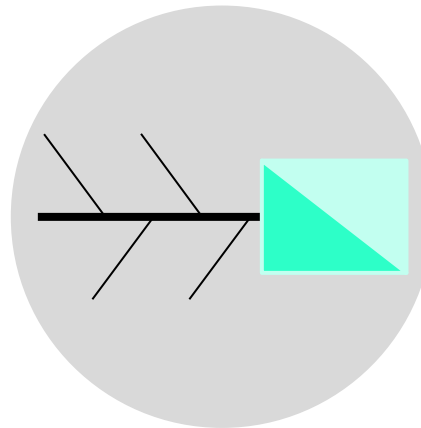


# Continuous Improvement Toolkit

## FISHBONE DIAGRAM



# FISHBONE DIAGRAM

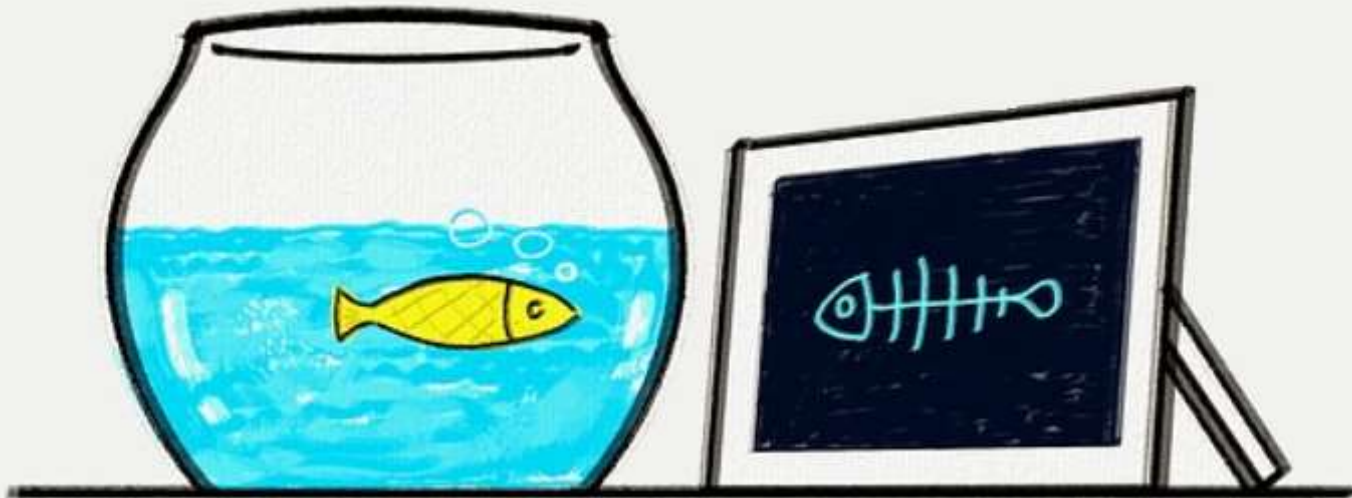
A fishbone diagram provides a **structured way** to identify and organize the potential causes of a problem (or effect)



It allows to establish and present the **cause-and-effect** relationship in an easy and understandable format

# FISHBONE DIAGRAM

It is called this way because of its **visual representation** that looks like the skeleton of a fish



It is also called a cause-and-effect diagram and an Ishikawa diagram after the man who created it

# FISHBONE DIAGRAM

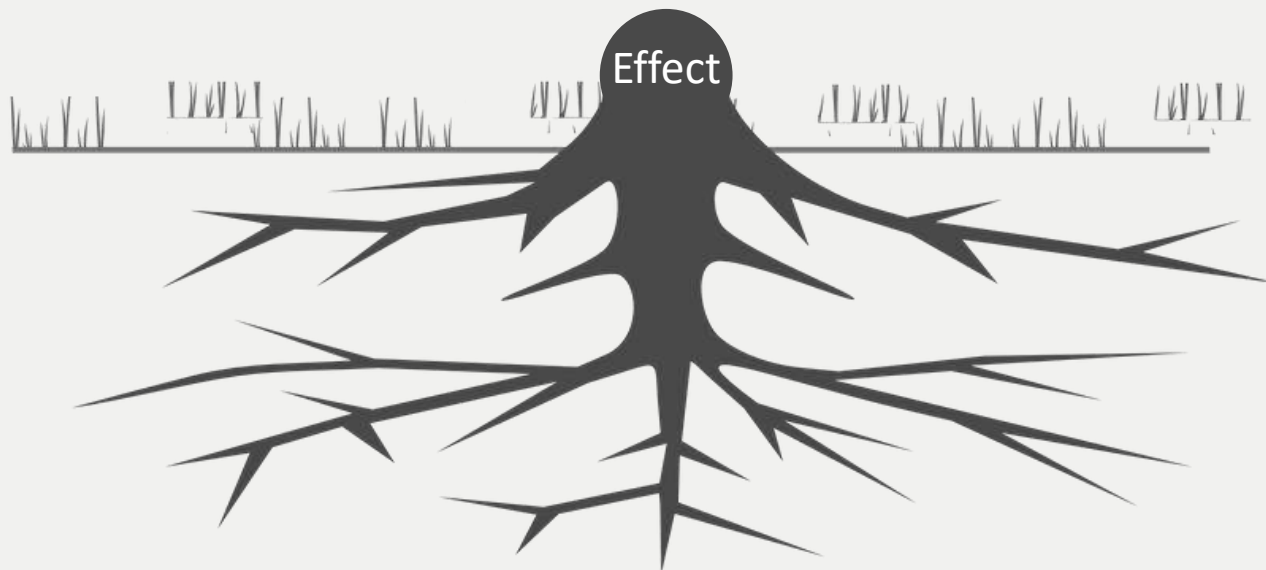
Used to identify the sources of **variation** within a process which causes a problem to occur



This brings attention to the **primary factors** affecting the quality of a product or service

# FISHBONE DIAGRAM

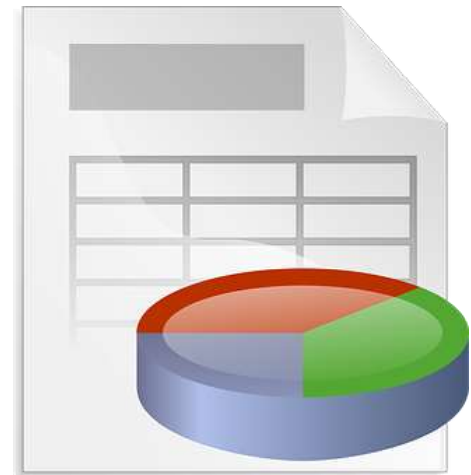
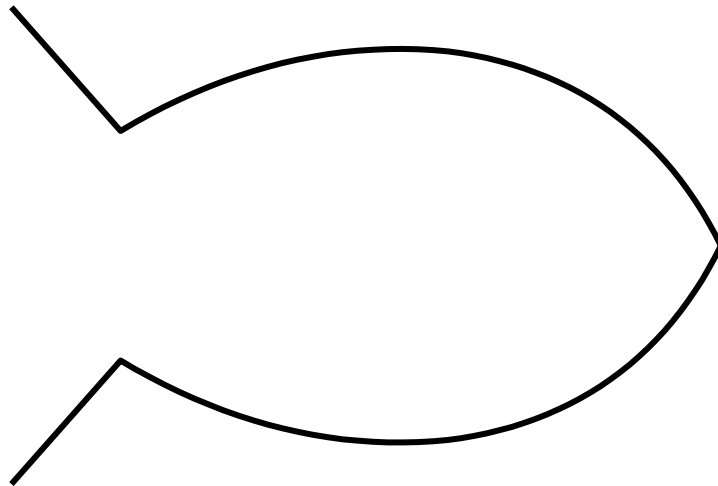
Helps to identify the **root causes** of an effect in order to identify a solution that can be effective



Often used in Lean Six Sigma and other quality improvement methodologies to narrow down the area of analysis

# FISHBONE DIAGRAM

The outcome of the fishbone analysis will provide useful information to **later** problem-solving tools



# FISHBONE DIAGRAM

Often used during **brainstorming sessions** to identify the causes of an undesirable effect of a problem



By going through the steps of drawing the diagram with your team, everyone gains insight into the cause-and-effect, which makes the solution easier to find later

# FISHBONE DIAGRAM

## Benefits

Provides a clarity about the causes of an effect and how to avoid it in future.

A teamwork exercise that helps to capture and organize people's knowledge of a process.

Identifies the potential factors that may cause an effect to prevent future problems (cause prevention).

Can be used in product and process design to plan new processes.

Can be used to identify the causes of risks.



# FISHBONE DIAGRAM

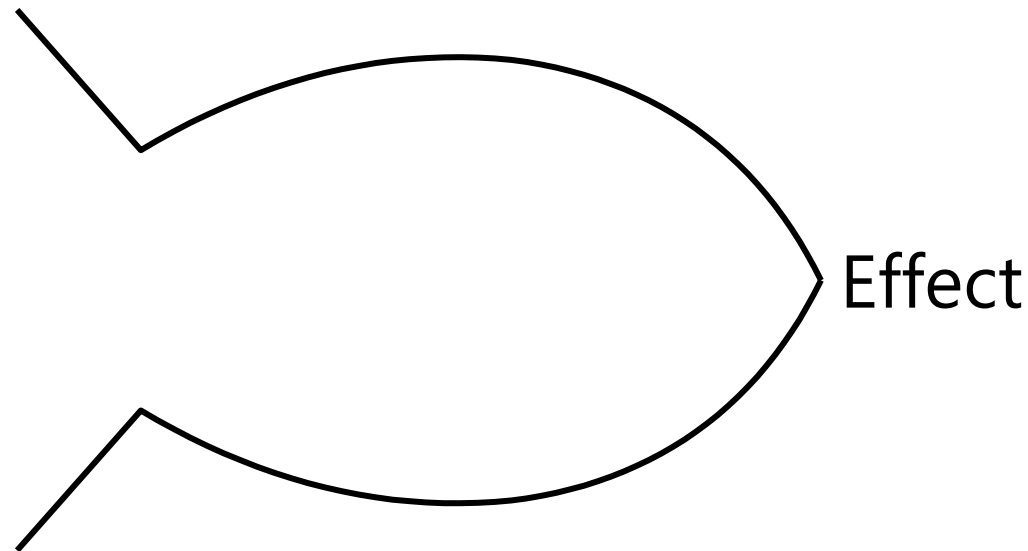
The first step in conducting a fishbone analysis is to clearly define the **EFFECT**



This could be a quality issue, a technical issue, or simply not meeting a performance target

# FISHBONE DIAGRAM

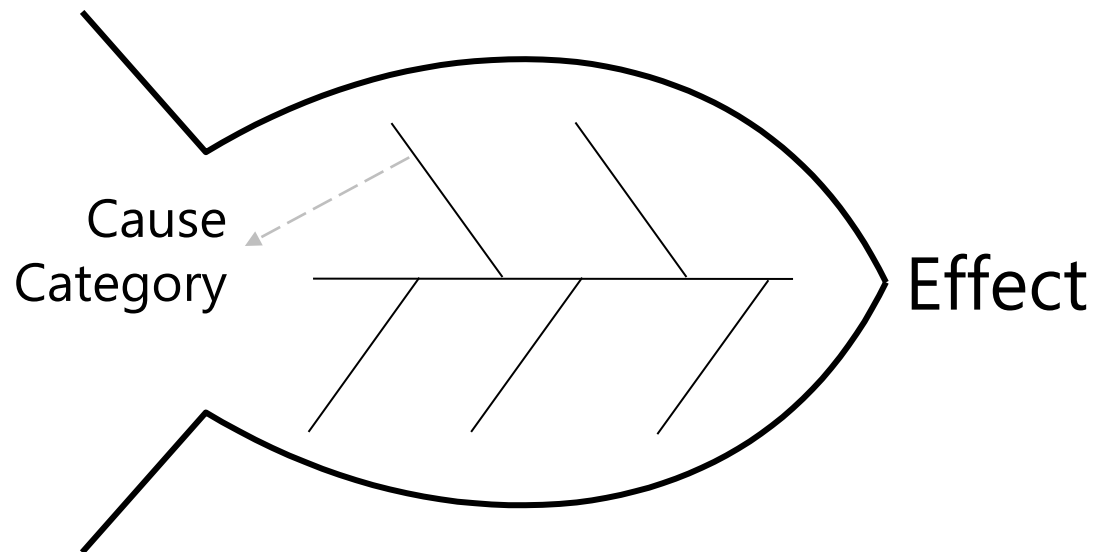
The effect will become the **head** of the fishbone



Should be brief. Use numbers where possible

# FISHBONE DIAGRAM

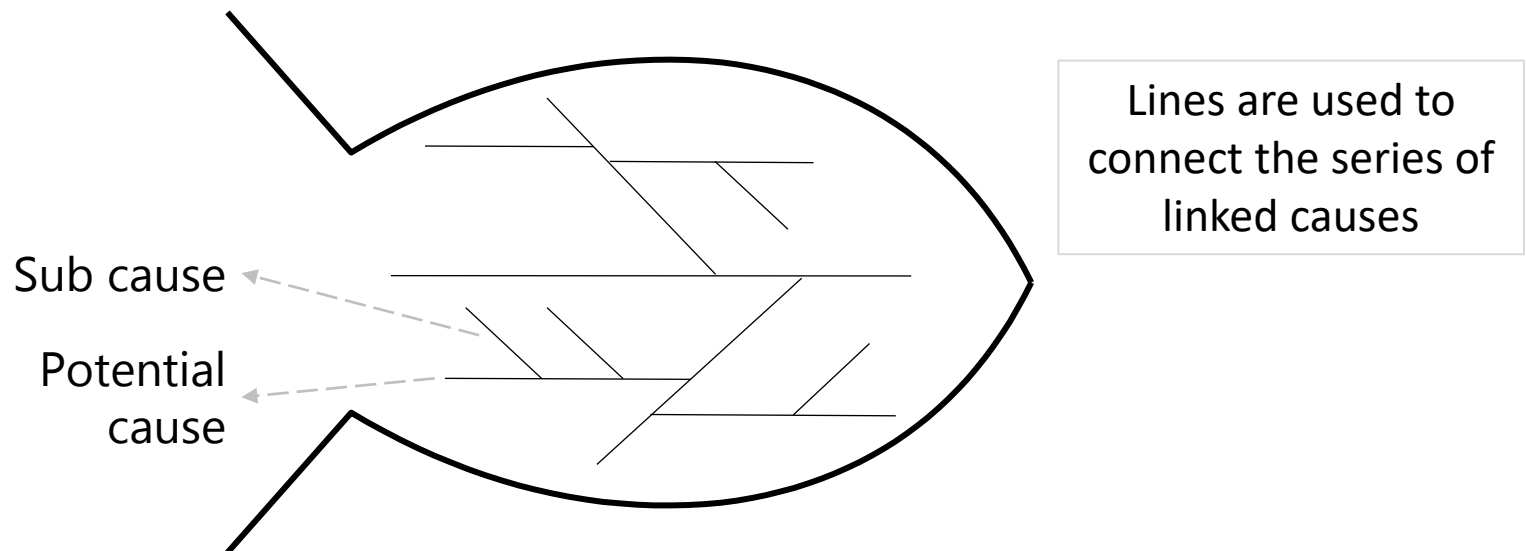
The causes will be placed in the **branches** of the chart



Each cause needs to be put into a category for easier sharing and reference

# FISHBONE DIAGRAM

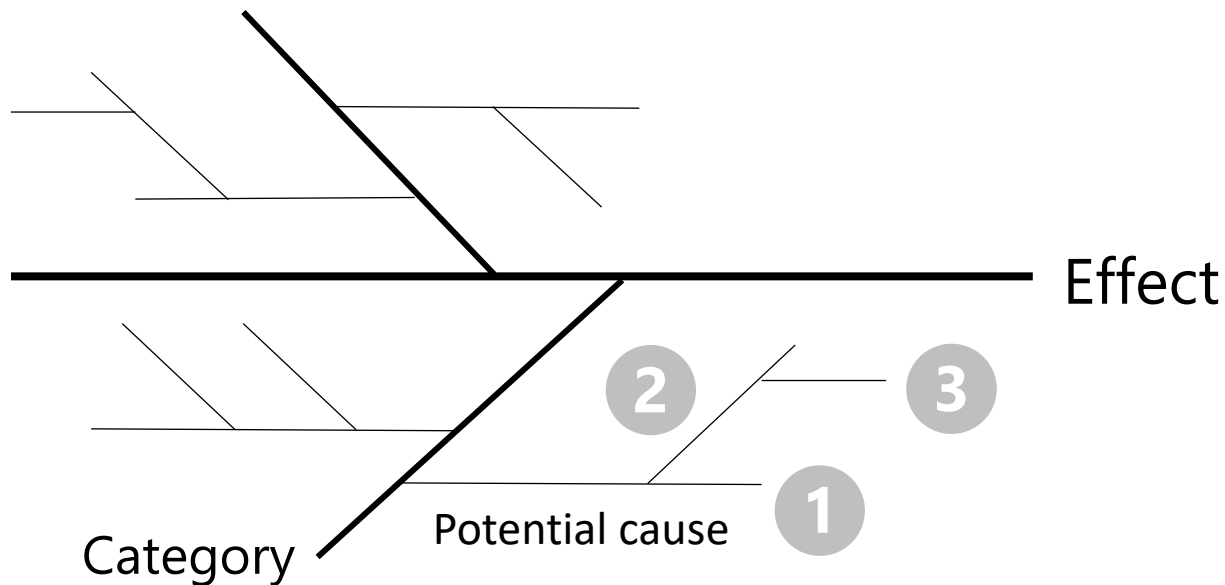
Allows to identify the **hierarchy of causes** including the possible root causes



**Root causes** are normally those at the ends of the chains of causes that do not have any sub causes

# FISHBONE DIAGRAM

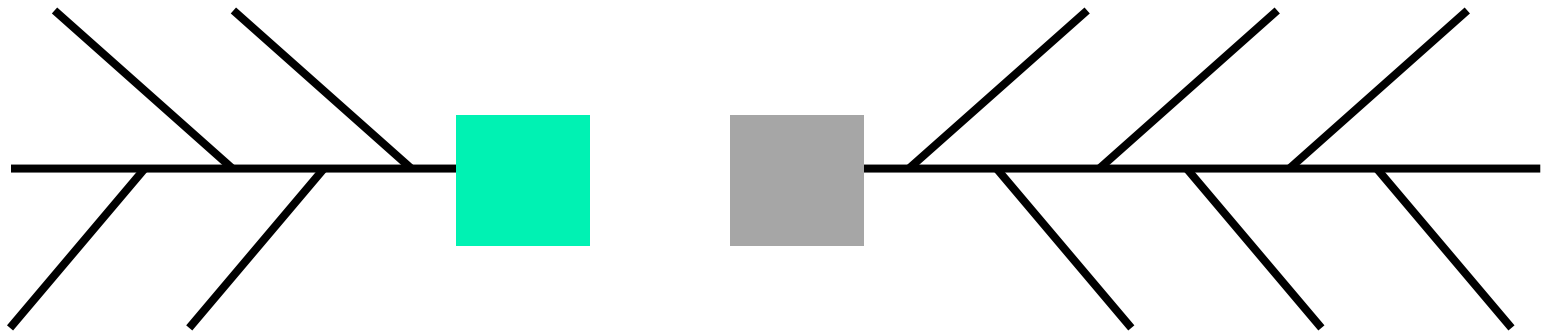
**5 why's** are often used to dig deeper and go beyond symptoms



Combining the fishbone with the 5 whys gives the analysis an extra dimension

# FISHBONE DIAGRAM

Potential causes in a fishbone diagram are normally **grouped** into categories for easier sharing and reference



These categories are used to label the different branches on the fishbone diagram

# FISHBONE DIAGRAM

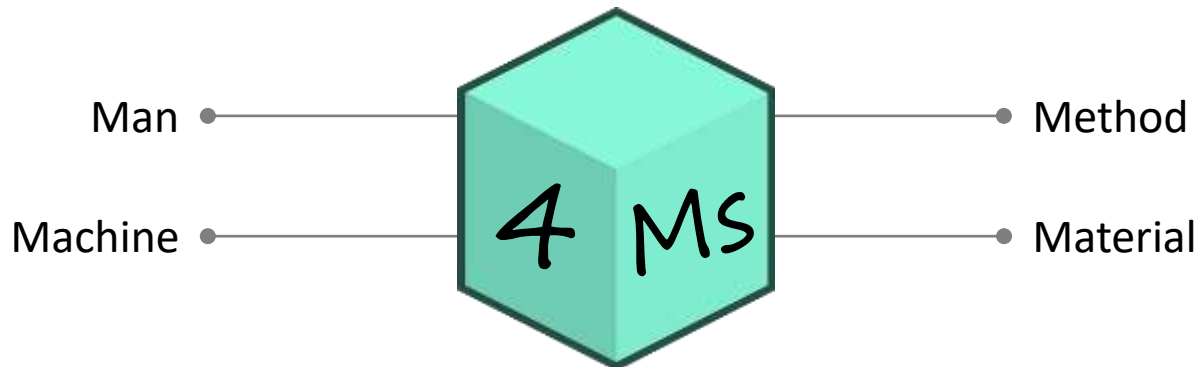
There are **different approaches** of constructing a fishbone diagram indicated by the branch labels



There is no right or wrong way to do that

# FISHBONE DIAGRAM

**4 Ms** – one of the most basic forms to group the potential causes of a problem or effect

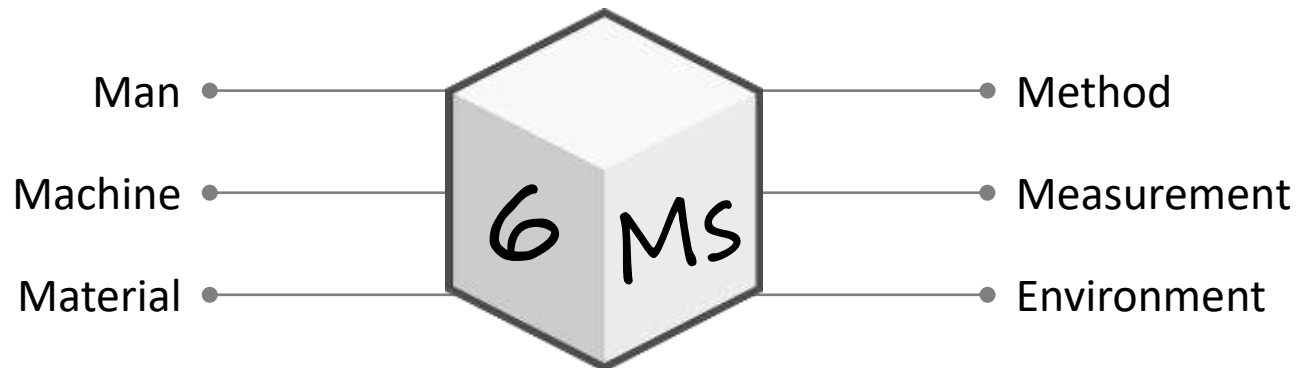


These categories typically include Man Method, Machine and Material



# FISHBONE DIAGRAM

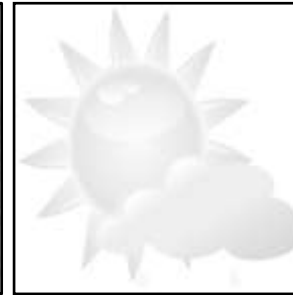
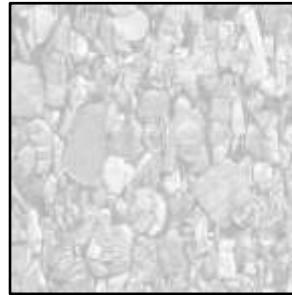
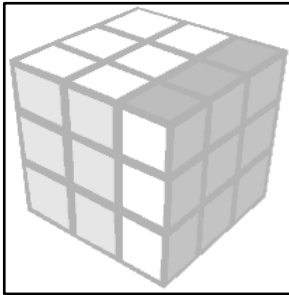
**6 Ms** – the most common way to categorize potential causes of a problem or effect



Commonly used in manufacturing and production environments as well as in service environments

# FISHBONE DIAGRAM

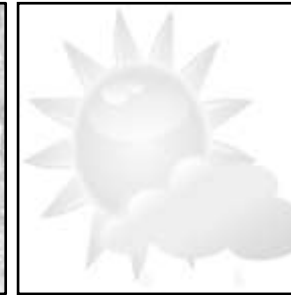
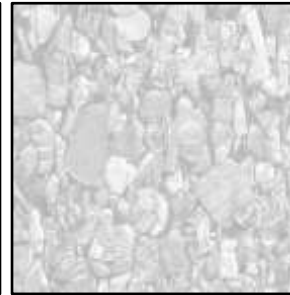
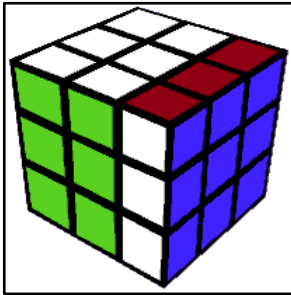
6 Ms



**Man** – anyone involved with the process and contributes to the effect Including governance and support functions

# FISHBONE DIAGRAM

6 Ms



**Method** – how the process is performed and the specific requirements for doing it

Rules and  
policies

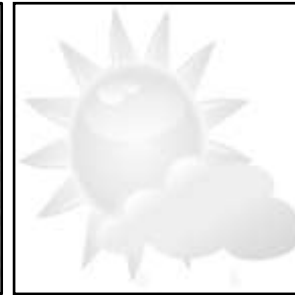
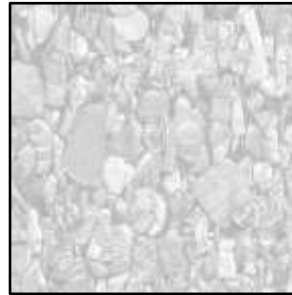
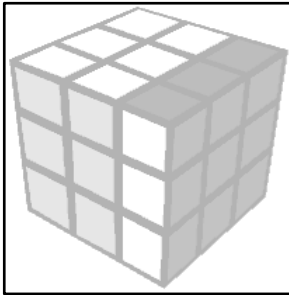
Procedures

Work  
instructions

Common  
practices

# FISHBONE DIAGRAM

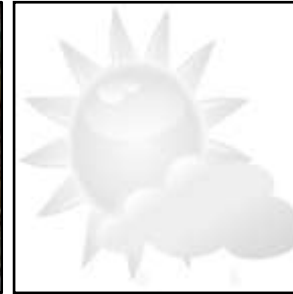
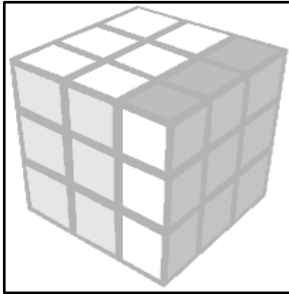
6 Ms



**Machine** – the machinery, equipment and tools required to perform the process

# FISHBONE DIAGRAM

6 Ms



**Material** – all the materials needed to perform a process

Raw materials

Parts

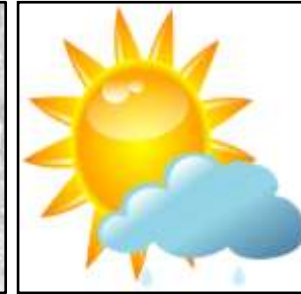
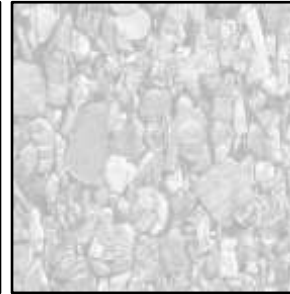
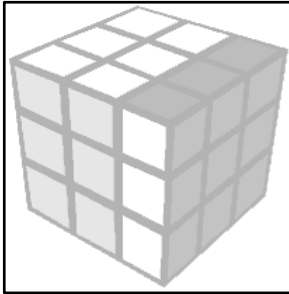
Packaging

Information

Paperwork

# FISHBONE DIAGRAM

6 Ms



**Environment** – the conditions in which the process operates

Location

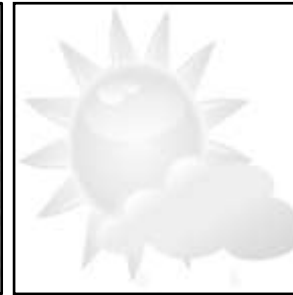
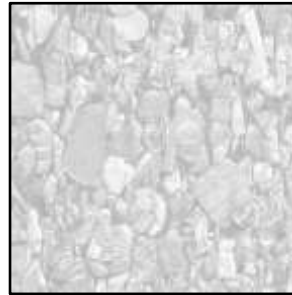
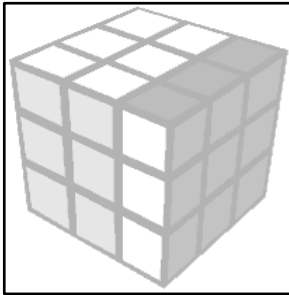
Time

Temperature

Culture

# FISHBONE DIAGRAM

6 Ms



**Measurement** – the data and metrics that are used to evaluate the performance of the process

# FISHBONE DIAGRAM

**Different names** may be used for the same category depending on the situation and on the user's choice

**Man** – Men – Manpower – People – Labor

**Machine** – Machinery – Equipment – Tools – Systems

**Measurement** – Metrics – Inspection

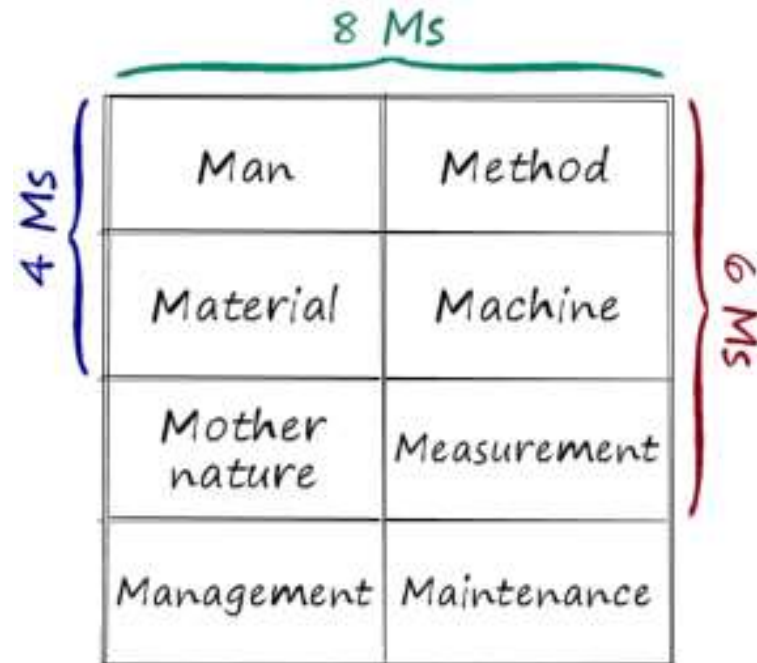
**Method** – Process – Procedure

**Environment** – Mother Nature – Milieu



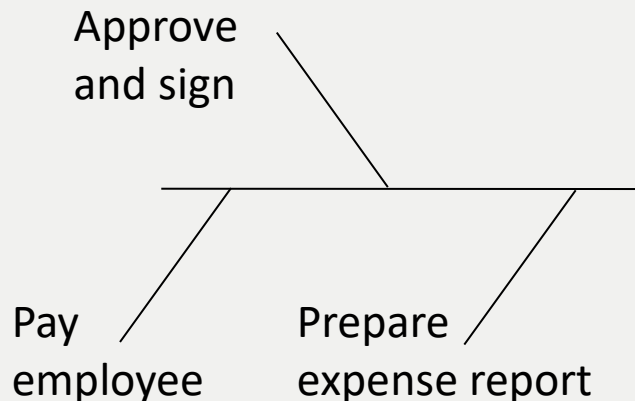
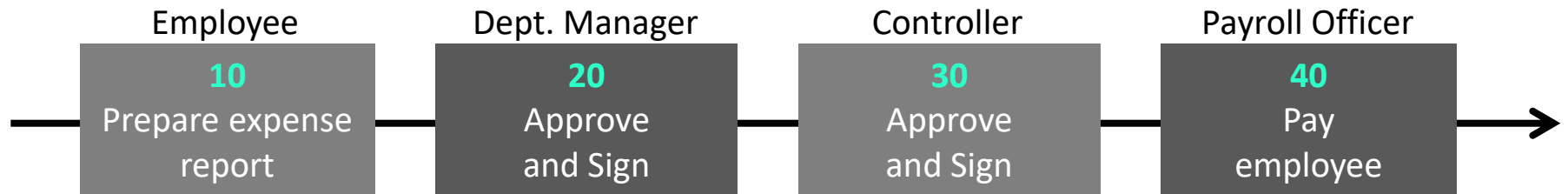
# FISHBONE DIAGRAM

8 Ms – adds Management and Maintenance to the 6 M categories



# FISHBONE DIAGRAM

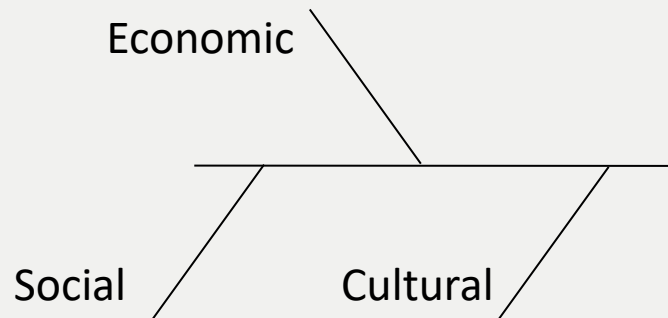
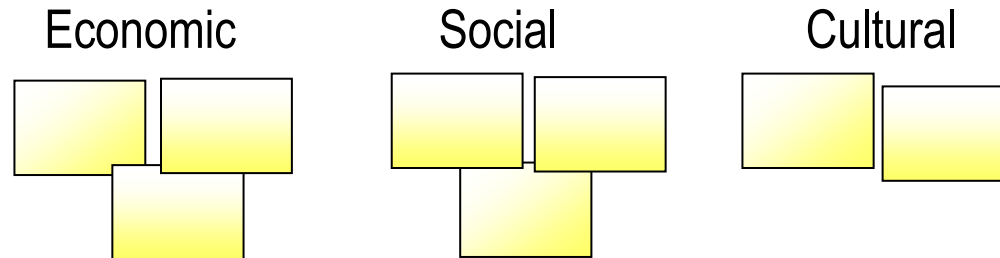
When the effect results from a **mapped or documented process**, the process steps can be used as the basis for categorization



The process input variables (design factors) can be the potential causes

# FISHBONE DIAGRAM

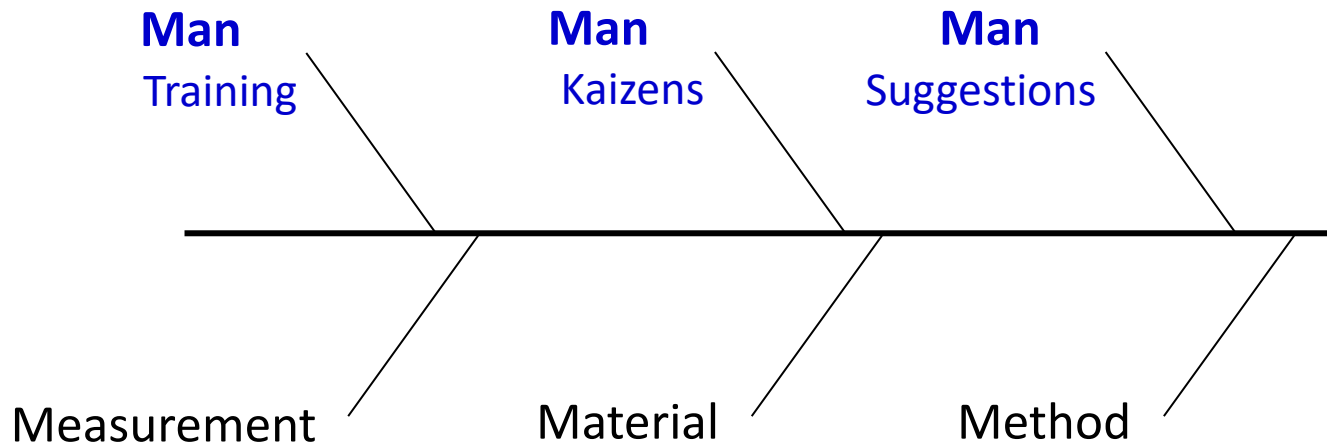
When you are working on an **affinity diagram**, you can use the titles of the affinity groups as the basis for categorization



The items within each affinity group can be the potential causes

# FISHBONE DIAGRAM

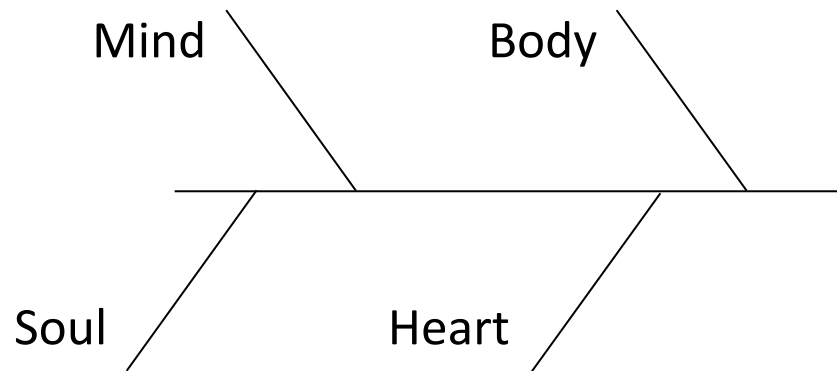
You may also create **subcategories** of a main category and include it in new branches



Remember to avoid writing real names of persons under the “Man” category

# FISHBONE DIAGRAM

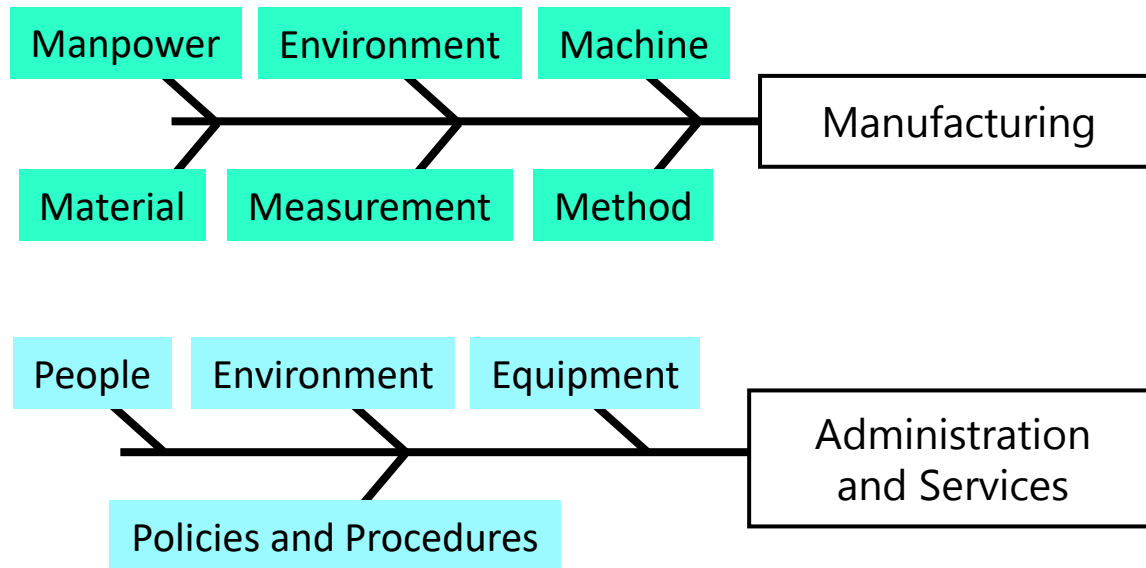
You may even rename or create **your own branches** that best suit your project



Fishbone analysis can also be used in our **personal** lives to create ideas about the certain personal issues and how to avoid them

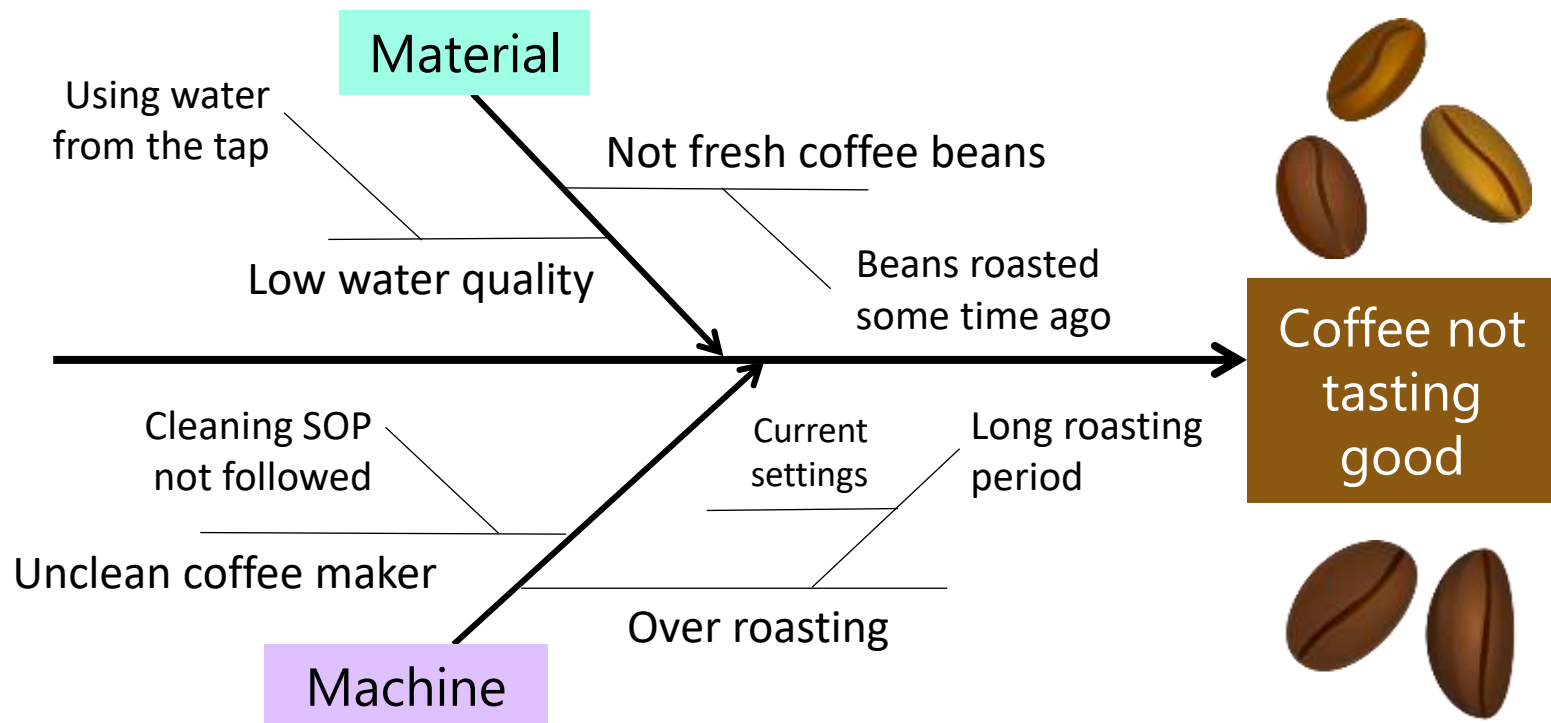
# FISHBONE DIAGRAM

## Typical Categories for Manufacturing and Non-manufacturing Processes



# FISHBONE DIAGRAM

Now that we have identified the categories, it time to add to the diagram the **possible causes** of the effect

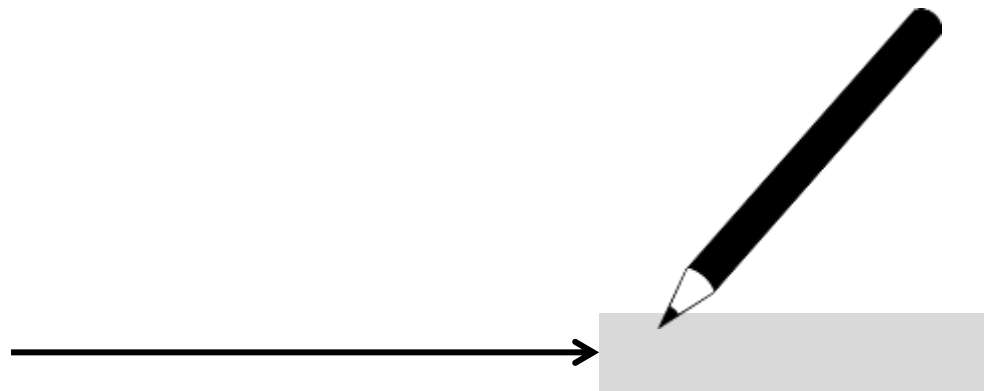


# FISHBONE DIAGRAM

## How to Conduct a Fishbone Analysis

With your team, clearly define the **effect** that you want to work on

Write the effect statement in a box at the center right of a large piece of paper (or on a wall) and draw a long horizontal line pointing to the box



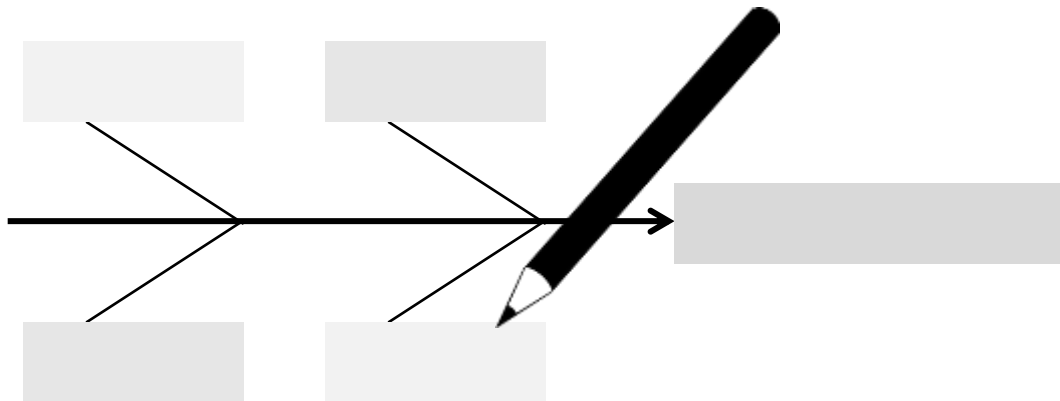


# FISHBONE DIAGRAM

## How to Conduct a Fishbone Analysis

Identify the **cause categories** using the 6 Ms or any other approach

Write them in boxes parallel to the horizontal line

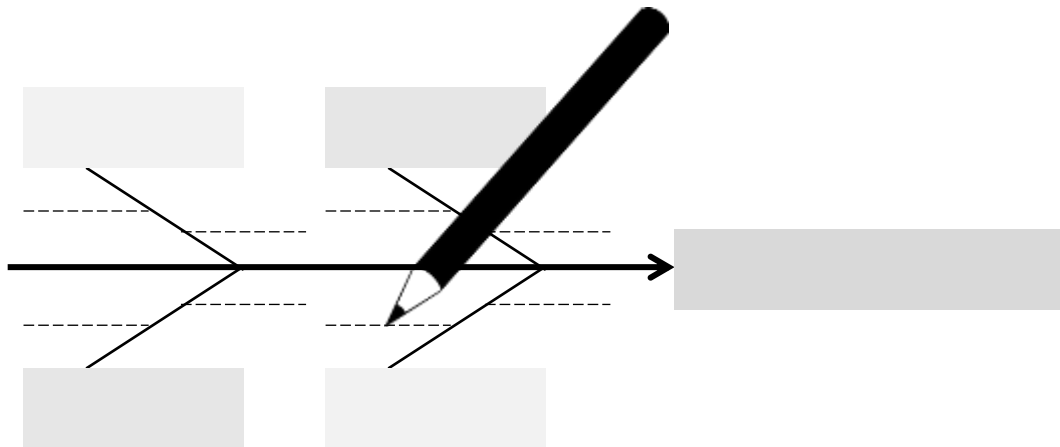


# FISHBONE DIAGRAM

## How to Conduct a Fishbone Analysis

Use brainstorming to **log all possible causes** under the appropriate categories

Start with the main causes and then the secondary causes and so on  
Use 5 whys to get to the root causes

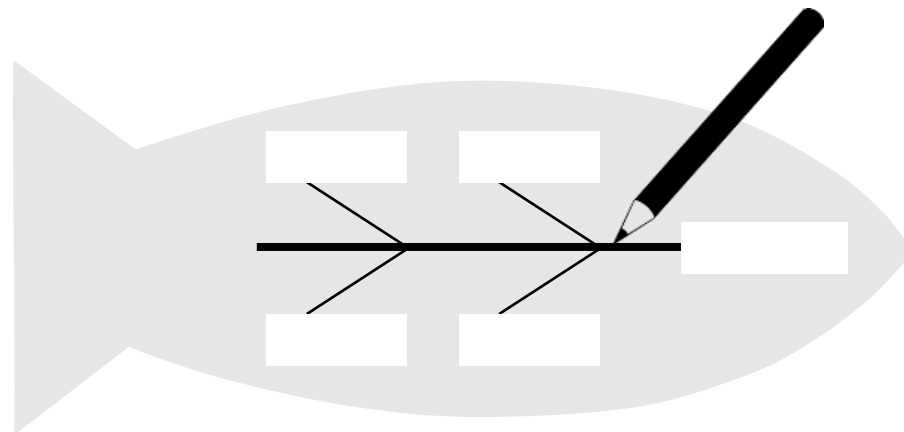


# FISHBONE DIAGRAM

## How to Conduct a Fishbone Analysis

**Take time** to ensure the appropriateness of the recorded information

Update the chart as new potential causes become apparent

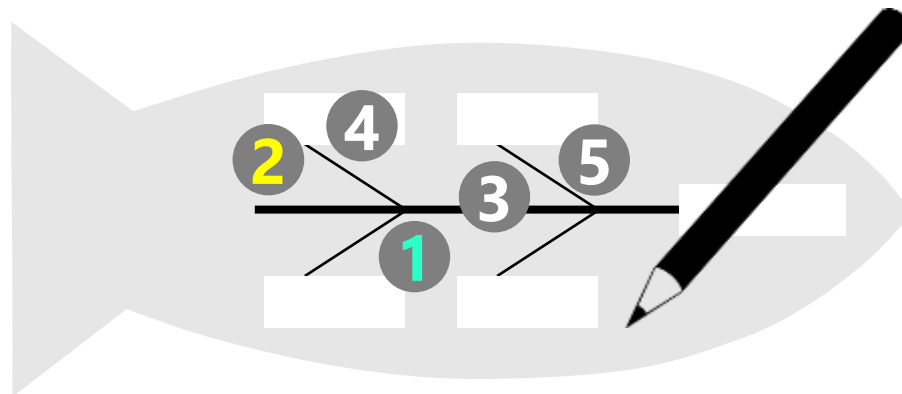


# FISHBONE DIAGRAM

## How to Conduct a Fishbone Analysis

**Highlight** or assign numbers near to the key causes to show their relative importance

Draw links between causes that are related



# FISHBONE DIAGRAM

## How to Conduct a Fishbone Analysis

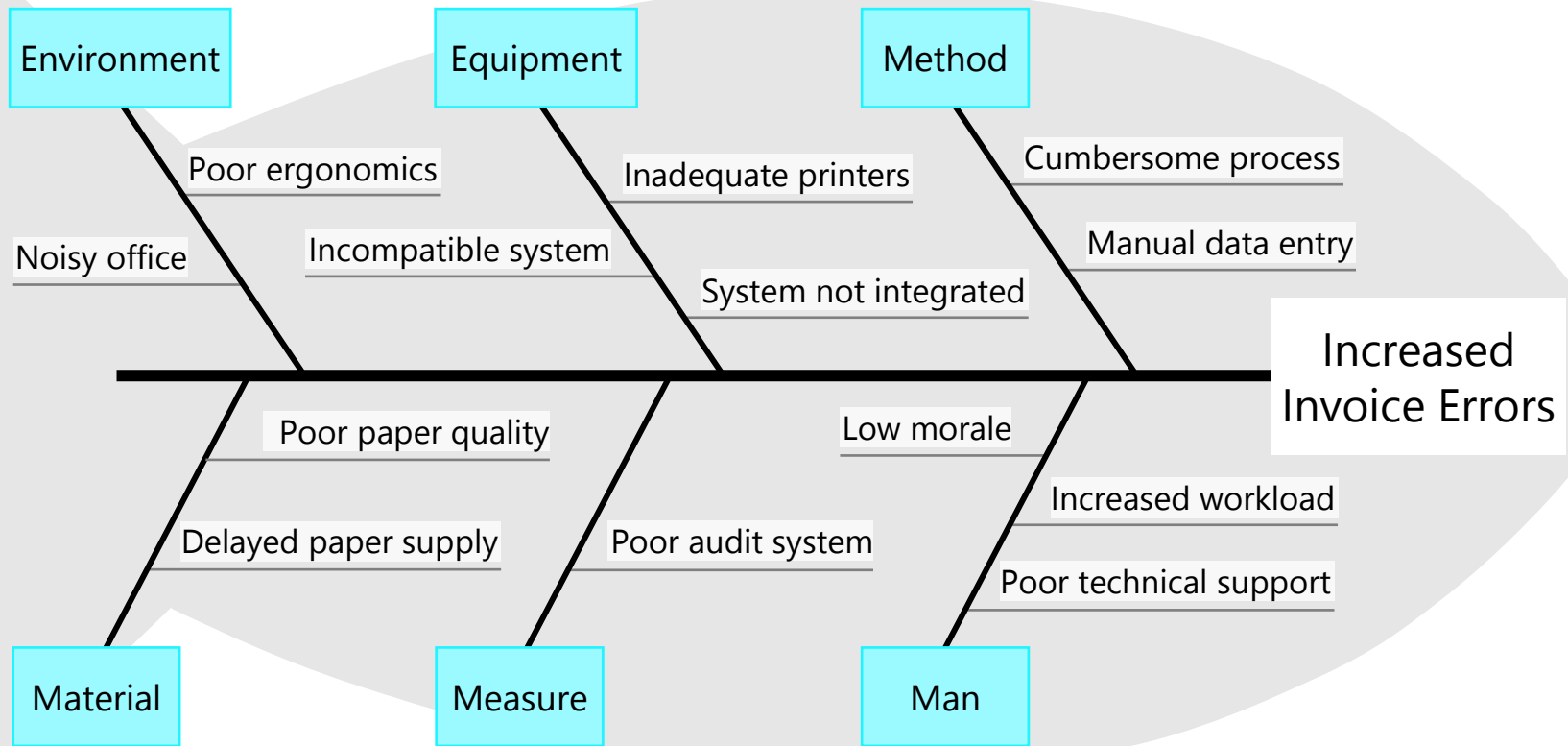
If necessary, **collect data** to confirm key causes are real

Plan and implement actions to address the key causes



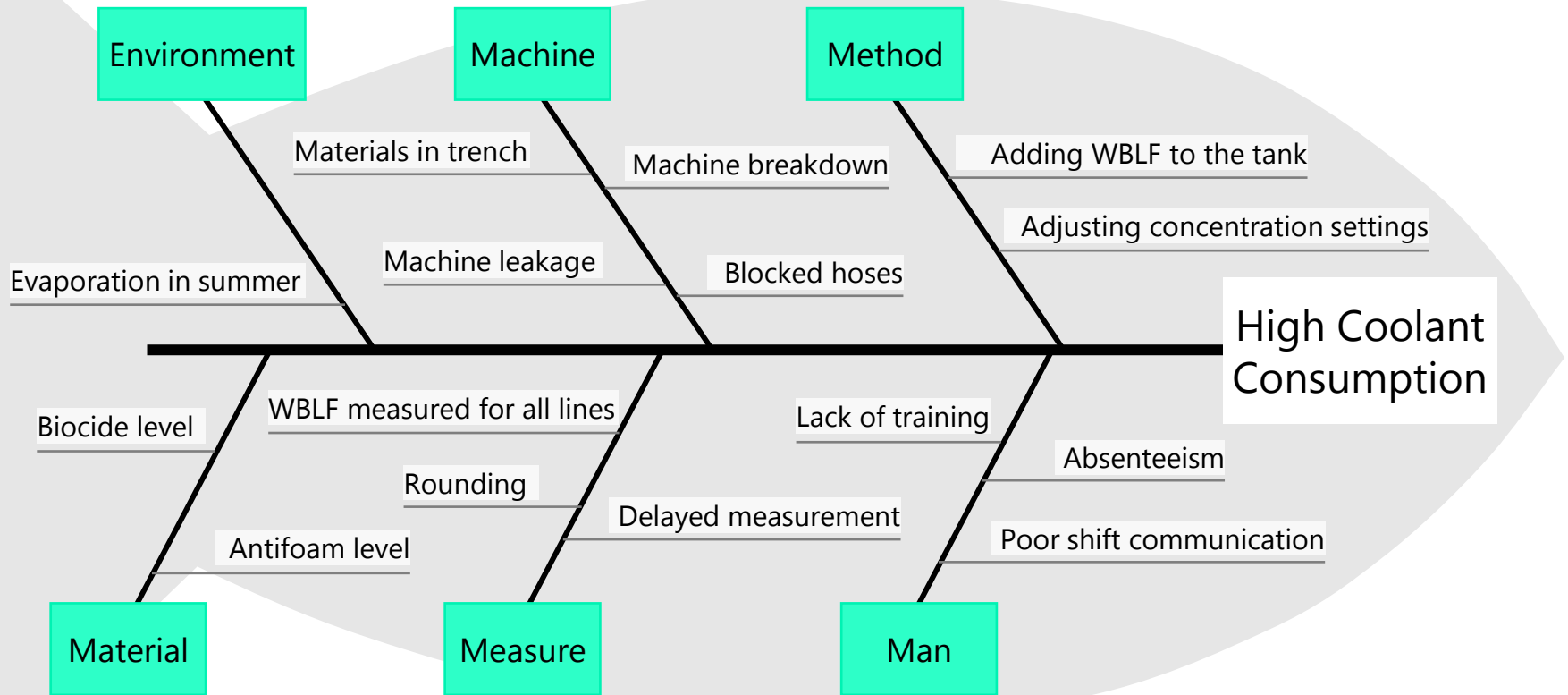
# FISHBONE DIAGRAM

## Example – Increased Invoice Errors



# FISHBONE DIAGRAM

## Example – Increased Coolant Consumption



# FISHBONE DIAGRAM

## Further Information

Be aware of adding causes which are **actually solutions**



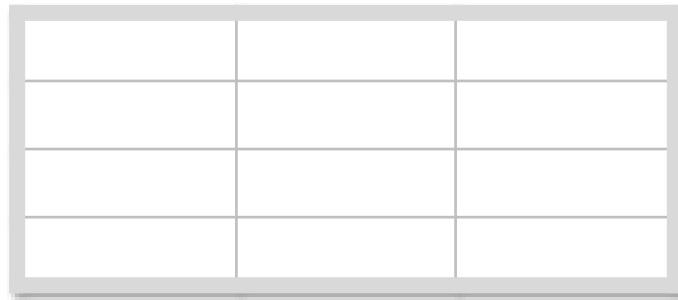
The main idea behind the fishbone analysis is to brainstorm all possible causes that may contribute to a problem, and not brainstorm solutions



# FISHBONE DIAGRAM

## Further Information

A **cause-and-effect matrix** can be used to prioritize the causes of the problem

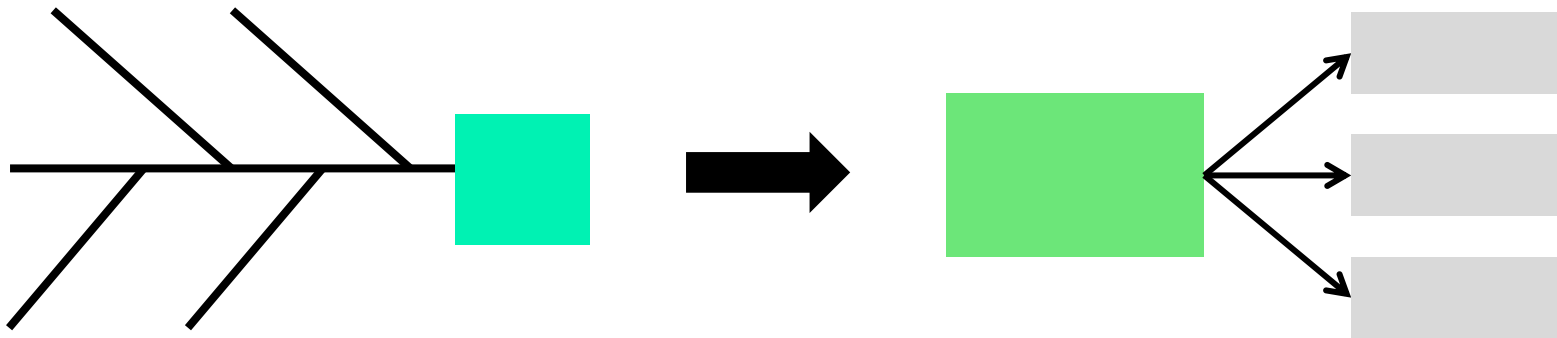



Prioritizing and selecting the key causes will minimize the need for more statistical analysis of inputs that are unlikely to have an impact on the output

# FISHBONE DIAGRAM

## Further Information

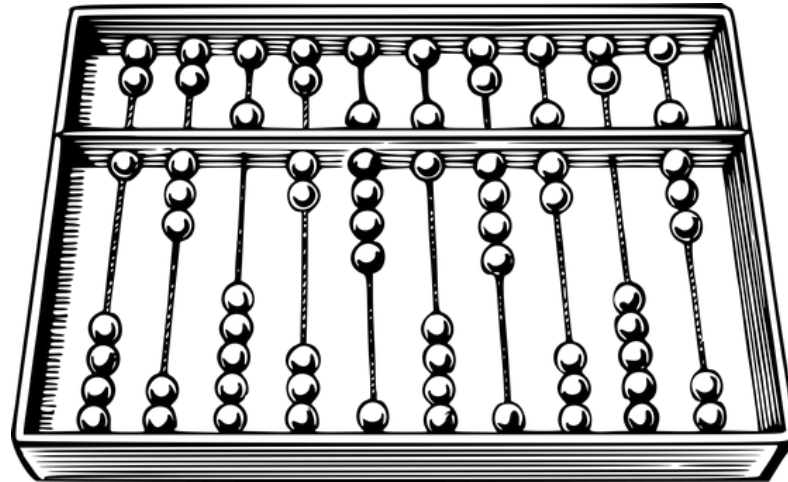
Another way of highlighting the structure of the possible causes is to use the **tree diagram**



# FISHBONE DIAGRAM

## Further Information

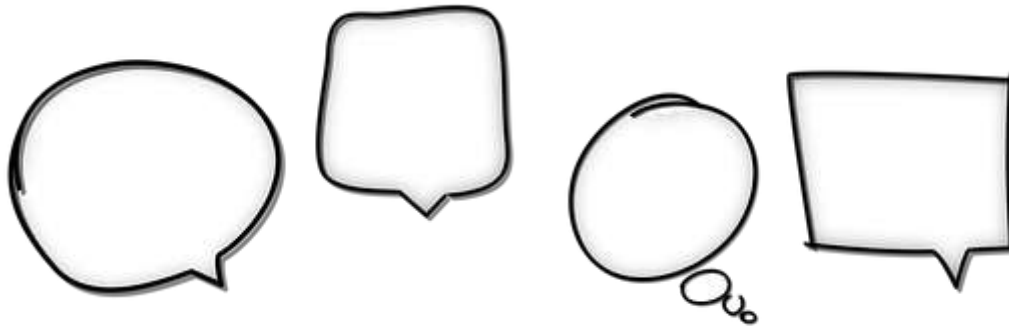
The measure of success for a fishbone diagram is not quality of ideas but **quantity** of ideas



# FISHBONE DIAGRAM

## Further Information

A fishbone diagram can also be used to **structure the thoughts** of a team

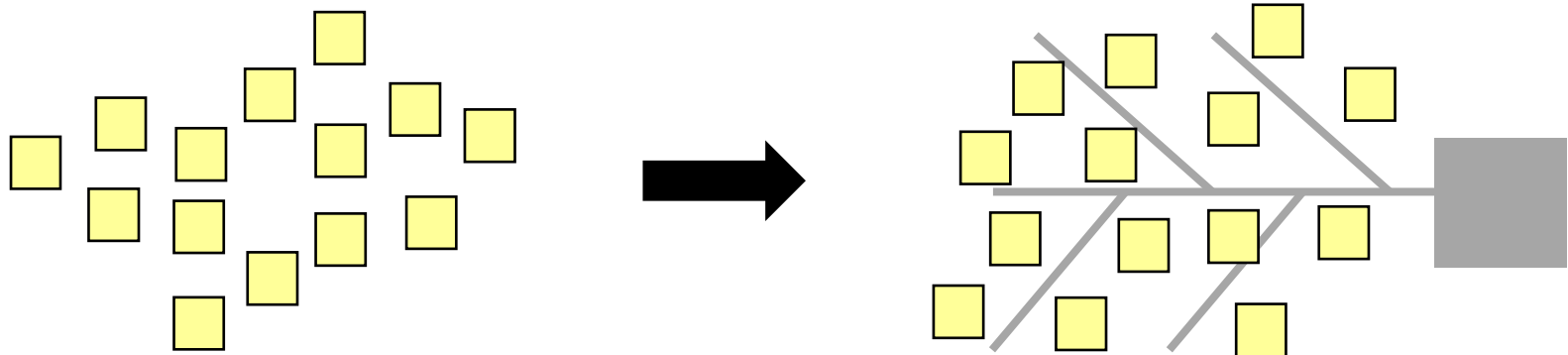


Sometimes it is useful to change the effect statement into the **ideal situation** and ask the team to brainstorm what produces this ideal situation

# FISHBONE DIAGRAM

## Further Information

Sometimes it is useful to brainstorm out the ideas first then organize them by category later

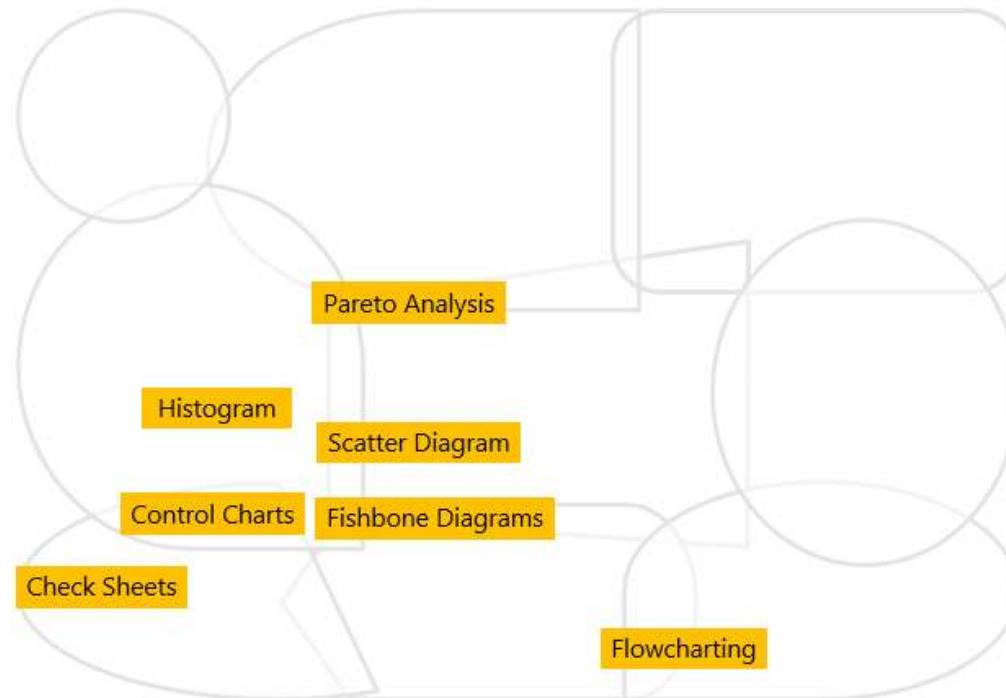


People sometimes tend to focus more on the categories than the content and this slows down and restricts their thinking

# FISHBONE DIAGRAM

## Further Information

One of the seven basic tools of quality



# FISHBONE DIAGRAM

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The Continuous Improvement Toolkit

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