

# PROCESS IMPROVEMENT QUALITY MANAGEMENT\_3 METHODS

27/04/2023

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Goal

**TQM**

Principles

Customer  
focus

Process  
improvement

Total involvement

Supporting  
elements

Leadership

Supportive  
structure

Communication

Education and  
training

Reward and  
recognitions

Measurement

# Documentation requirements

Level 1: defines how the QMS operates

*Everyone should be able to work from valid documents, all the time*

Quality  
MANUAL

Level 2: defines who, what, when

Quality  
PROCEDURES

Level 3: answers how

Job INSTRUCTIONS

Level 4: shows that the system is operating

Quality records, reports, forms

# Injection moulding

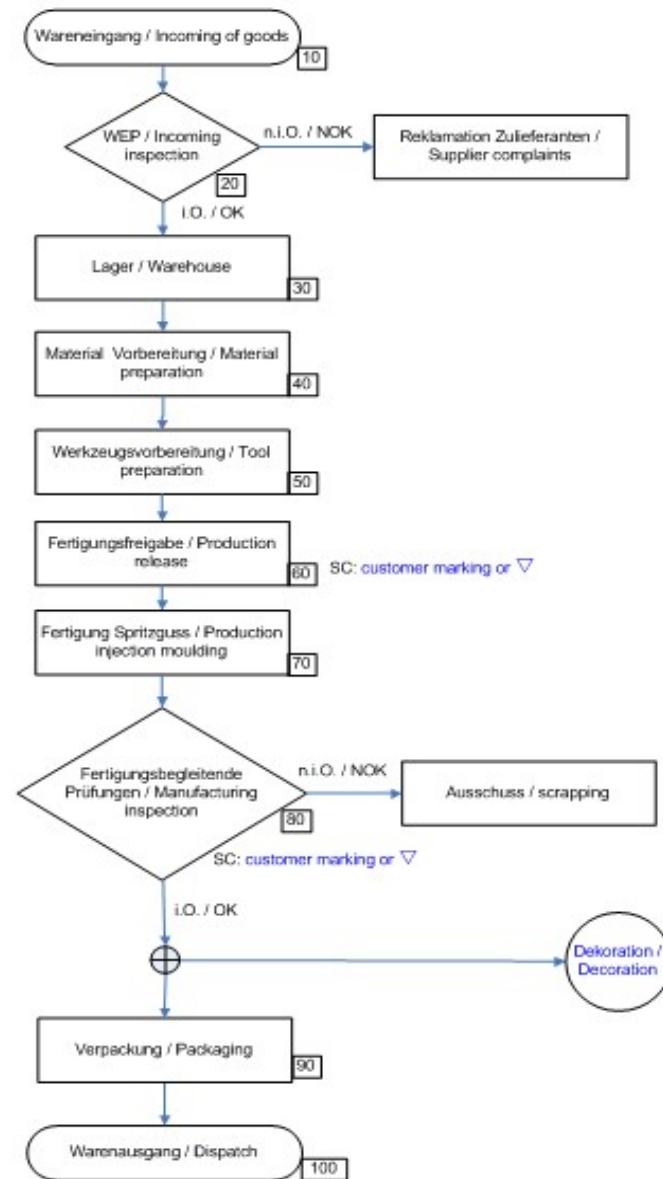
- <https://www.youtube.com/watch?v=b1U9W4iNDiQ>
- <https://www.youtube.com/watch?v=8UELHOzfUk>

# Quality tools

- Classification:
  - According to strenght (mathematical background)
  - According to application field
    - Process modelling
    - Idea collection
    - Problem solving
    - SPC
    - Other

# Flowchart (process modelling)

# Flowchart - example

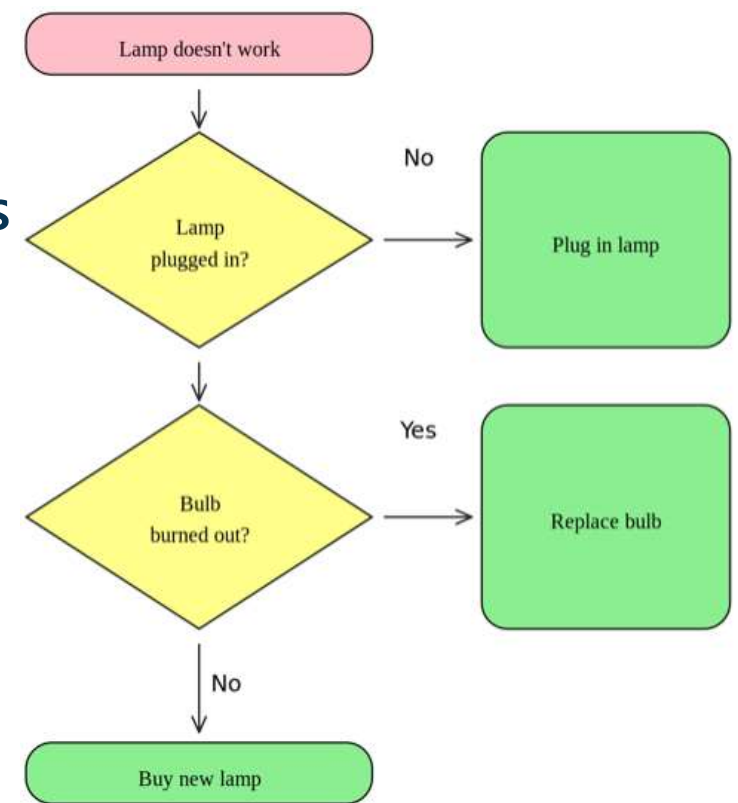


# Flowchart

a tool to describe processes

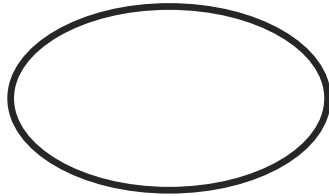
A flowchart enables

- the identification of the **participants** in the process
- providing all participants in the process with a **shared understanding** both of all steps in the process and of their roles
- identification of inefficient, wasteful and redundant steps
- offering a **framework** for defining process measurements





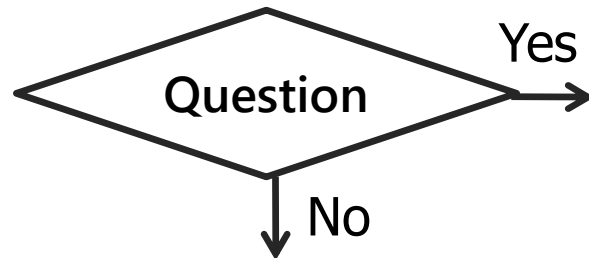
# Flowchart – basic symbols



Oval: the beginning of the process or the result of the process



Rectangle: process steps or activities



Diamond: the decision point of the process, yes / no answer or a decision is needed, or branching of the process



Arrow: the flow direction of the process

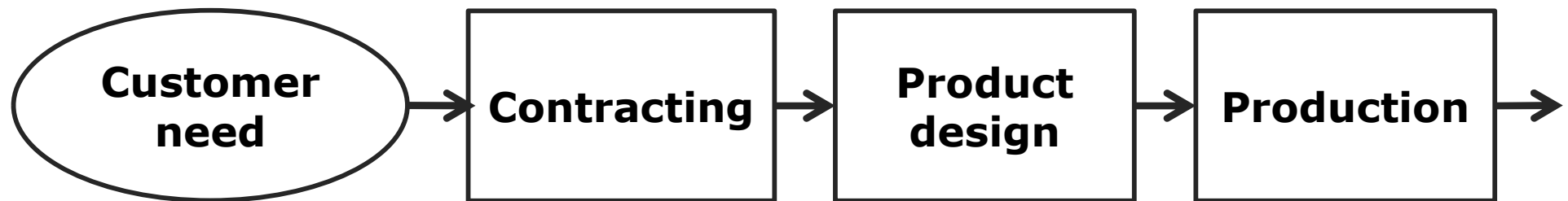
# How to use a flowchart?

- Define the boundaries of the process
- Define the steps of the process
- Draw the figure
- Check the completeness of it
  - Correct?
  - Are logical lines closed?
  - Do the stakeholders justify it?
- Evaluation (development opportunity, process discipline, ideal flow)



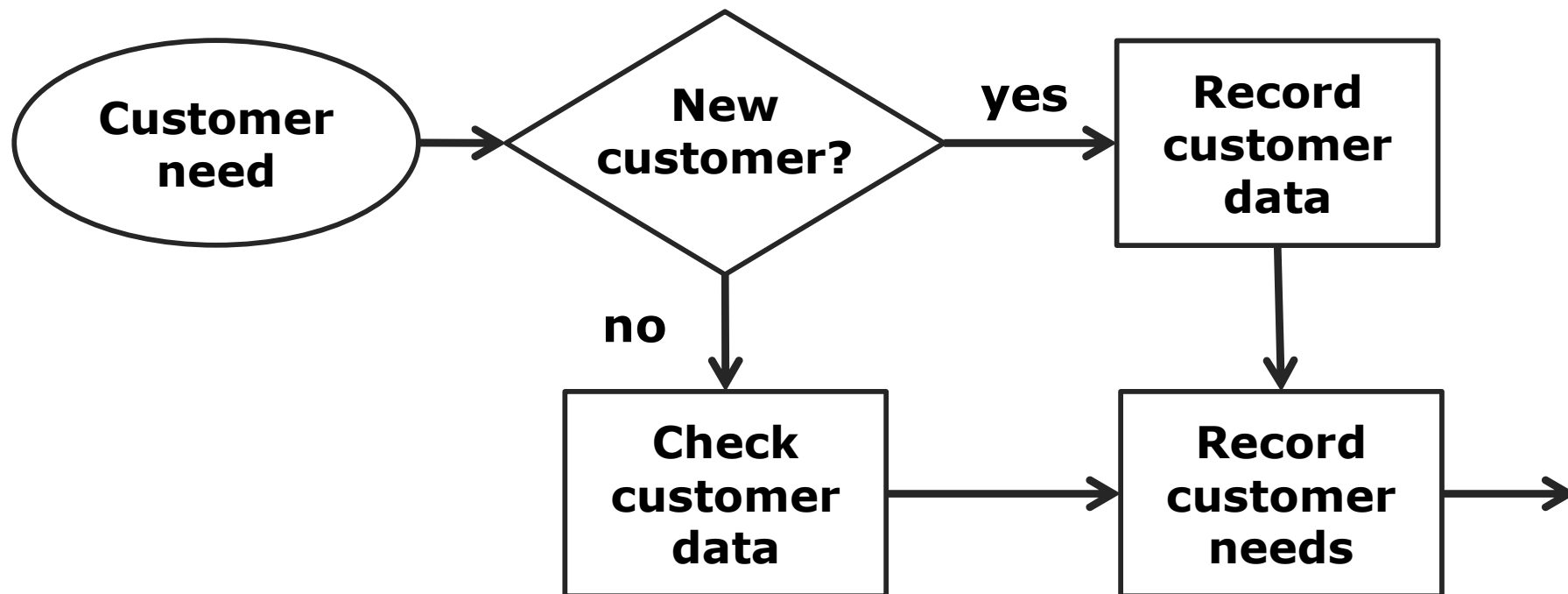
# Type 1: high-level flowchart

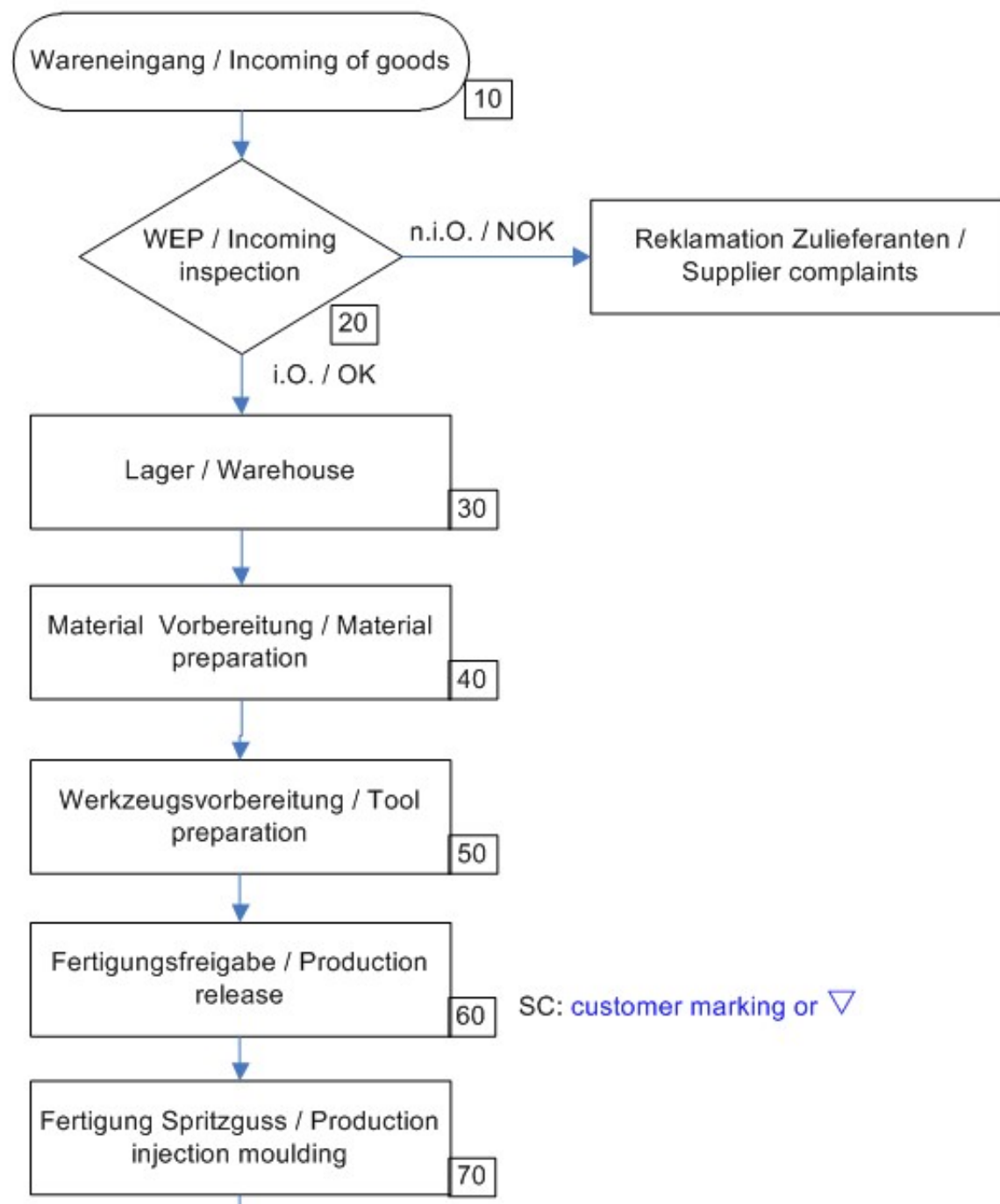
- Suitable for a general overview of the process
- It is made up of sub-processes, which consist of more activities and decision points

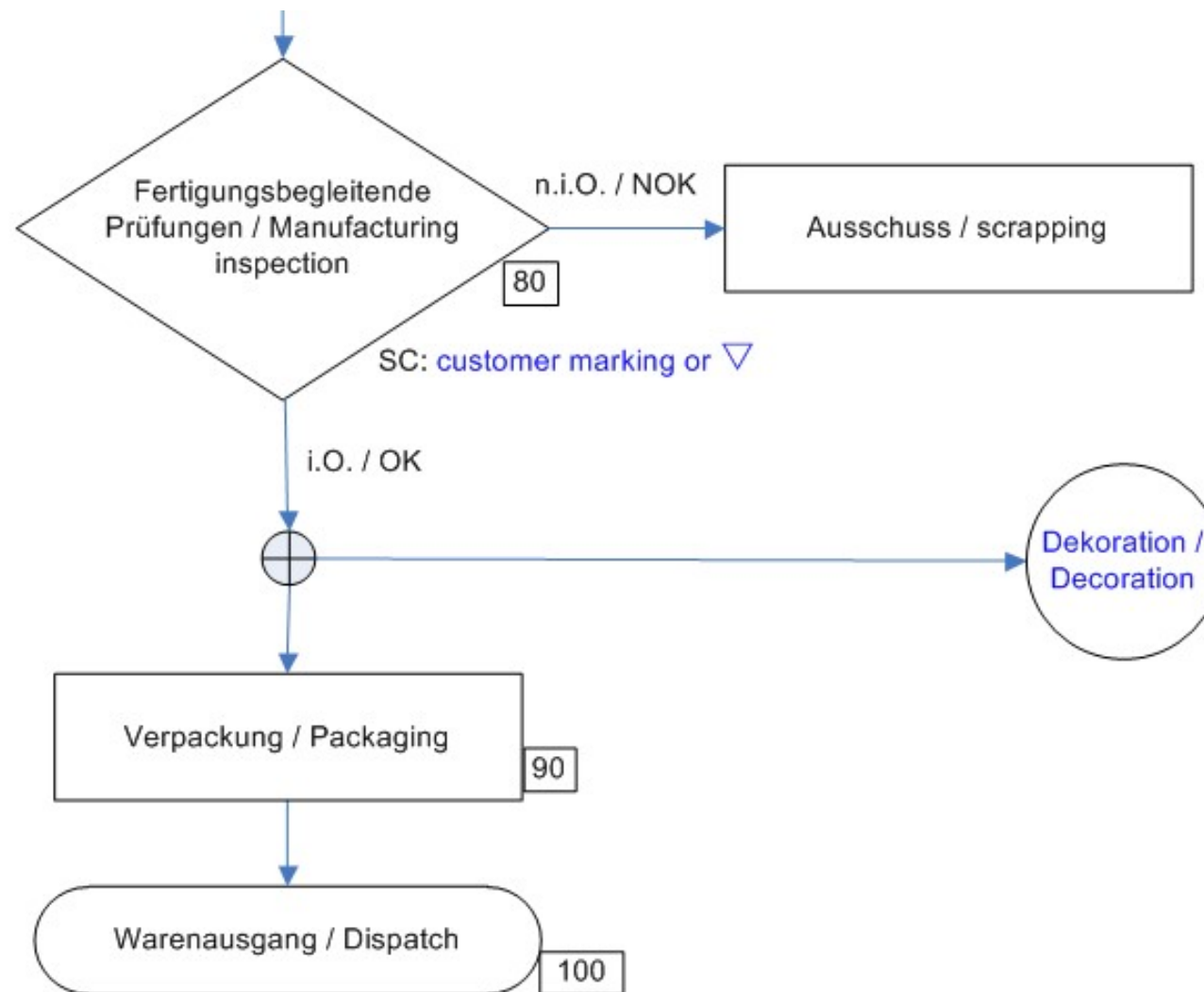


# Type 2: detailed flowchart

- Can be made in different detail levels
- It contains all activities and decision points







## 2. Idea collection

- TEAMWORK
- Creativity, ideas
- Support for other techniques
- Brainstorming, Affinity chart



# Brainstorming

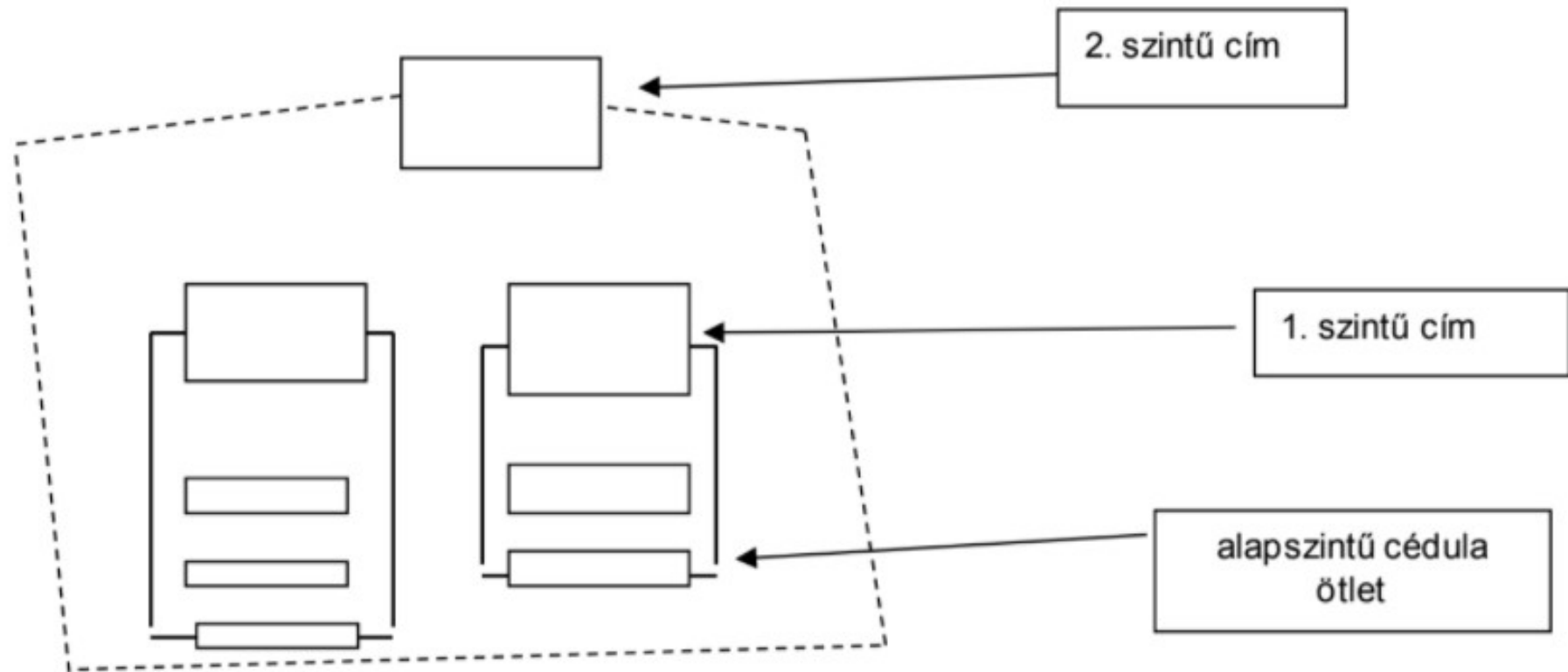
- Rules:
  - 15-20min
  - Team + moderator
  - All ideas will be collected
  - No individual idea
  - No comment, or feedback
  - Nothing can be wrong
  - Quantity instead of quality



# Affinity diagram

- Ideas and cause-effect connection
- Idea collection and categorization
- Ranking
- Team and individual work also
- More time than Brainstorming

# Affinity chart

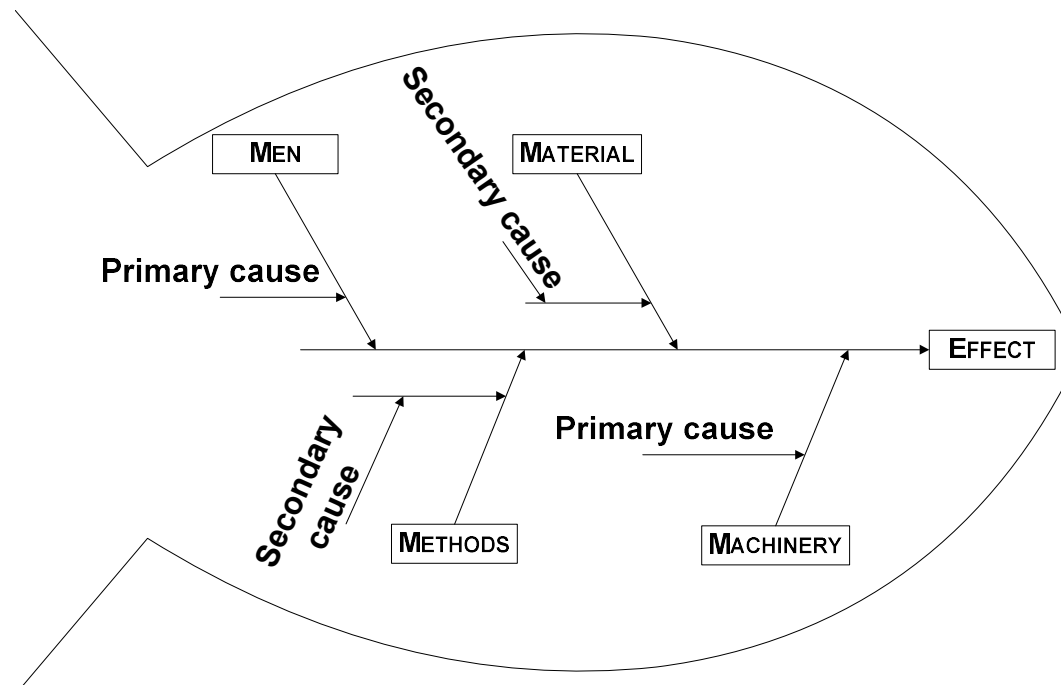


# 3. Problem solving

- One of the most important area
- Usage:
  - Process improvement
  - Failure analysis
  - Example: Ishikawa, 5Why, Pareto.

# Cause&effect/Ishikawa diagram

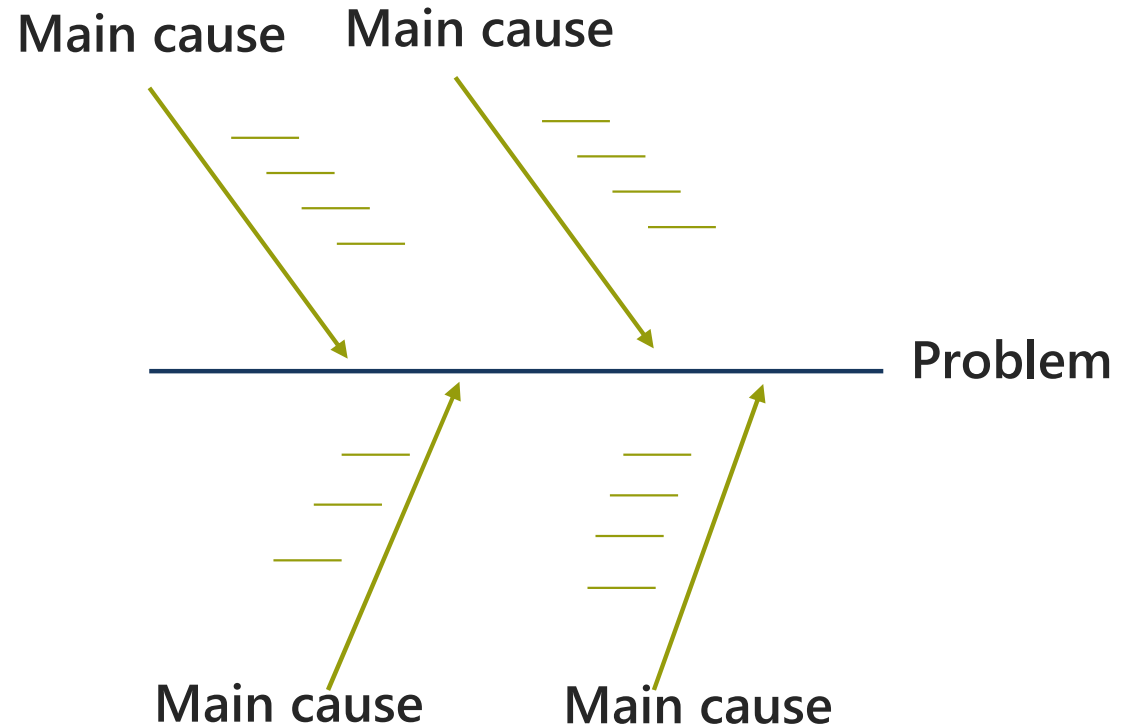
- Identifies, explores and graphically represents all the possible causes related to a problem to discover its root causes.
- Helps the team to focus on the causes in increasing detail, not on the symptoms.
- Reveals the key relationships

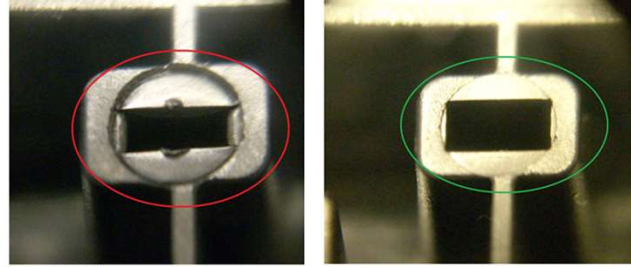


# Ishikawa diagram

Main causes:

- 4M-5M-9M
  - ✓ Machine
  - ✓ Material
  - ✓ Method
  - ✓ Man
  - ✓ Measurement
  - ✓ Maintenance
  - ✓ Money
  - ✓ Millieu
  - ✓ Motivation

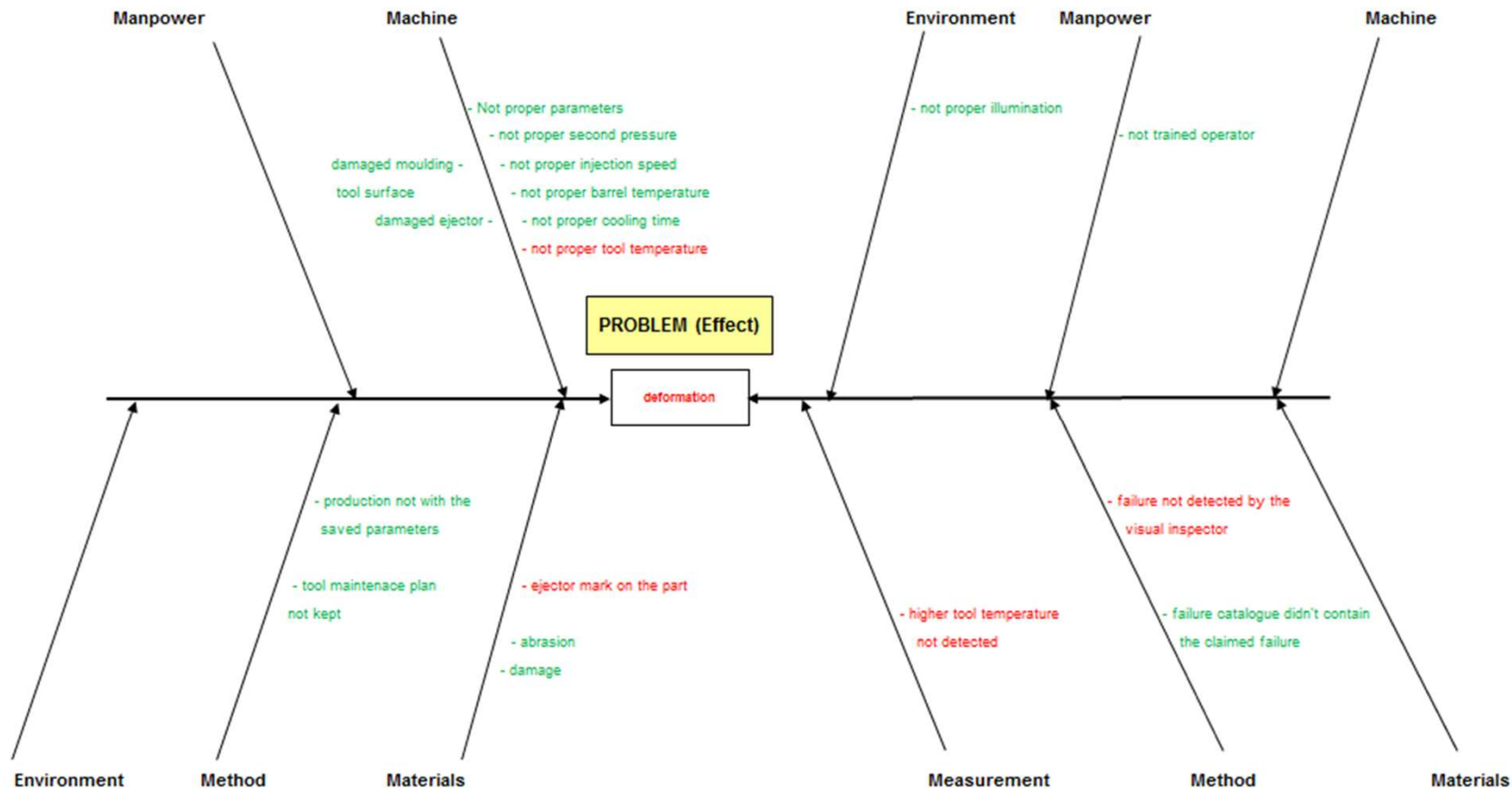




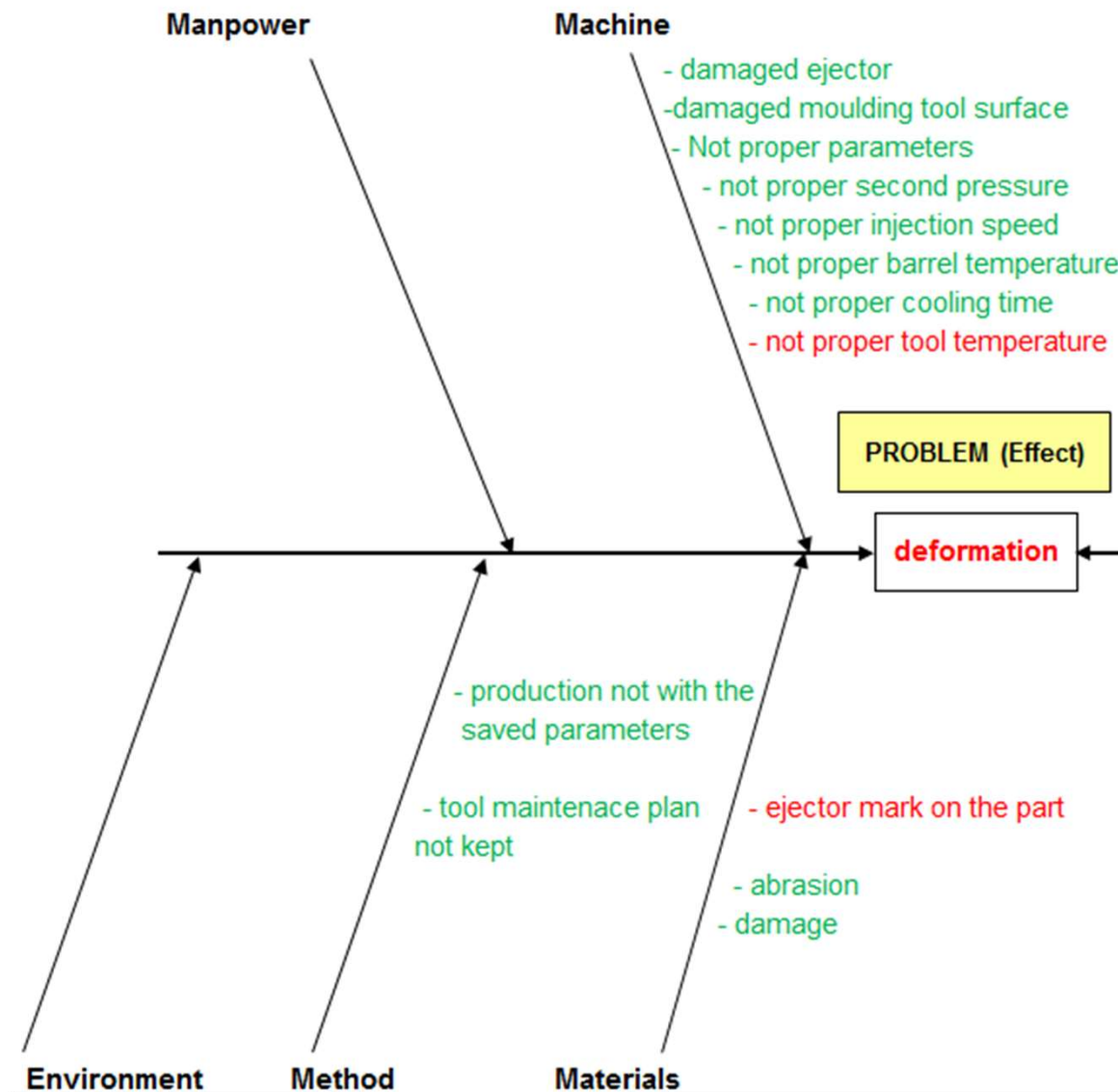
why?  
why?  
why?

Why Happened? (Occur Path)

Why Undetected? (Escape Path)

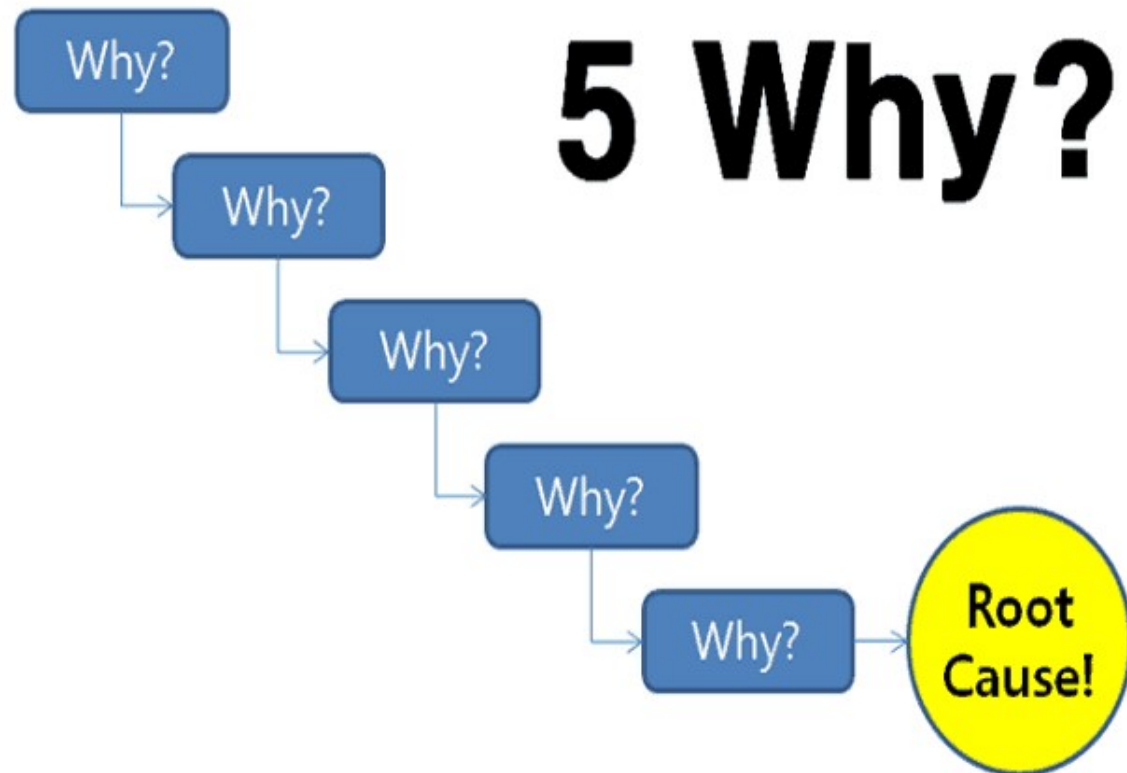


## Why Happened? (Occur Path)



# 5Why

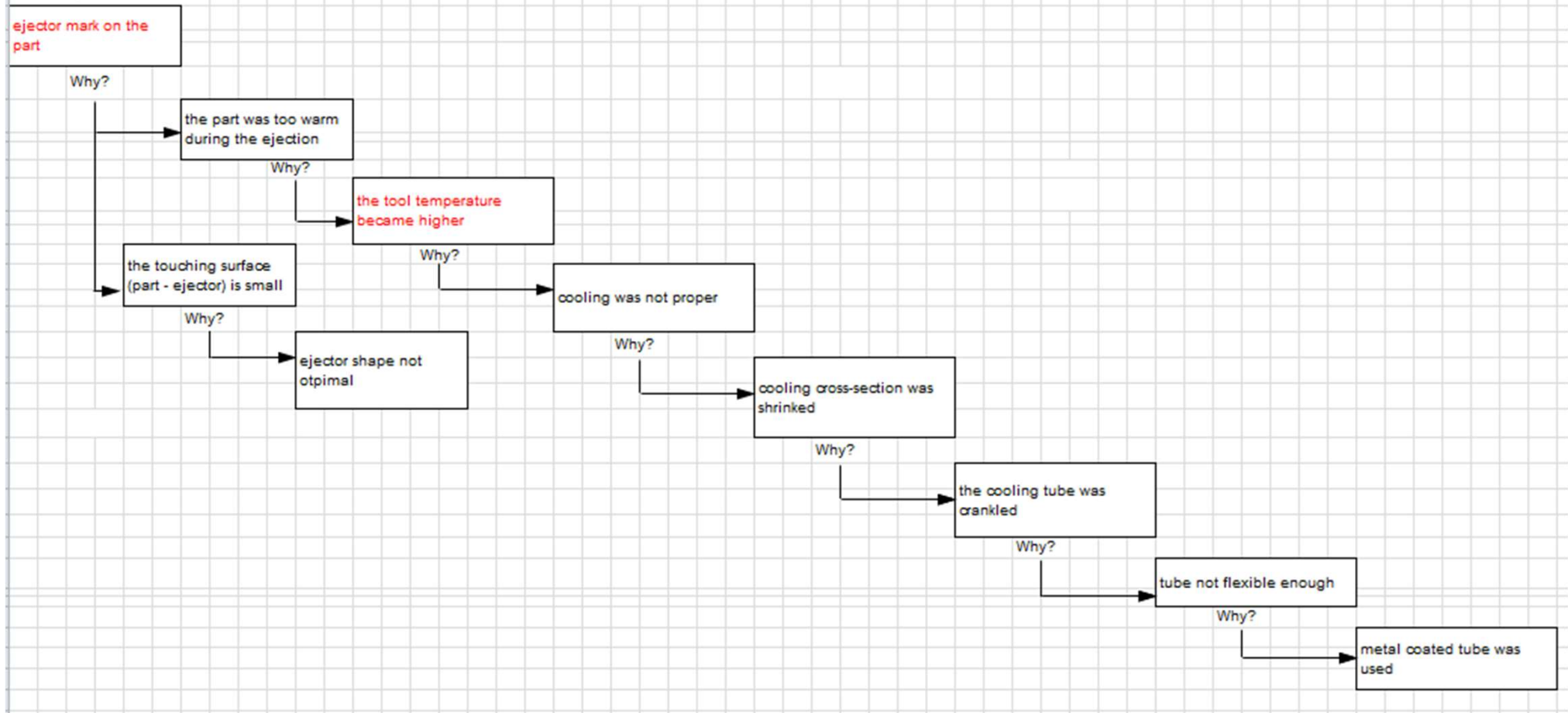
- Reaching the rootcause
- 5 times why?





# 5Why?

## Occur path



## Occur path

ejector mark on the part

Why?

the part was too warm  
during the ejection

Why?

the tool temperature became  
higher

Why?

cooling was not proper

Why?

the touching surface (part  
- ejector) is small

Why?

ejector shape not optimal

► cooling cross-section was  
shrunk

Why?

► the cooling tube was cranked

Why?

► tube not flexible enough

Why?

► metal coated tube was used

## Detection path

failure not detected by the operator

Why?

inattention during visual checking

Why?

visual checking not 100% effective

no 100% visual inspection during the production

Why?

only random check defined (3 shots, 2 times / shift)  
The claimed failure was a random failure, not all parts

higher tool temperature not detected

Why?

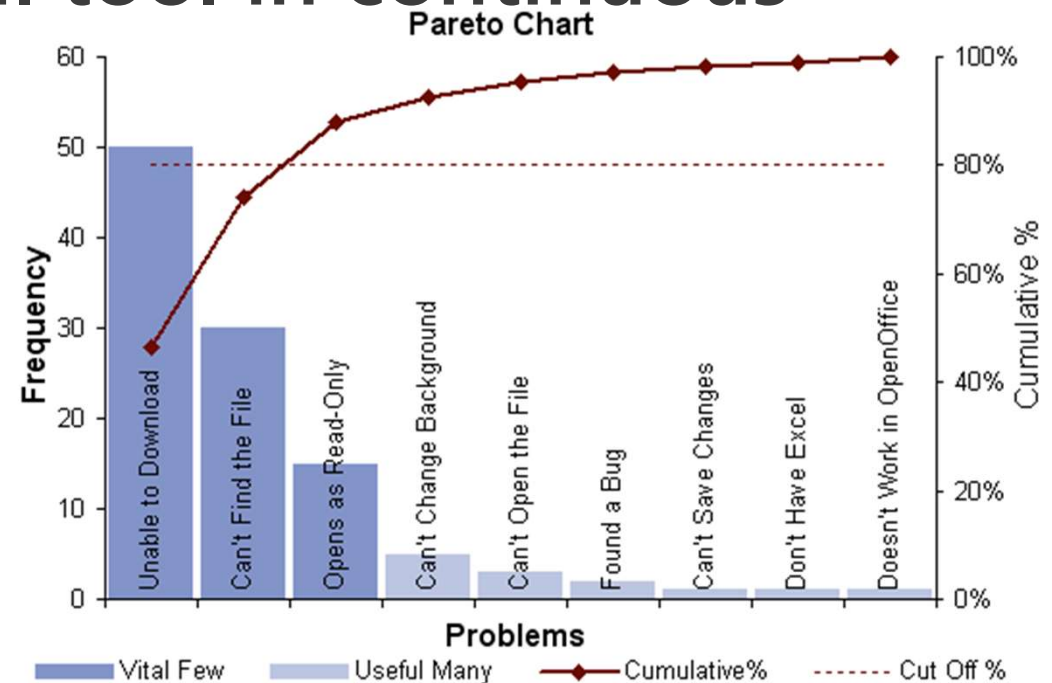
tool temperature during production not measured directly in

Why?

there are no heat sensor to measure the tool temperature directly

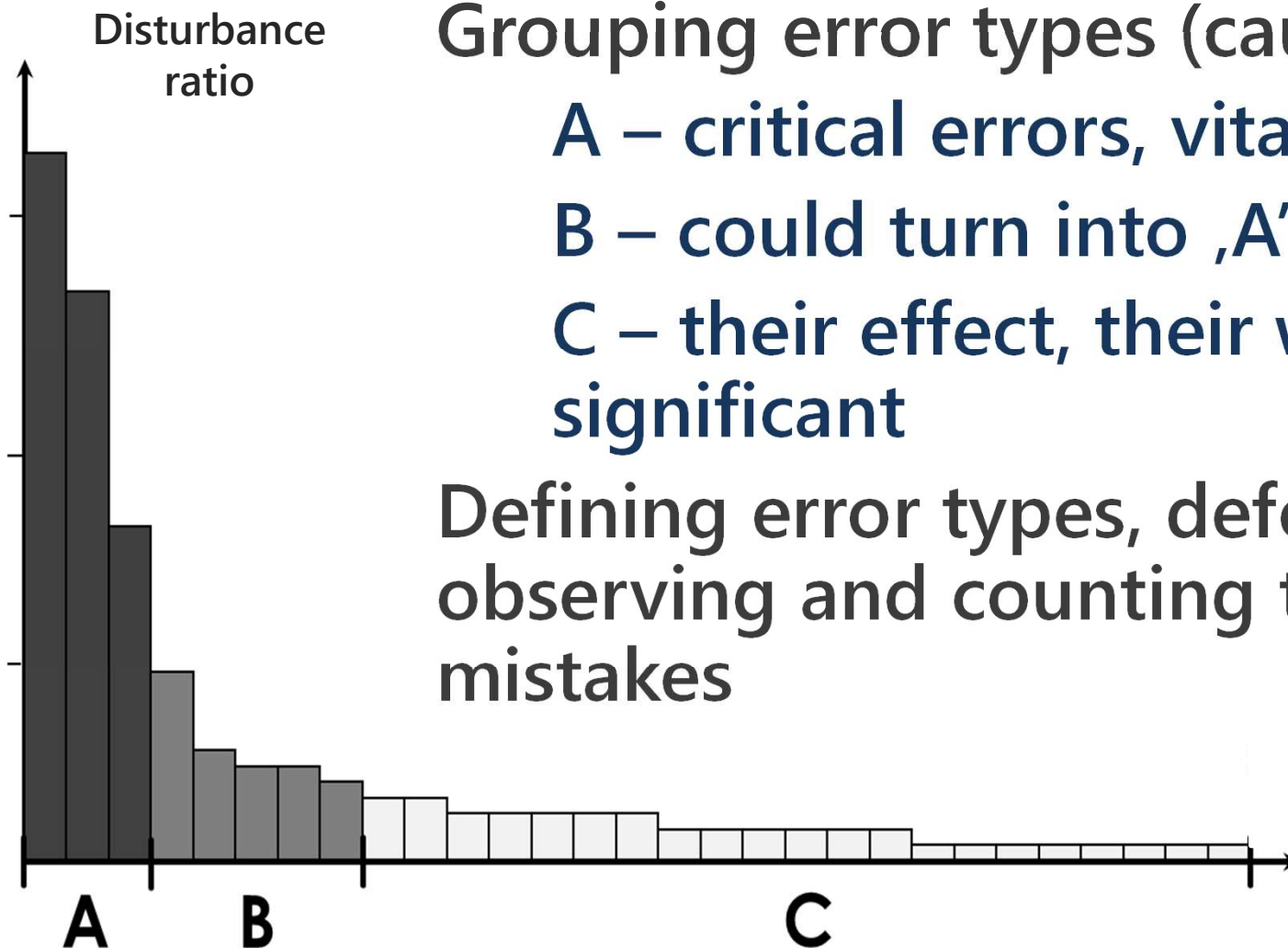
# Pareto/ABC diagram

- Basis: Vilfredo Pareto's 80/20 rule
- Formal statistical technique
- Powerful and useful tool in continuous improvement
- 80/20 rule  
(rule of thumb)



- vital few vs trivial many

# ABC for error types



Grouping error types (causes, products):

A – critical errors, vital few

B – could turn into ,A'

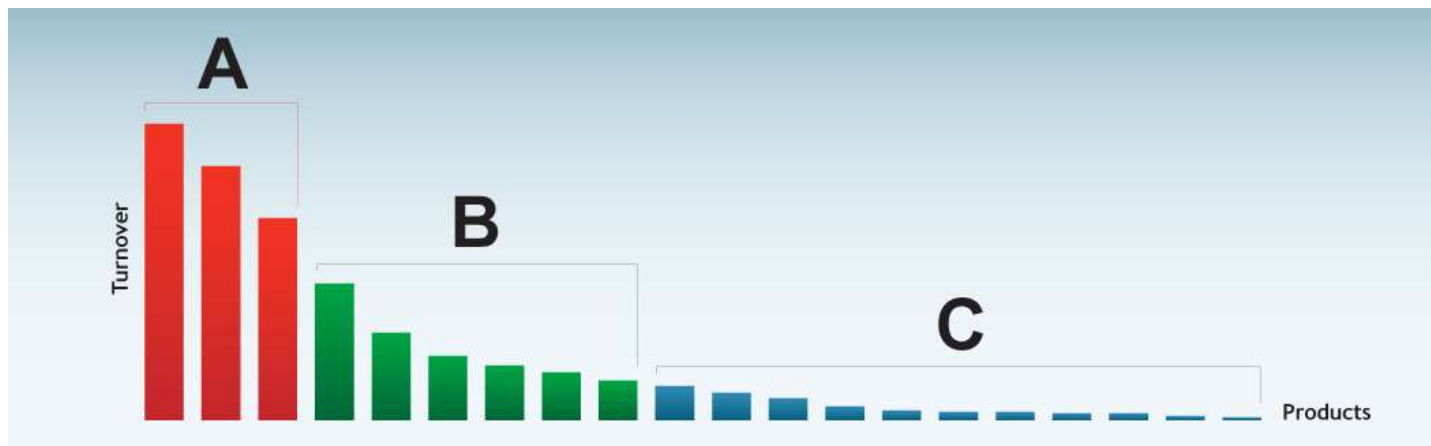
C – their effect, their weight is not significant

Defining error types, defect categories, observing and counting the occurrences of mistakes

Disturbances in descending order

# Pareto/ABC diagram

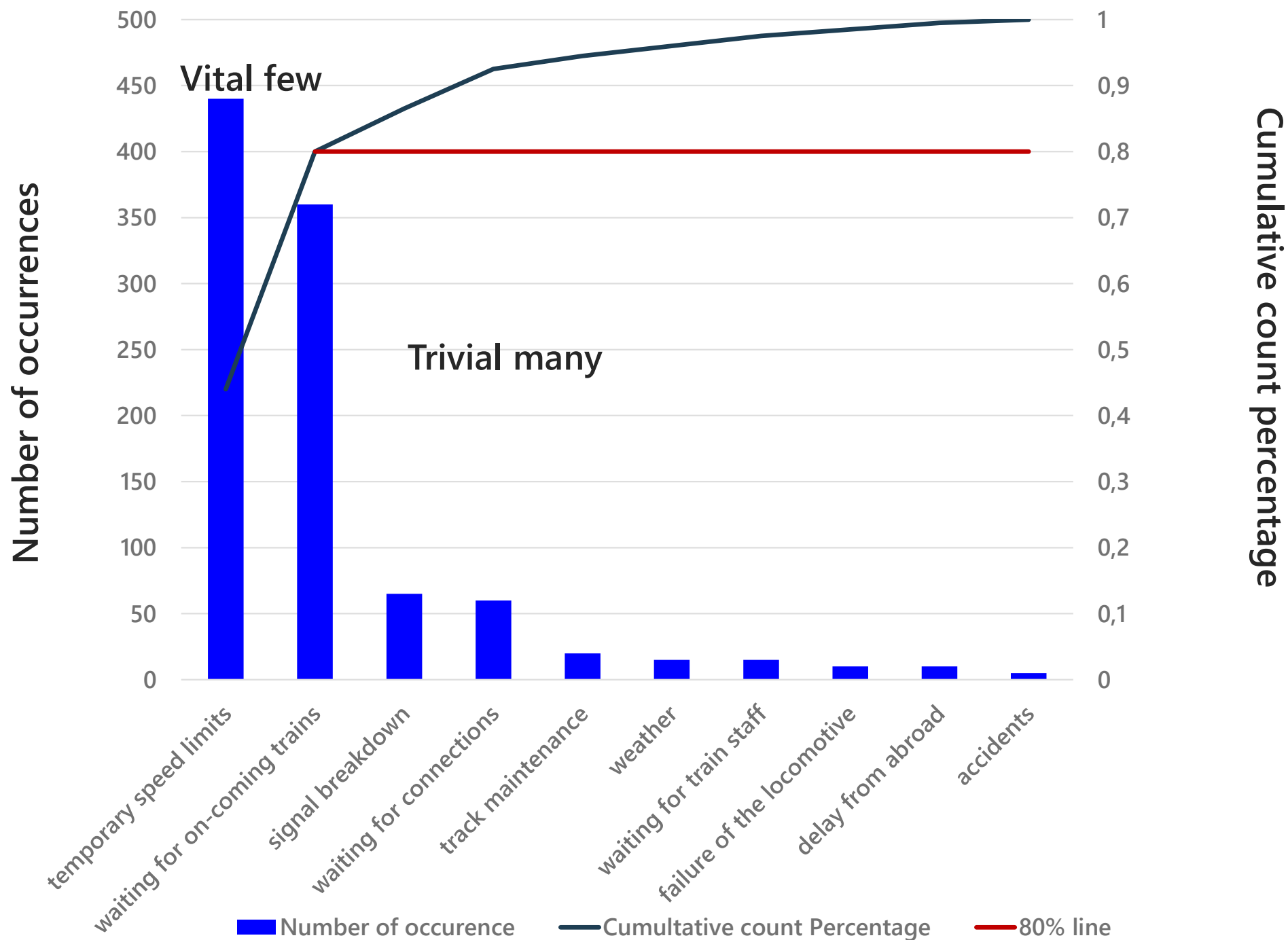
- Bar graph: The lengths of the bars represent frequency or cost (time or money) with the longest bars on the left and the shortest to the right
- Used for a selection of a limited number of task that reduce the significant overall effect
- Helps to identify the top portion of causes that need to be addressed to resolve the majority of the problems
- Displays the relative importance of problems in a simple, visual format



# Example – train delay

Cause of the delay	Number of occurrences	Cumulative count percentage
temporary speed limits	440	0,44
waiting for coming trains	360	0,8
signal breakdown	65	0,865
waiting for connections	60	0,925
track maintenance	20	0,945
weather	15	0,96
waiting for train staff	15	0,975
failure of the locomotive	10	0,985
delay from abroad	10	0,995
accidents	5	1
SUM	1000	





# Thank you for your attention

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