



ME290

**Global Engineering Professional
Seminar**

Problem Solving, Root Cause Analysis, Risk
Management

Lecture-1

Problem Solving, Root Cause Analysis, Risk Management

ABET* requirement: General Criterion 3. Student Outcomes

The program must have documented student outcomes that prepare graduates to attain the program educational objectives:

- 1. an ability to identify, formulate, and **solve complex engineering problems** by applying principles of engineering, science, and mathematics
- 2. an ability to apply engineering design to **produce solutions** that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

*ABET (Accreditation Board for Engineering and Technology, Inc.) is an organization that accredits post-secondary education programs.



Engineers: Problem Solvers

We solve problems



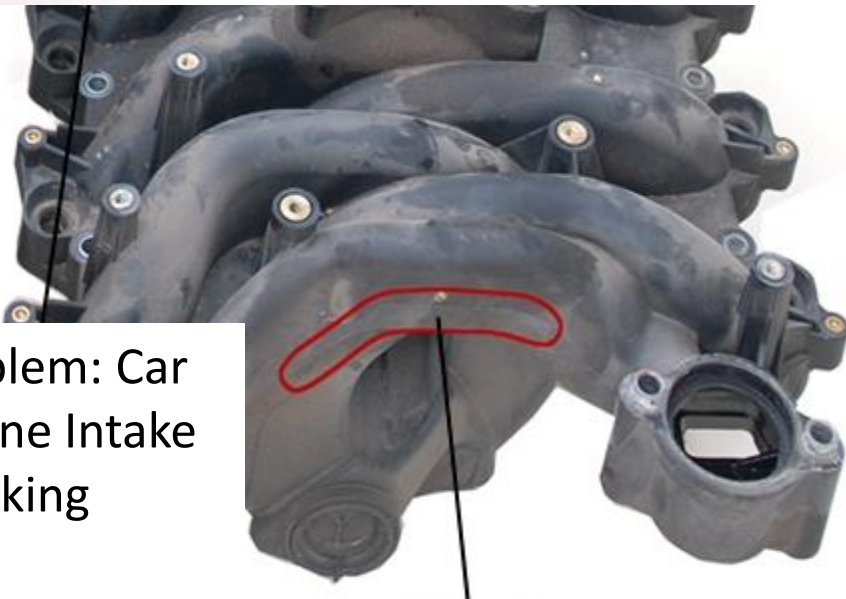
Engineers are creative problem-solvers



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Typical Problems in Engineering



Problem: Car
Engine Intake
Cracking

Reason/
Solution?

this area
may crack



Problem: Aircraft crashed

Reason/Solution?

Typical Problems



Problem: Bolt Corrosion and failure
Reason/Solution?



Problem: Welding Defects in production
Reason/Solution?

Any Tools/Techniques to Help?

Typical Problems



Problem/Need: Improve Low Metal Cutting Productivity

Reason/Solution?

Any Tools/Techniques to Help?

General Problem Solving Strategy



1. *Define/Identify the Problem*

2. *Determine the Root Cause(s) of the Problem*

3. *Develop Alternative Solutions*

4. *Select a Solution*

5. *Implement the Solution*

6. *Evaluate the Outcome*

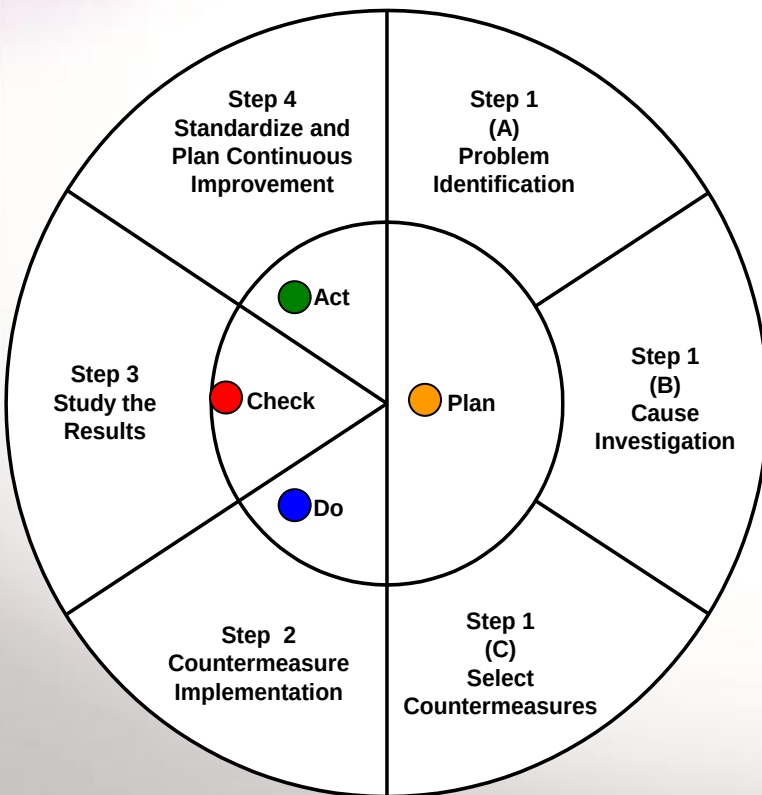
Plan-Do-Check-Act (PDCA) Tool

- *Step 1: (Hypothesis) “Plan”*
 - A. Identify problem
 - B. Investigate root cause(s)
 - C. Select appropriate solutions

- *Step 2: (Try) “Do”*
 - Implement solutions

- *Step 3: (Reflect) “Check”*
 - Study the Results

- *Step 4: (Adjust/) “Act”*
 - Standardize and Plan Continuous Improvement



Step 1: Define/Identify the Problem

- What is the problem?
- Status, background and symptoms (measurements, trials/tests, failure/incident reports, user complaints etc.)?
- Who/What/How does it affect / does not affect?
- When/Where is it a problem / is not a problem?
- If this is an old problem, what's wrong with the previous solution?
- Is this the real problem, or merely a symptom of a larger one?



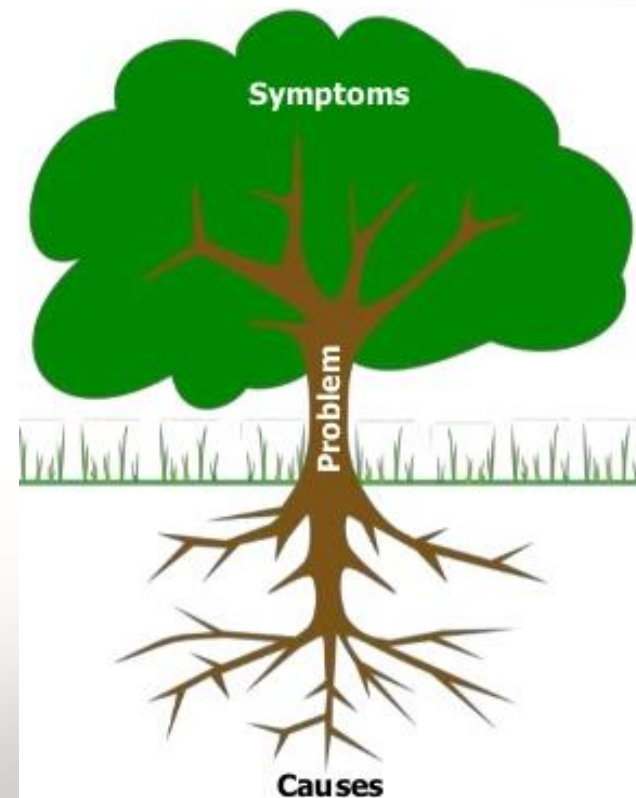
Step 2: Determine the Root Cause(s) of the Problem

Root Cause Analysis is a technique for identifying the **most basic** factors/reasons underlying in a problem.

WHY the problem occurs?

Tools to use:

- 5 Why's Analysis
- Pareto Analysis
- Fishbone Diagram, etc.





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Step 2: Determine the Root Cause(s)

Tool 1: “5 Why’s Analysis”



Simply ask 5 times WHY?

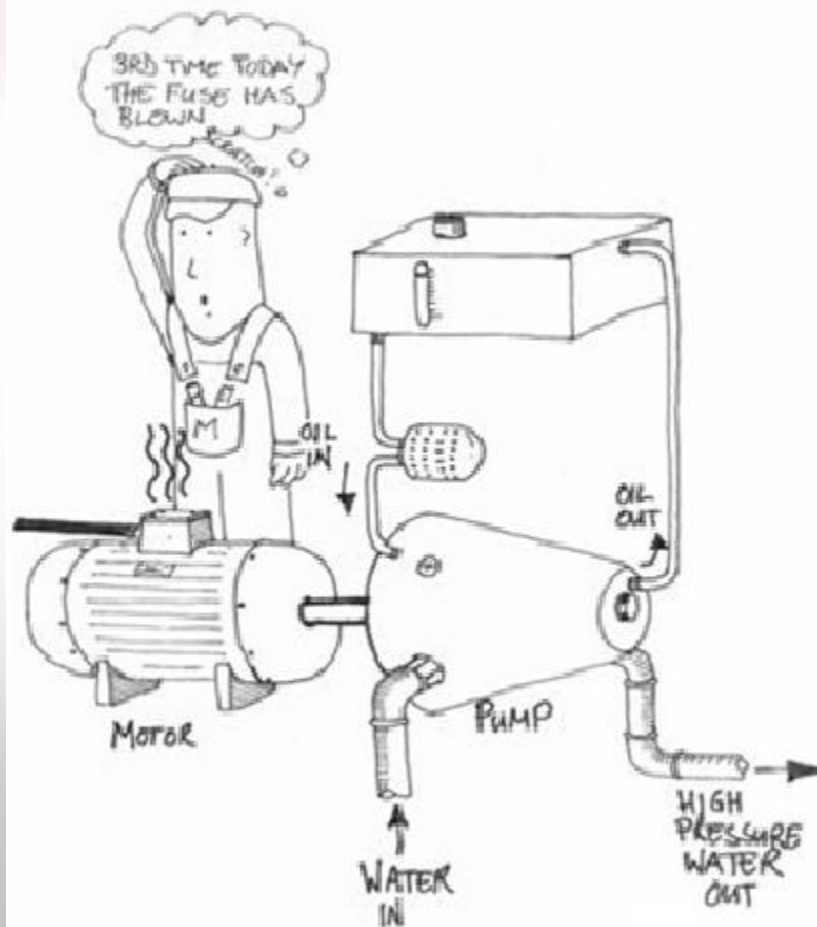


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Step 2: Determine the Root Cause(s)

Tool 1: “5 Why’s Analysis”



Simply ask Why? 5 times.

1. “Why did the fuse blow?”

Too much load on the motor

2. “Why is there too much load on the motor?”

Not enough oil flow through the pump

3. “Why is there not enough oil flow?”

The filter is blocked



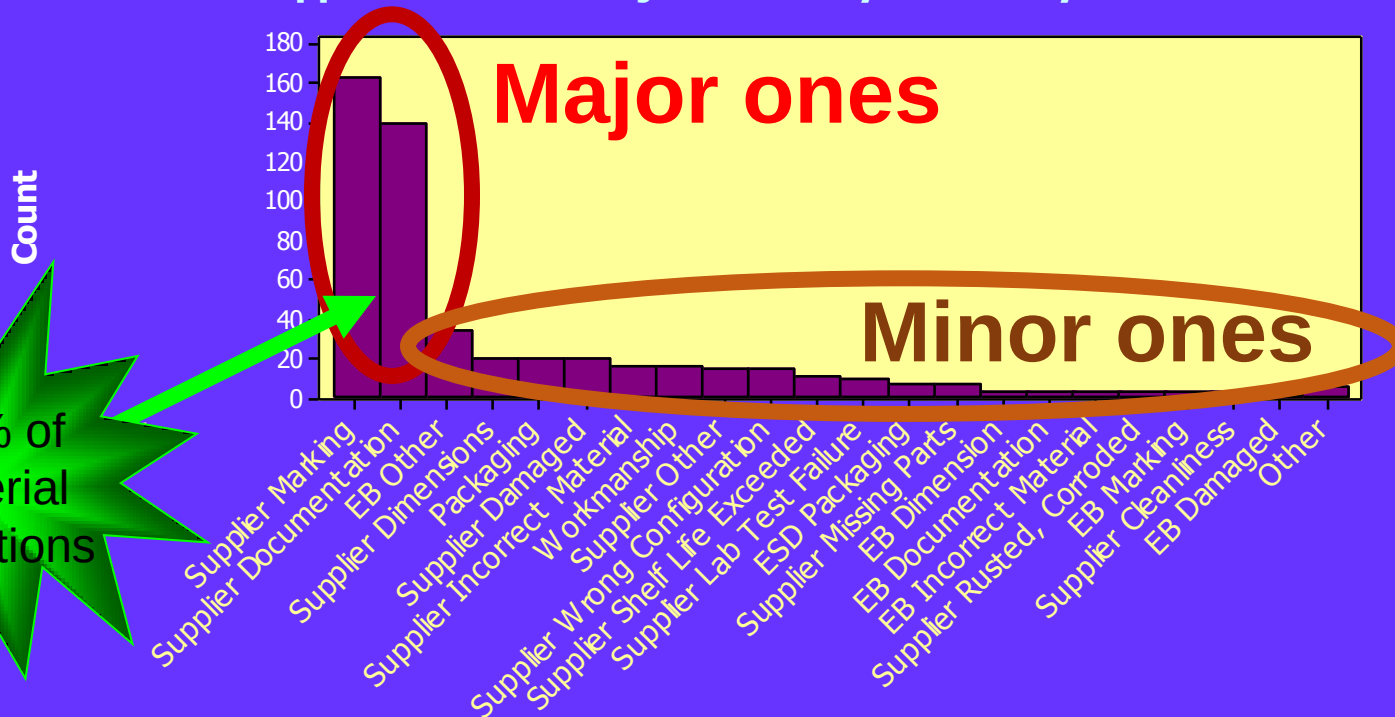
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Step 2: Determine the Root Cause(s)

Tool 2: Pareto Analysis (distribution)

Supplier Material Rejections May 06 to May 07

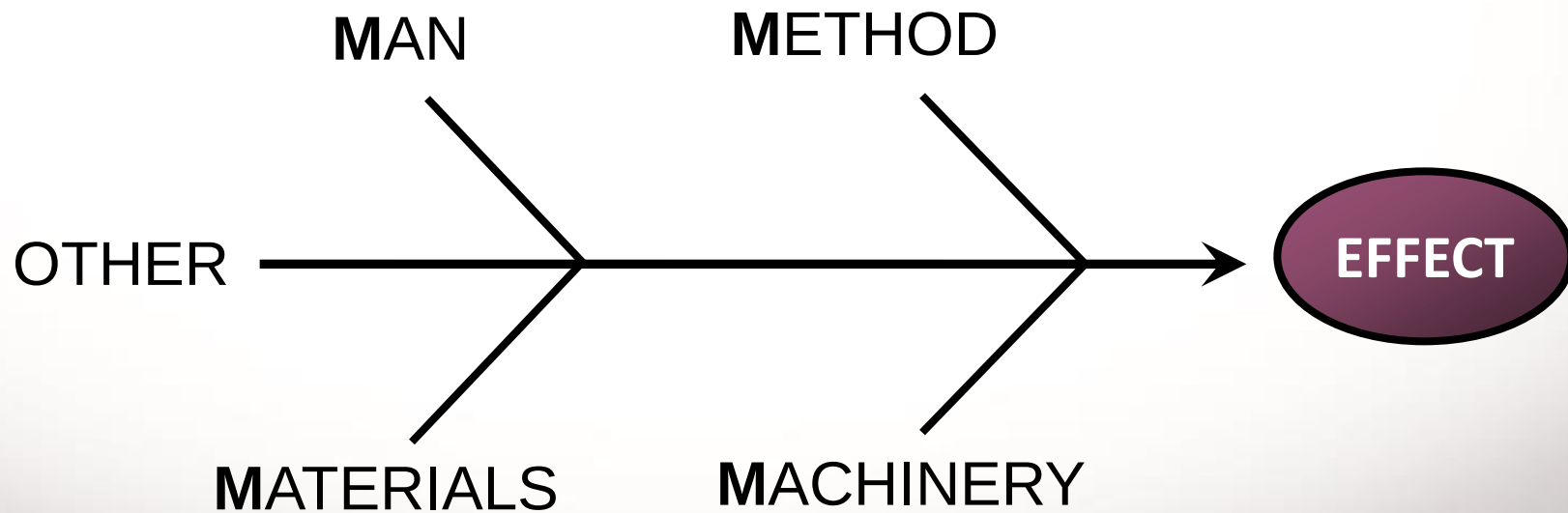


Count	162	139	34	20	19	19	15	15	14	14	11	9	7	7	3	3	3	2	2	1	5
Percent	32	27	7	4	4	4	3	3	3	3	2	2	1	1	1	1	1	1	0	0	1
Cum %	32	59	66	70	74	78	80	83	86	89	91	93	94	96	96	97	97	98	98	99	100

Step 2: Determine the Root Cause(s)

Tool 3: Fishbone/Ishikawa Diagram

“M’s” Model



(Manpower, Methods, Material, Machines, Measurement, Mother-Nature/Environment, Management, etc.)

Step 2: Determine the Root Cause(s)

Tool 3: Fishbone/Ishikawa Diagram

The Cause & Effect, or fishbone diagram, was first used by Dr. Kaoru Ishikawa of the University of Tokyo in 1943 - hence its frequent reference as a "Ishikawa Diagram". This diagram is used to identify all of the contributing root causes likely to be causing a problem. This methodology can be used on any type of problem, and can be tailored by the user to fit the circumstances. Use of this tool has several benefits to process improvement teams:

- Straightforward and easy to learn visual tool.
- Involves the workforce in problem resolution - preparation of the fishbone diagram provides an education to the whole team.
- Organizes discussion to stay focused on the current issues.
- Promotes "System Thinking" through visual linkages.
- Prioritizes further analysis and corrective actions.

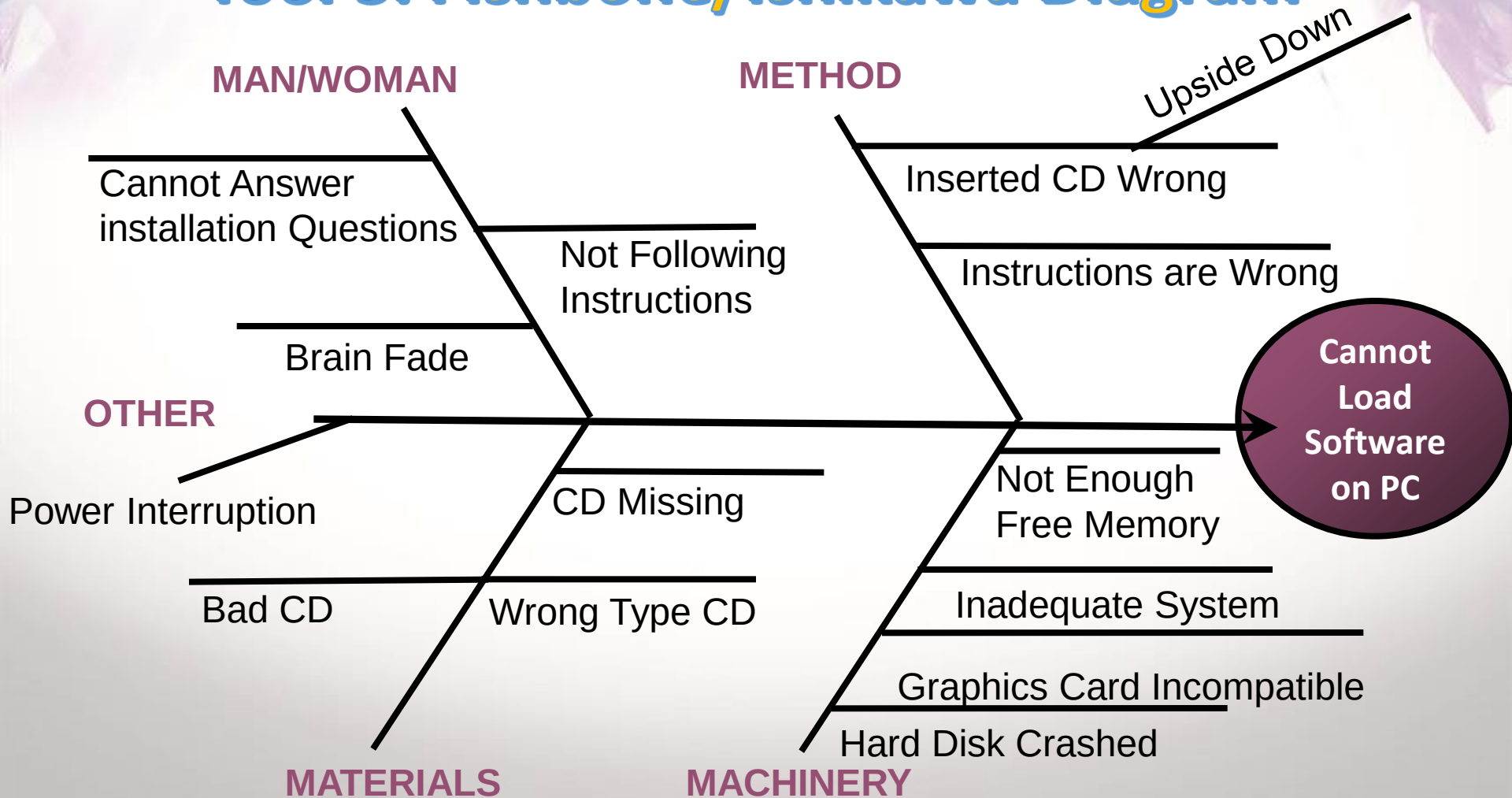


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Step 2: Determine the Root Cause(s)

Tool 3: Fishbone/Ishikawa Diagram



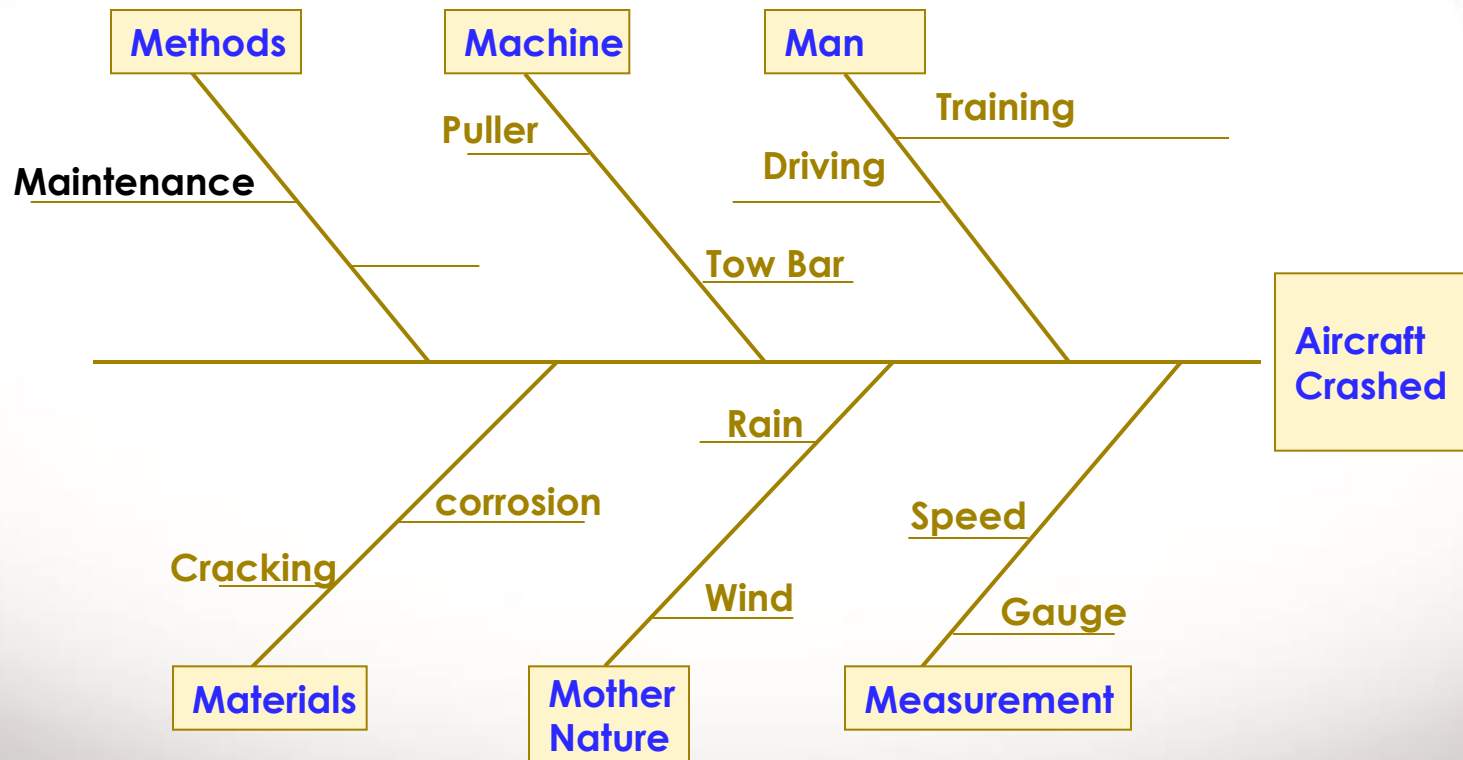


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Step 2: Determine the Root Cause(s)

Tool 3: Fishbone/Ishikawa Diagram



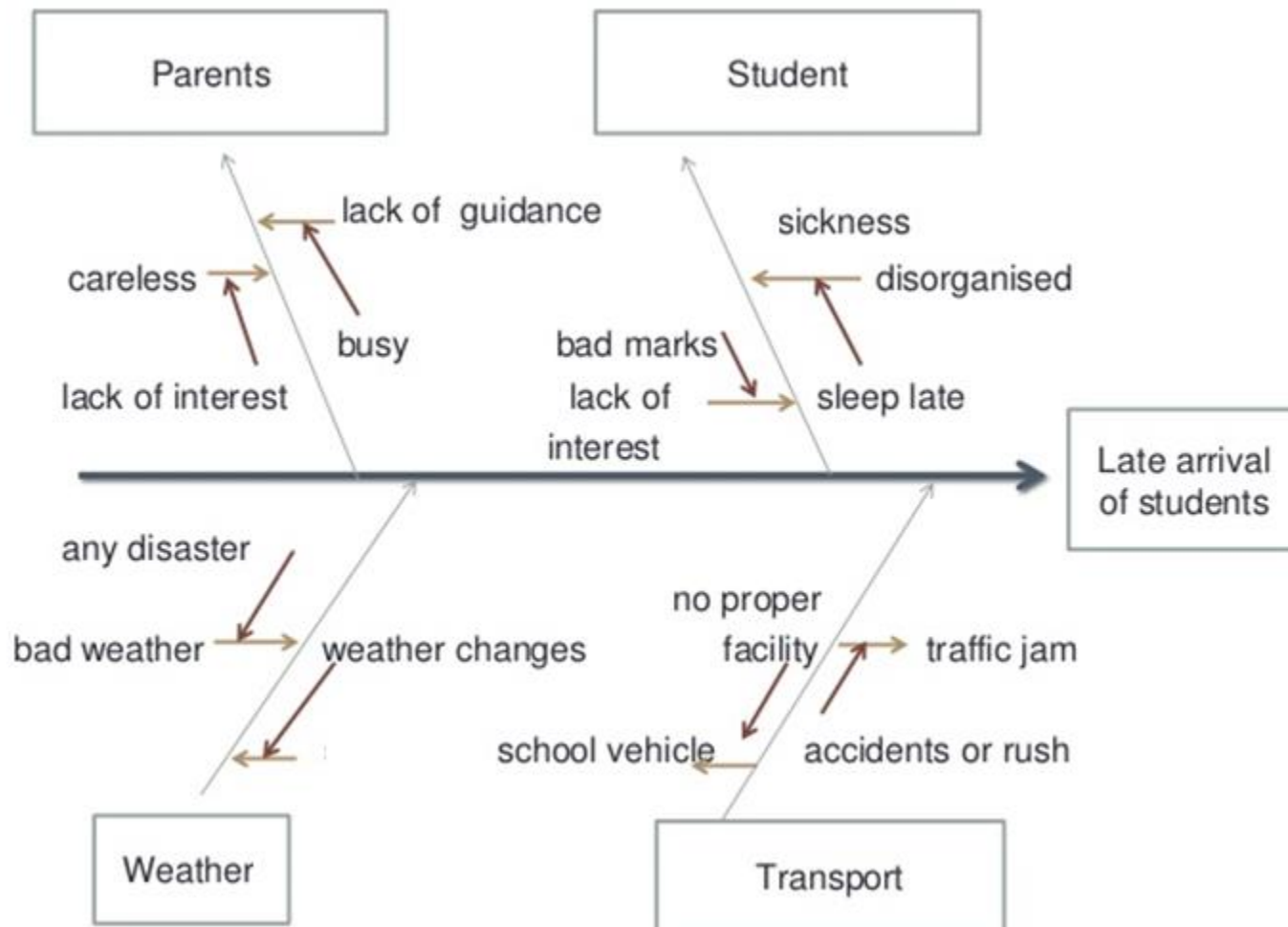


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Step 2: Determine the Root Cause(s)

Tool 3: Fishbone/Ishikawa Diagram



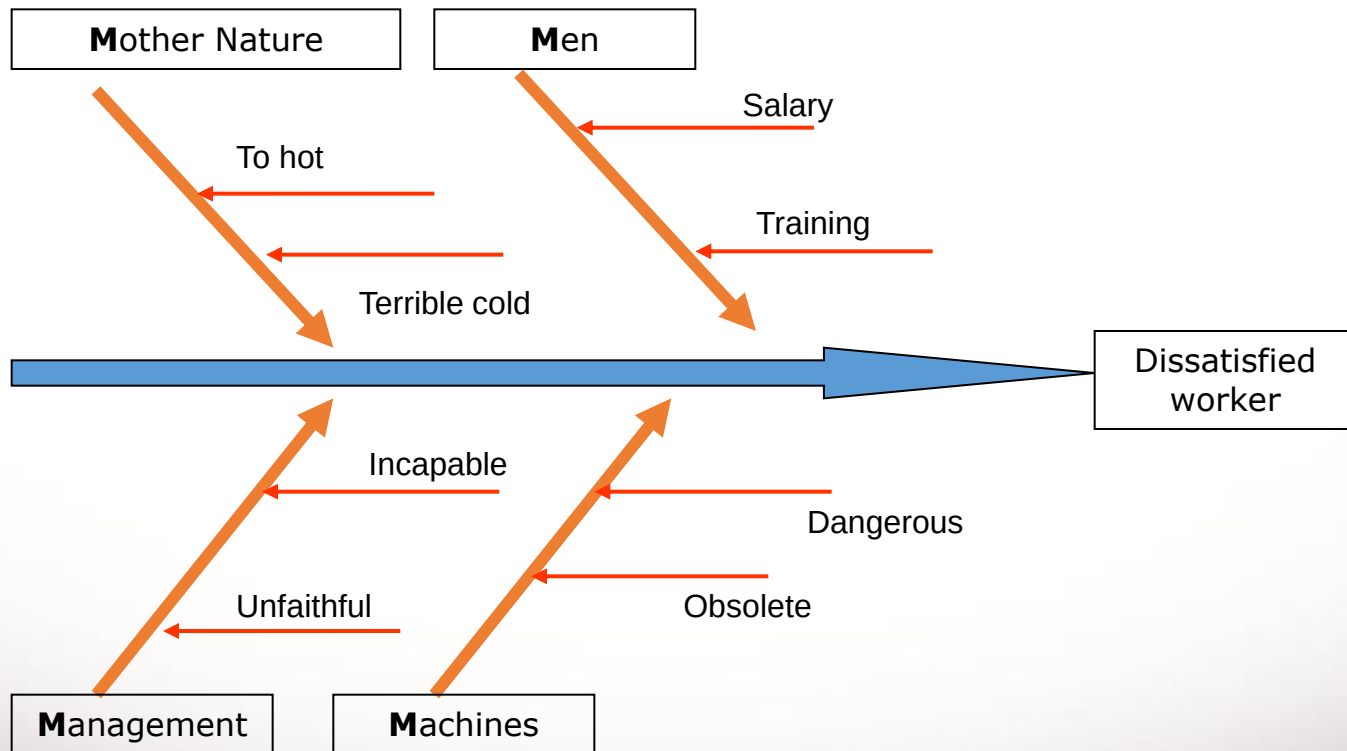


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Step 2: Determine the Root Cause(s)

Tool 3: Fishbone/Ishikawa Diagram

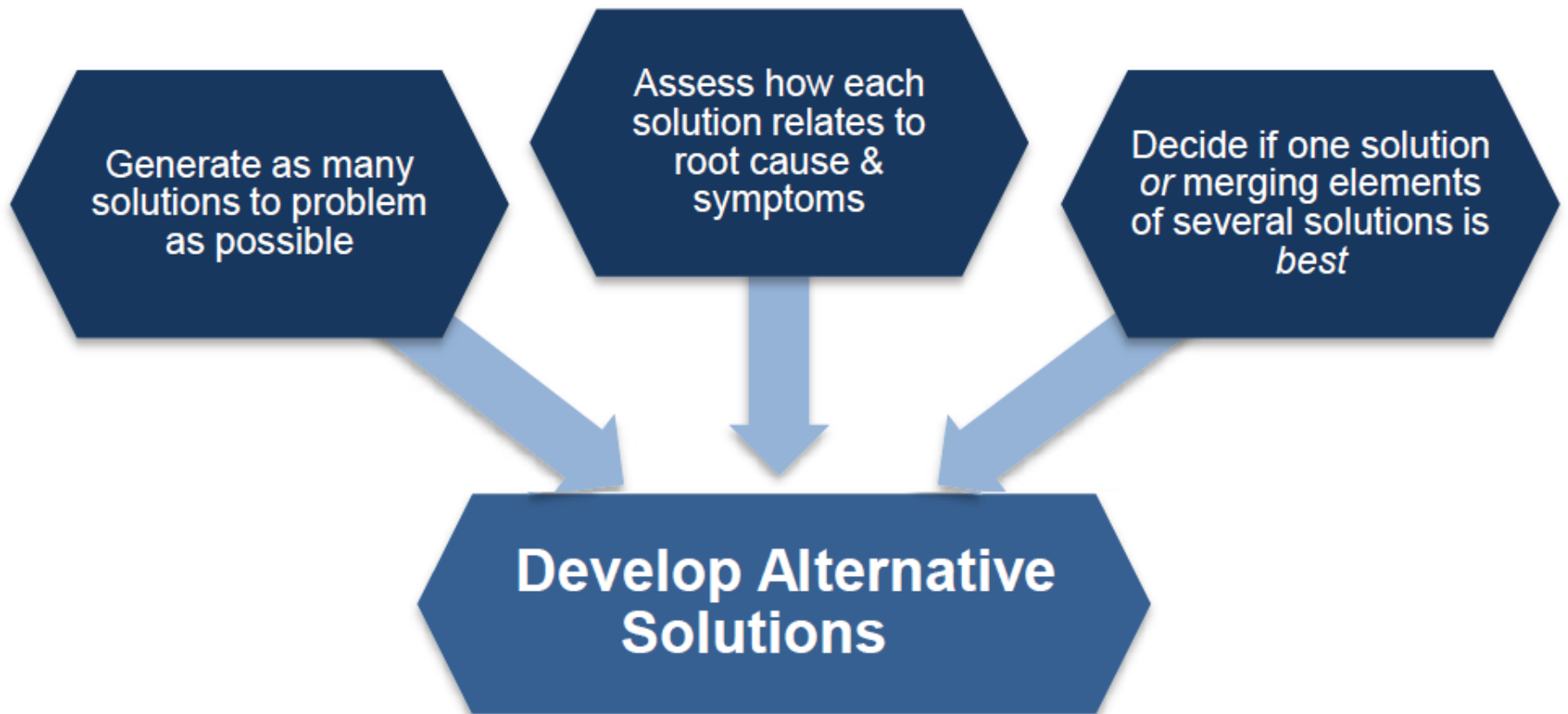




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Step 3: Develop Alternative Solutions



Step 4: Select a Solution

- Which solution is most feasible?
- Which solution is favored by those who will implement and use it?
- Can be implemented within an acceptable timeframe?
- Is cost effective, reliable and realistic?
- Will make resource usage more effective?
- Can adapt to conditions as they evolve and change?
- Its risks are manageable?
- Will benefit the organization?





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Step 5: Implement the Solution

5. Implement the Solution

Agree team members & prepare a plan

Plan sets out actions required before & during implementation

Tools such as - Gantt chart, timeline & log frame can be used

Start date is determined & key milestones set

Step 6: Evaluate the Outcome

Study the Results



- If the outcome/results is satisfactory: **Congratulations**
- If the outcome/results is not satisfactory or needs improvement: **Go back to Step 1 and Review all previous Steps**

End of “Problem Solving, Root Cause Analysis, Risk Management”

Lecture-1