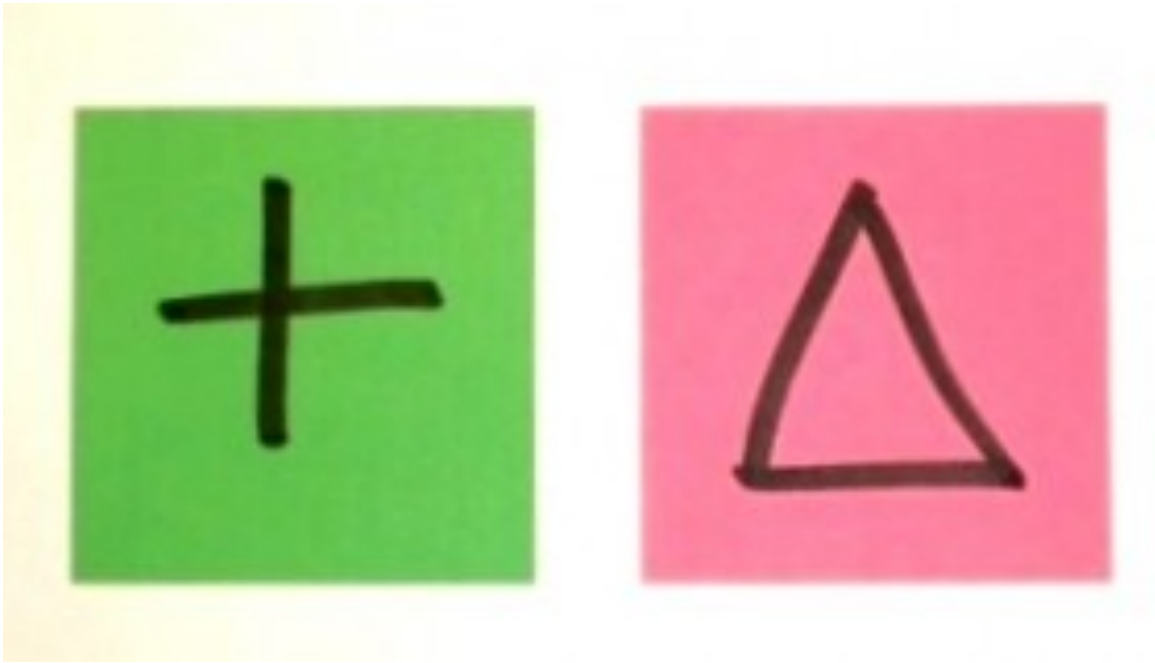
Root Cause Analysis



Root Cause Analysis

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- Did we meet our objective?
  - To teach you how to:
    - quickly identify a problem,
    - quickly solve the problem using 5 Why, or
    - immediately swarm it using Root Cause Analysis,
  - and devise and test countermeasures to achieve a Target Condition.

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Root Cause Analysis

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Do you:

- Know how to distinguish between a problem that can be quickly resolved and one that requires deeper analysis?
- Know how better to clearly define and state “the problem”?
- Know how to employ a method called “5 Why”?
- Understand how to employ methods to dig deeper beyond the problem’s symptoms to discover true causes?
- Know how to develop and test mitigation measures to solve defined problems?
- Know how to employ a method called “Root Cause Analysis” using the fishbone analysis technique?

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Root Cause Analysis

This concludes The American Institute of Architects
Continuing Education Systems Course

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