8D PROCESS
8 DISCIPLINES OF PROBLEM SOLVING

Table of Content

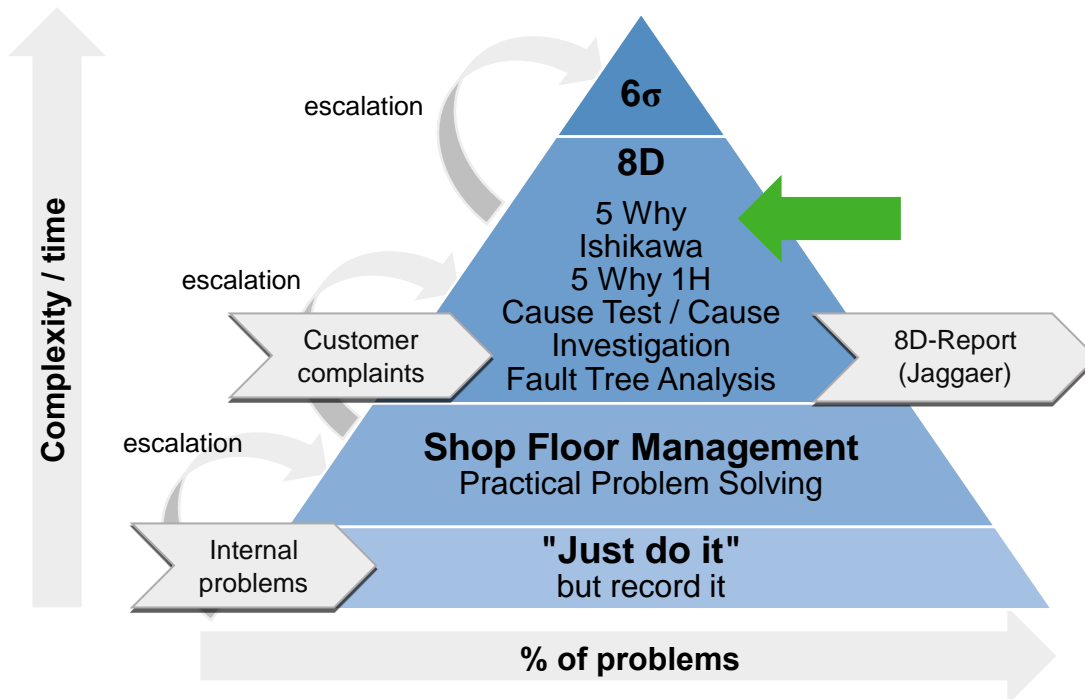# Table of figures

8D Process

![MAHLE logo]

Introduction

There are different problem-solving tools that are shown in the problem - solving pyramid depending on time/complexity and the percentage of problems.

Figure 1: problem-solving pyramid

8D is one of these systematic methods used to tackle and solve problems.

The primary aims of the 8D methodology are to **identify the root cause**, correct and eliminate problems in a team approach, while making the problems solved useful in product and process improvement.

- **Problem:** deviation from desired state

Then it proposes and implements a short-term fix and a long-term solution to prevent the recurring problem.

The 8D refers to the eight essential and critical steps that are required to achieve this:

D1: Formation of a problem-solving team
D2: Problem description
D3: Containment action
D4: Root cause analysis
D5: Potential corrective action
D6: Implement corrective action
D7: Take preventive action
D8: Closure & team celebration

8D Process

MAHLE

1-5-20 Rule

1-5-20 Rule: timeline for supplier feedback.

1 1 day or 24 hours after receiving the complaint, the supplier has to define and communicate containment actions **(D1-D3).**

5 Five working days after the request, the supplier has to define and communicate a root cause analysis and corrective actions **(D1-D5).**

20 Twenty working days after the request, the supplier has to communicate the implemented corrective actions and actions to prevent recurrence **(D1-D8).**

D1: Formation of a problem-solving team

Establish a cross functional team of people with different product/process skills and knowledge.

Procedure

In this step the best possible problem-solving team is defined. The problem-solving team should meet the following conditions:

- **Cross functional**
  → Members from various fields are nominated, for example from the areas of production, quality, development, ...including Production, Quality, Engineering, etc.

- **Team of experts**
  → Members should have knowledge, experience, and Competence to…
    … analyze the root cause
    … define and implement corrective actions and
    … monitor their effectiveness

- Team members should preferably be listed with function.
- The team leader is responsible for the correct execution of the 8 steps.

Results

Problem-solving team is defined.

👤	**Moderator** defined
👥	**Cross-functional** team with different skills & knowledge
💬	**Communication** is the key
👍	**Required resources** identified and approved by management champion

8D Process

MAHLE

D2: Problem description

Define, quantify, and describe the problem.

Procedure

- Short description → working title that has a recognition value for team members
- Detailed description includes:
  1. description out of customer inspection report
  2. failure effect
  3. exact, quantified product failure (characteristic that is out of specification, possible defect type, defect location, …)
  4. **5W1H method**
  5. all available other information, e.g.
     - Production date, shift batch
     - Measurement results
     - Rejected quantity

5W1H Method

The 5W1H method is a question technique with 6 questions.

It is a simple method

…to bring questions about a problem to its core points

…to describe the problem completely and simply

…to create a common understanding of the problem within a(cross-functional) team

…to obtain the numbers, data and facts resulting from the problem.

Question		Explanations	Examples
1.W	What?	What specific object has the problem?	Error accumulation / product number / Typ number / Material dependence / …
2.W	When?	When was the problem observed?	Time / season / date / shift / frequency / …
3.W	Where?	What part/place did the problem occur?	Appendix / field / part / component / location / … → Specific description
4.W	Who?	Can the problem be associated with special skills?	Shift A/B/C / qualification / employee / …
5.W	Which?	Is there a trend?	Chronically / sporadic / trend / direction / key figures / wear & tear / …
1.H	How?	How is the deviation from desired state?	Measurements / Sketch / description → Evaluation of facts and figures **Condition** **scale**

Figure 2: 5W1H Method

8D Process

1. What specific object has the problem?
In particular, fact-based information such as product or type number and the material are helpful.

2. When was the problem observed?

Information such as time, date, shift or interval are particularly relevant here.

3. What part/place did the problem occur?

By specifying, for example, the affected system, area, component, or location, we provide an answer to the question of which part of the product and where the problem occurred exactly.

4. Can the problem be associated with special skills?

Can the error possibly be associated with certain qualifications? Who is affected or must be involved in the solution? Which shift and which employee is affected and what qualifications are required?

5. Is there a trend?

Does the error occur chronically or sporadic? Is there a trend or a direction in this respect and can the observations be confirmed by key figures?

6. How is the deviation from desired state

The deviation must be evaluated and validated by facts and data as for example measurements or sketches.

Results

Complete and explicit description of the product failure that is used as input for the root cause analysis.

🕐	Take enough time to **understand the problem**
📂	Use **data and facts**
📝	Concise **problem statement & specification**
?	**Read across** (yoko ten kai): start to think where else?

8D Process

MAHLE

D3: Containment actions

Define and implement containment actions to isolate the problem from any customer and avoid delivery and assembly of suspect parts.

Procedure

1 Containment is to protect the customer

2 Problem must be stopped <u>everywhere</u> (whole supply chain starting backwards from customer to your internal processes). Suspect parts needs to be segregated and quarantined.

3 Define interim containment actions in addition the regular process flow (what action: 100% inspection, sorting, rework, … of suspect parts)

- Containment actions are only sensible if they ensure that no further defective parts come to the customer. Not all immediate actions are measures within the meaning of step D3!

  → For example, it is not enough just to fix the error on your own production line. Bad parts can then still reach the customer and be assembled. Better: e.g., 100% inspection, sorting checks, rework of suspicious parts, ...

- For each containment action responsibility and planned start date has to be defined. The current status should be monitored.

4 Do a risk assessment to be careful of **unwanted side-effects** which can be caused by the containment actions What could that be?

5 Collect data & monitor the status to verify the effectiveness (typical tools: monitoring/run chart, MSA / Inspection instruction) using data and facts.

6 Define clean point → when are we sure to deliver good parts to the customer.

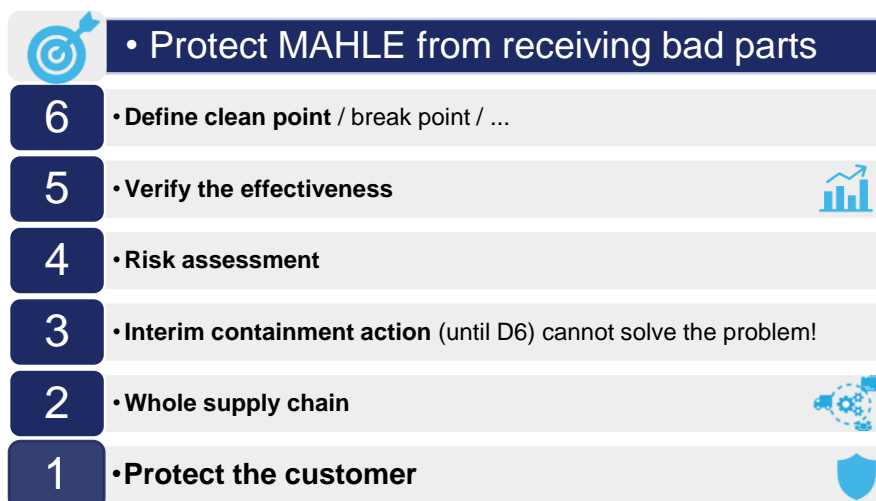| • Protect MAHLE from receiving bad parts |
|---|
| **6** • **Define clean point** / break point / ... |
| **5** • **Verify the effectiveness** |
| **4** • **Risk assessment** |
| **3** • **Interim containment action** (until D6) cannot solve the problem! |
| **2** • **Whole supply chain** |
| **1** • **Protect the customer** |

Figure 3: Procedure D3

MAHLE

D4: Root cause analysis

Determine, identify, and verify root causes (technical, quality assurance & PDP)

1.1 Application

After doing the problem description in D2 we have to follow up with the root cause analysis in D4.

1.1.1 Root cause types

To ensure that similar problems do not occur in the future, all levels of cause must be considered. All potential sources of error must be considered!

We need to analyze the occurrence case & non-detection of:

- The **Technical root cause** explains the occurrence of the defect on the product.
- The **Quality Assurance root cause** explains why the defective product was not detected and did escape to the customer.
- For deeper analysis we must consider failures in development phase (PDP) to answer why the problem was not prevented.

→ This distinction must be considered when processing subsequent steps. Individual analysis tools may have to be used several times depending on the necessity and complexity and of the problems!
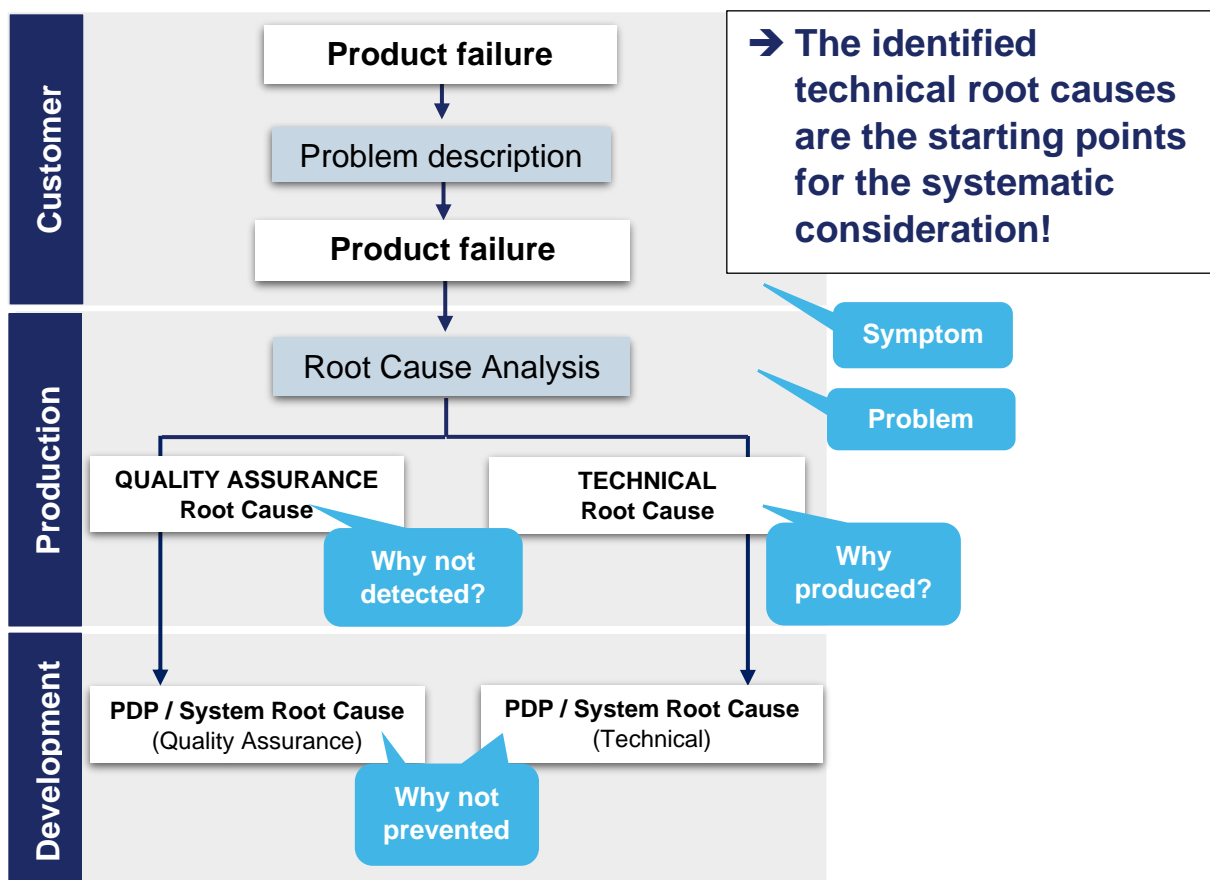
Figure 4: Root Cause Analysis

8D Process

MAHLE

1.1.2 QM-Tools for the root cause analysis:

Following up with the root cause analysis depending on the evaluation of the problem we have to use different tools.

- **Potential cause is known** (by knowledge and experience)
  → use 5-Why to identify the root cause and confirm it.

- **Potential cause is unknown and less complex**

  →use Ishikawa to identify possible causes and use 5 Why or Fault Tree Analysis (FTA) to identify the root cause and confirm it.

- **Potential cause is unknown and complex**

  → use 5 Why 1H and/or Ishikawa to identify possible causes and use the 5 Why or FTA to identify the root cause and confirm it.

- **Potential cause is unknown and multi parameter problem**

  → use statistical methods to identify possible causes and use 5 Why or FTA to identify the root cause and confirm it.
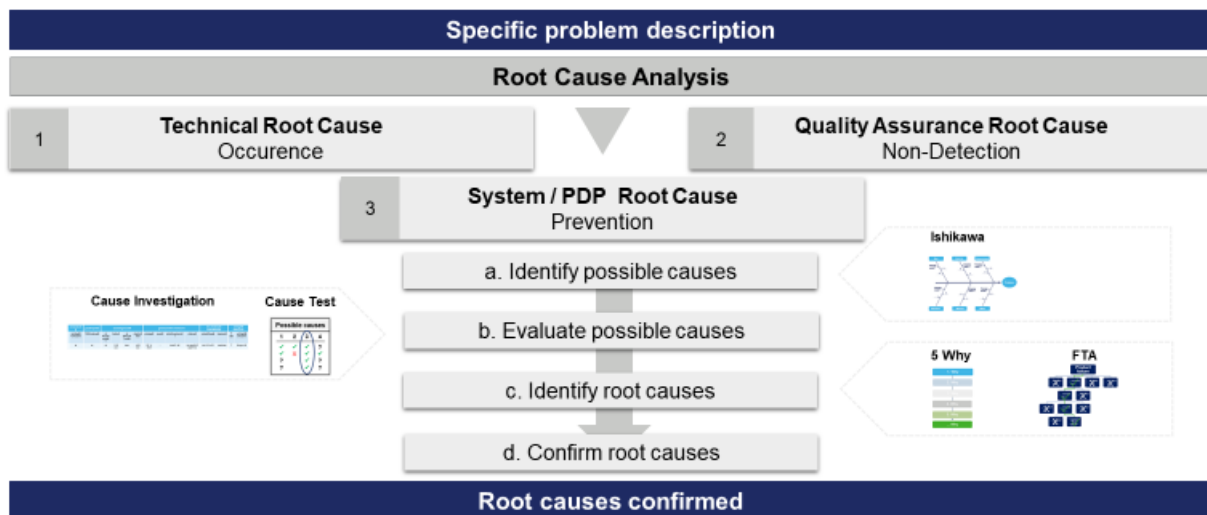

Figure 5: Root cause analysis

MAHLE

1.2 Procedure

The root cause analysis is divided in 4 steps.

1.2.1 Identify possible causes

1.2.1.1 Ishikawa diagram

The cause and effect diagram, also called a fishbone because of its shape, or an Ishikawa diagram after its inventor, supports a team in brainstorming for potential causes in various categories. Potential and known factors (causes) of a problem (effect) are collected, divided into main and secondary causes, and shown graphically.

- It should only be used if an identification of possible causes on IS / IS NOT isn`t possible.
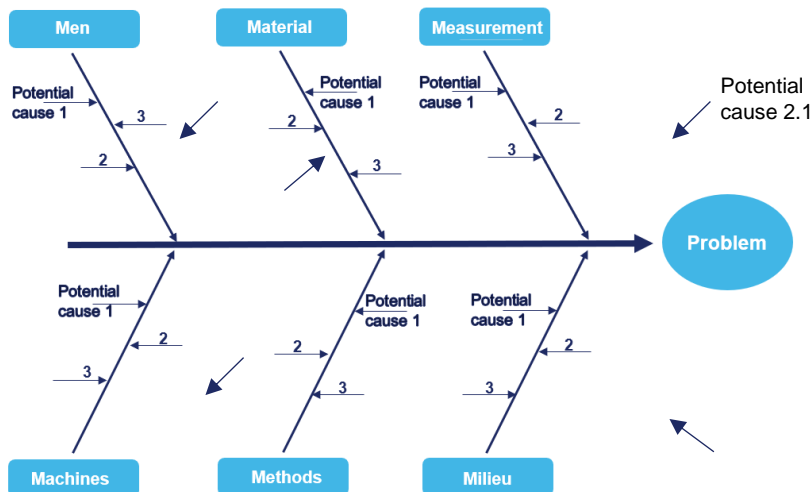

Figure 6: Ishikawa diagram

Procedure

1. Formulate the problem.

2. Brainstorm possible causes for the problem and assign them to different M-categories (the 6 M`s are: Men, Material, Measurement, Machine, Method and Milieu). According to the complexity further M`s can be added.

3. For each collected possible cause ask by what it could be caused and connect it with an additional arrow to build a cause and effect theory.

4. Test all cause and effect theories based by investigations to confirm or eliminate them.

5. Prioritize the cause and effect theories which fully explain the occurrence of the problem and try to confirm them in the next step

Result

The possible causes of a problem are systematically determined and visualized.
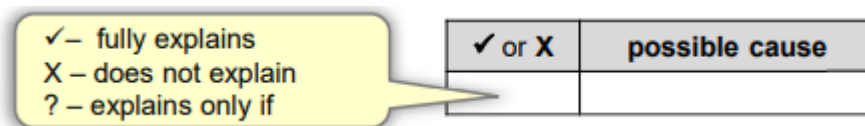
1.2.2 Evaluate possible causes

Review and update the problem description and check relevant standards.

1.2.2.1 Cause test

The Cause Test is a method to test and verify possible causes based on data.

Each possible cause is checked, if it explains each data. As result there are the following options:

1) Possible cause fully explains the facts   **(✓)** → confirmed as potential cause

2) Possible cause does not explain all facts **(X)** → eliminated as potential cause

3) If it is not clear **(?)** or the possible cause can explain the fact only under certain assumptions → further investigations are needed: in this case we should use the Cause Investigation

4) Then we determine the most likely cause: What cause fully explains the facts or includes the fewest assumptions?

✓ – fully explains	
X – does not explain	
? – explains only if	

✓ or X	possible cause

1.2.2.2 Cause investigation

To be used for more complex cases with multiple possible causes

Possible causes		Standard and Specification		Cause Investigation				Measurement Results				Check	Evaluation
Possible Cause	T QA	Standard	Specification	Action	Responsible	Date	Result	BAD part	In spec?	GOOD part	In spec?	Standard OK? To identify OK & NOK parts	Potential cause?
Ø too big	T	drawing	20 ± 0,2 mm	Test 25 Parts	Mr. Check	…	4 / 25 NOK	20,4 mm	no	20,1 mm	yes	yes	yes

Figure 7: Cause Investigation

Possible causes: List of identified possible causes.

Classification: "T" → technical; "QA" → quality assurance

Specification: Standard which is related to the possible cause & specification out of the standard

Cause Investigation: Investigations to validate (eliminate or confirm) the possible cause and/or the standard. Define responsible, due date and result.

Measurement Results: Fill in the measured result for GOOD and BAD parts & is it in specification? → Yes / No

Check: Can we identify GOOD & BAD parts based on: Additional investigations, consulting of experts, …

Evaluation: Evaluate the possible cause based on investigation results to eliminate

or confirm it as potential cause: **Yes** if bad part out of specification and standard ok.

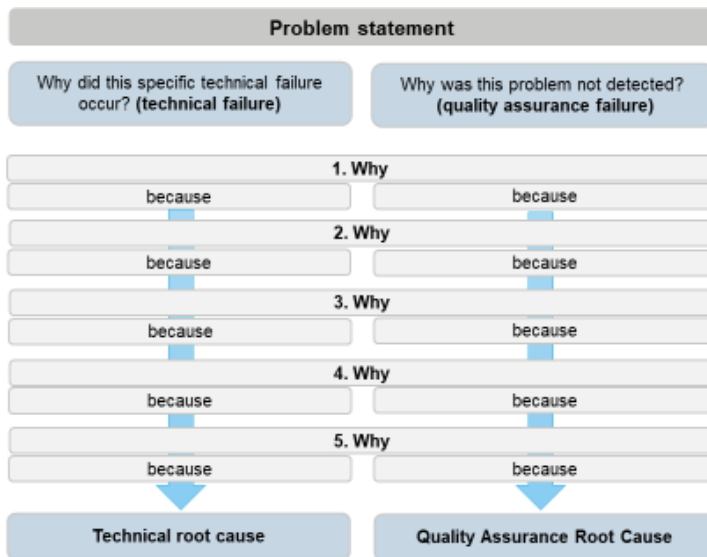**No** if nok part in specification and standard ok.

1.2.3 Identify the root cause
1.2.3.1 5 Why Analysis

With the 5 Why Analysis the deeper causes of a problem are investigated in order to identify the root cause. The method prevents initiated actions from addressing only superficial symptoms, instead of the actual root causes, which would not effectively prevent the problem from recurring. It is used for simple, clearly defined problems.

Procedure

1. Define the problem clearly and unambiguously with the team.
2. Ask: Why (does the problem occur)?
3. After the answer, ask again: Why?
4. Repeat this process about 5 times

Figure 8: 5 Why analysis

→ The number 5 is just a rule of thumb. Sometimes the root cause is already found after 2-3 rounds of asking, "Why"; but sometimes, it must be asked more than 5 times. → The basic idea is to break down a problem by asking it repeatedly (usually 5x) about the WHY so far that it can no longer be further broken down, so that it is brought to the lowest common denominator, which ideally leads to the root causes actually sought.

Result: Root Cause is identified.

1.2.3.2 Fault Tree Analysis

With the Fault Tree Analysis the deeper causes of a problem are investigated in order to identify the root cause.

Procedure

1. Select root cause type: technical, quality assurance or PDP / system root cause.

2. Basis for the FTA is the Problem failure itself. First all potential causes/factors of the problem are listed. Each potential cause needs to be evaluated (switch on-switch of problem), to verify, that it is causing the problem.

3. Find root cause: Identify the potential causes for the one you just validated in stage A and list them in stage B. Prove again which of the potential cases is the verified cause, and proceed like this, until you identify the root cause of the problem.
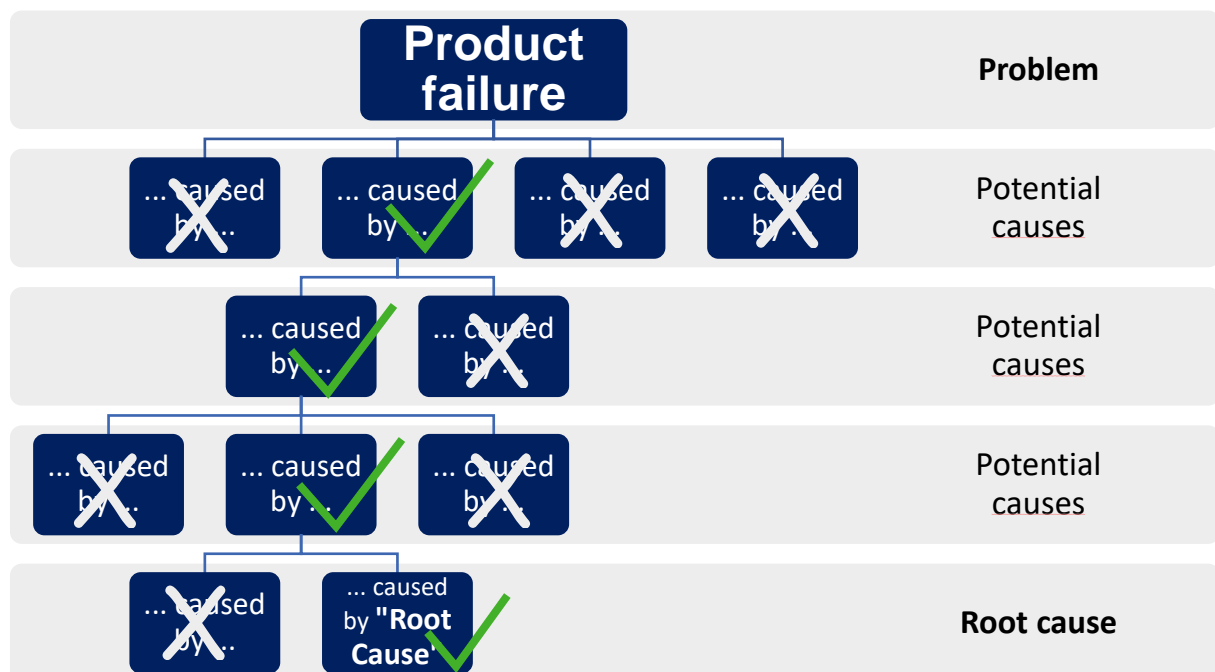
Figure 9: Fault Tree analysis (FTA)

- The FTA should be done for all root cause types.

- The FTA is similar to the 5 Why method but instead of only one possible answer to the why or caused by question, there are several options.
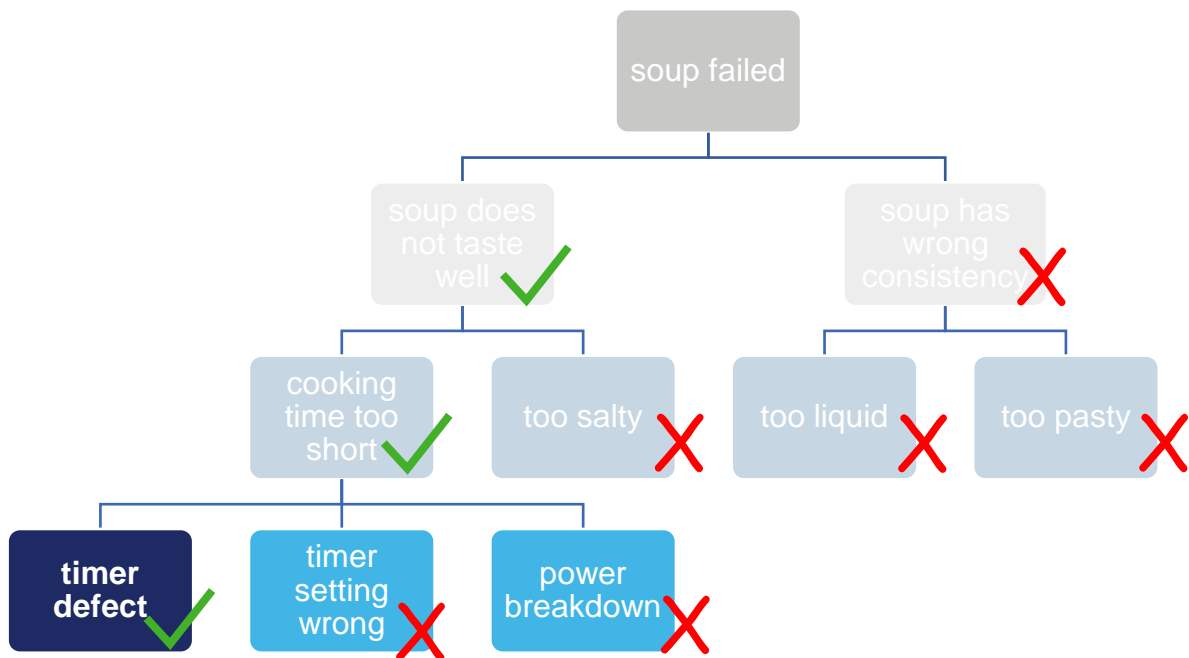
Figure 9: Example FTA

1.2.4 Confirm root cause

Pick the safest, easiest, quickest, cheapest way to confirm the root cause by

- Reproducing the defect, turn the failure on/off, …

Switch on/off the root cause to show that the problem disappears

	Different **root cause types**
	Identify the root causes **systematically**
	Different tools depending on complexity
	Verify and **confirm** each root cause using data and facts

MAHLE

D5: Potential corrective action

Determine potential corrective actions: verify them and chose the most effective one(s).

Procedure

1. Identification
   ▪ List of potential corrective actions to cover all root causes identified in D4.

2. Verification & evaluation
   ▪ prove that the action can solve the problem
   ▪ comparison of the advantages / disadvantages to make sure all possibilities have been considered
      ○ Risk analysis: be careful of unwanted side-effects and do not create new Problems.

3. Selection
   ▪ Target**:** chose the best option (time, costs, …)
   ▪ Possibilities to decide: consensus, compromise, voting, priorization, …

Result

The most effective potential corrective action(s) is chosen.

🌐	Cover **all root causes** from D4 (**technical and quality assurance**)
⏱	Use the **simplest most cost-effective solution** available
!	Be careful about **unwanted side-effects**
!	**Verification and confirmation** of possible measures on the basis of **objective investigations (figures, data, facts).**

MAHLE

D6: Implement corrective action

D6 is about the implementation and validation of the corrective actions.

Procedure

1.1 Implementation plan

To ensure a correct implementation an action plan with dates and responsibilities is necessary.

1.2 Proof of effectiveness

After the implementation, the effectiveness of the implemented actions must be checked:

> ➢ Quick check → provocation test
> ➢ Long term check → process capability, failure analysis, … problem solved?
> ➢ Containment actions (D3) can be removed for effective corrective actions

1.3 Update standards

After check and validation of the effectiveness of the corrective actions, related documents like work instruction or control plan need to be updated and operators need to be trained to the new procedures.

→ In the automotive industry, only process improvement actions are valid as corrective actions in the sense of the 8D process. Personnel measures such as reminders, employee training or training are not considered to improve processes.

Result

The corrective actions are implemented and validated.

📋	Follow up **corrective action plan**
👍	Confirm long-term **effectiveness using data and facts.**
⌄	**Withdraw containment action**
↻	**Update** relate **standards**

MAHLE

D7: Take preventive action

Define and implement actions to prevent a recurrence of this failure in the future.

1.1 Update relevant documents

New standards to prevent recurrence should be updated or established, e.g.

- Drawing modified (internal / external drawing)
- FMEA's
- Control plan (generic)
- List Special Characteristics (product and process)
- Product standard (handbook, guideline, …)
- Process standard (handbook, guideline, …)
- Maintenance plan (preventive and predictive)
- Supplier Quality Assurance documentation

1.2 Share information

1.2.1 Read across (Yokoten):

Transfer to products & processes which are existing today.

- where else can the problem occur **today**?
- ensure that similar products or processes are also investigated for the problem.

1.2.2 Lessons learned:

Prevent failure for **future** products and processes.

- ensure that future products or process designs will not repeat the same failure
- Update documentation: transfer lessons learned into standards (design standards, FMEA, …)

🛡	**Prevent recurring problems**
↻	**Update** relevant **standards** (drawings, control plan, FMEA, …)
⌟	**Read across** / Yokoten: transfer to similar products
🛡	**Lessons learned:** failure prevention → identify and correct systemic weaknesses

8D Process

MAHLE

D8: Closure and team celebration

Recognize the collective effort of the team.

<u>In this step different aspects of conclusion can be done:</u>

- Finalize the 8D-Report
- Congratulate your team
- Share findings or customer feedback with the team
- Approval of the 8D-report
- Every 8D process must be completed by the plant or quality manager!

All **actions closed & documentation completed**

Recognize the team

8D approval

Review the process → **MAHLE 8D Assessment**