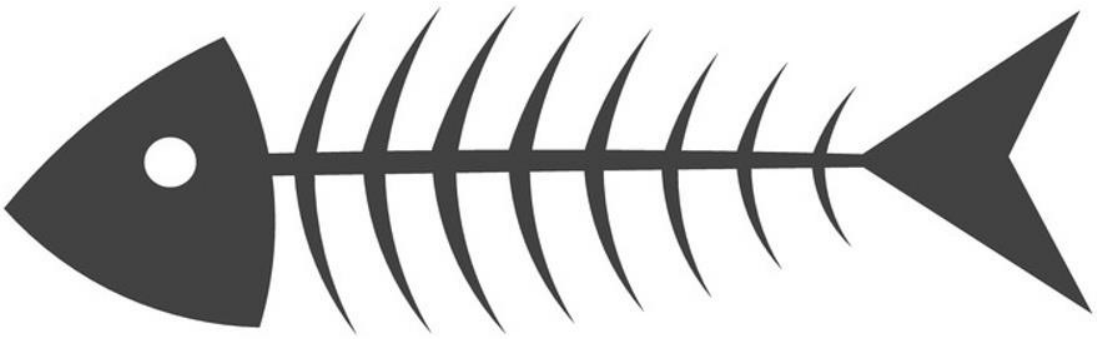
# Cause & Effect Diagrams

*The **Cause and Effect Diagram** is a **visual tool** to explore all the **potential factors** that may be **causing** or contributing to a **particular problem** (effect).*

This tool was popularized by **Kaoru Ishikawa** and allows you **to graphically capture all the potential causes of a problem**, then select those which require further investigation.

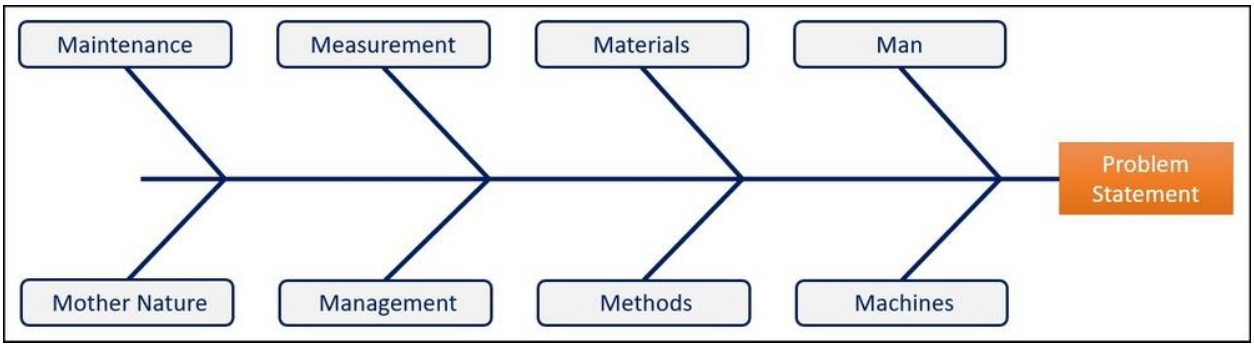


The Cause & Effect Diagram is also commonly referred to as the **Fishbone Diagram, the Ishikawa Diagram, Cause & Effect Matrix, C&E Diagram or the C-E Diagram.**

The Cause and Effect Diagram can be completed as part of a 3-step process.

**Step 1** is to agree on the **problem statement,** this is the negative **"effect"** you're experiencing. This might seem simple, but it's important to align on the problem statement prior to continuing.

**Step 2** is the **brainstorming process** which is facilitated by the **8M's of the Fishbone process (below)**, and should be used with a **process flow chart** and **5-Why technique** to truly identify causes, and not simply stop at symptoms.




**The Ishikawa Diagram** has **8 major categories** (The 8M's) that might contribute to your problem which include:

- **Man** - How do Humans interact with your product/process/equipment and how could that contribute to your problem.
- **Machine** - What type of equipment or machinery are used in your process and how could a deviation here contribute to your problem.
- **Method** - What type of process/procedure do you follow and what potential issues might contribute to your problem.
- **Materials** - What type of material is used and how could any material deviations contribute to your problem.
- **Mother Nature** - How does the environment interact with your product/process in a way that might contribute to your problem.
- **Measurements** - What type of measurements and measurement equipment do you use and how might this relate to the problem.
- **Management** - What are the attitudes, outlooks & priorities of management and how could this be contributing to your problem.
- **Maintenance** - What type of maintenance/calibration activities are being performed on your machines or measurement equipment that could be contributing to your problem.

Once you've brainstormed and created a list of **potential causes and contributing factors**, you can move on to Step 3.

Step 3 is to **prioritize an action plan of investigation steps** that will help **confirm or exclude the potential causes and factors.**

Another underrated characteristic of the Cause & Effect Diagram is its **effectiveness as a communication aid**. Especially when you're dealing with a very complex issue.

Let's go through a quick example

## Cause & Effect Example

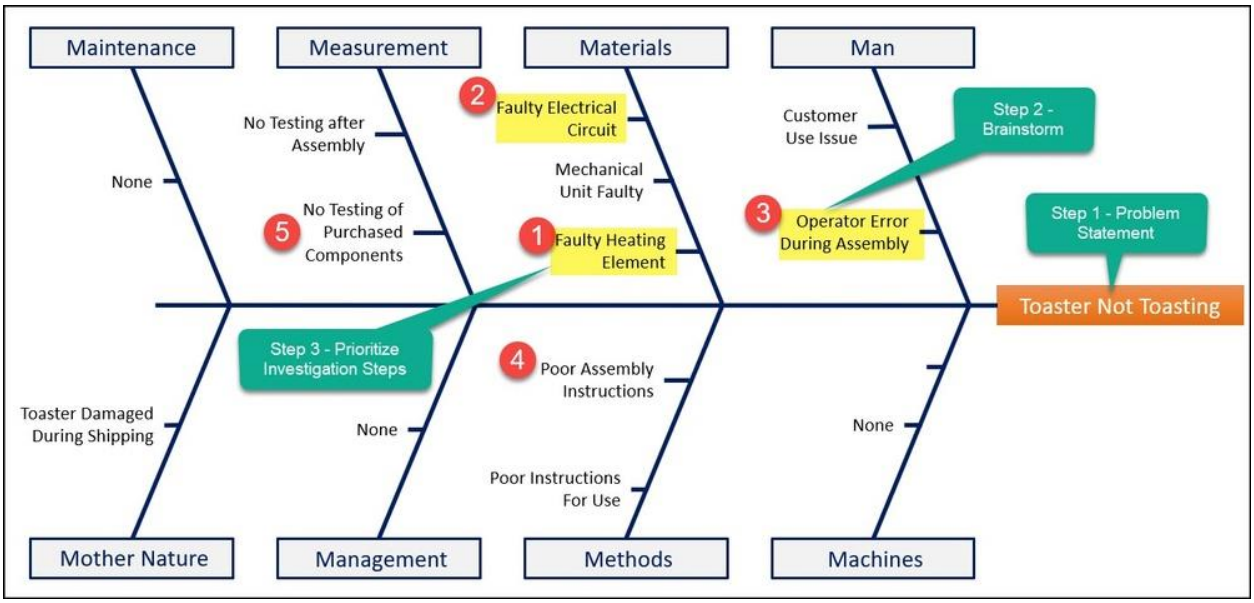
Let’s say you’re a Toaster Manufacturer and you received a customer complaint for a toaster that is not toasting.

Step 1 in the Cause and Effect process is to **agree on a problem statement**: The Toaster is not toasting.

With more data we could refine this problem statement to improve the brainstorming, but for now we will leave it generic.

We can always refine the problem statement as the investigation progresses.

Then we can go through the brainstorming process using the 8M’s to identify potential causes and contributing factors that require further investigation.

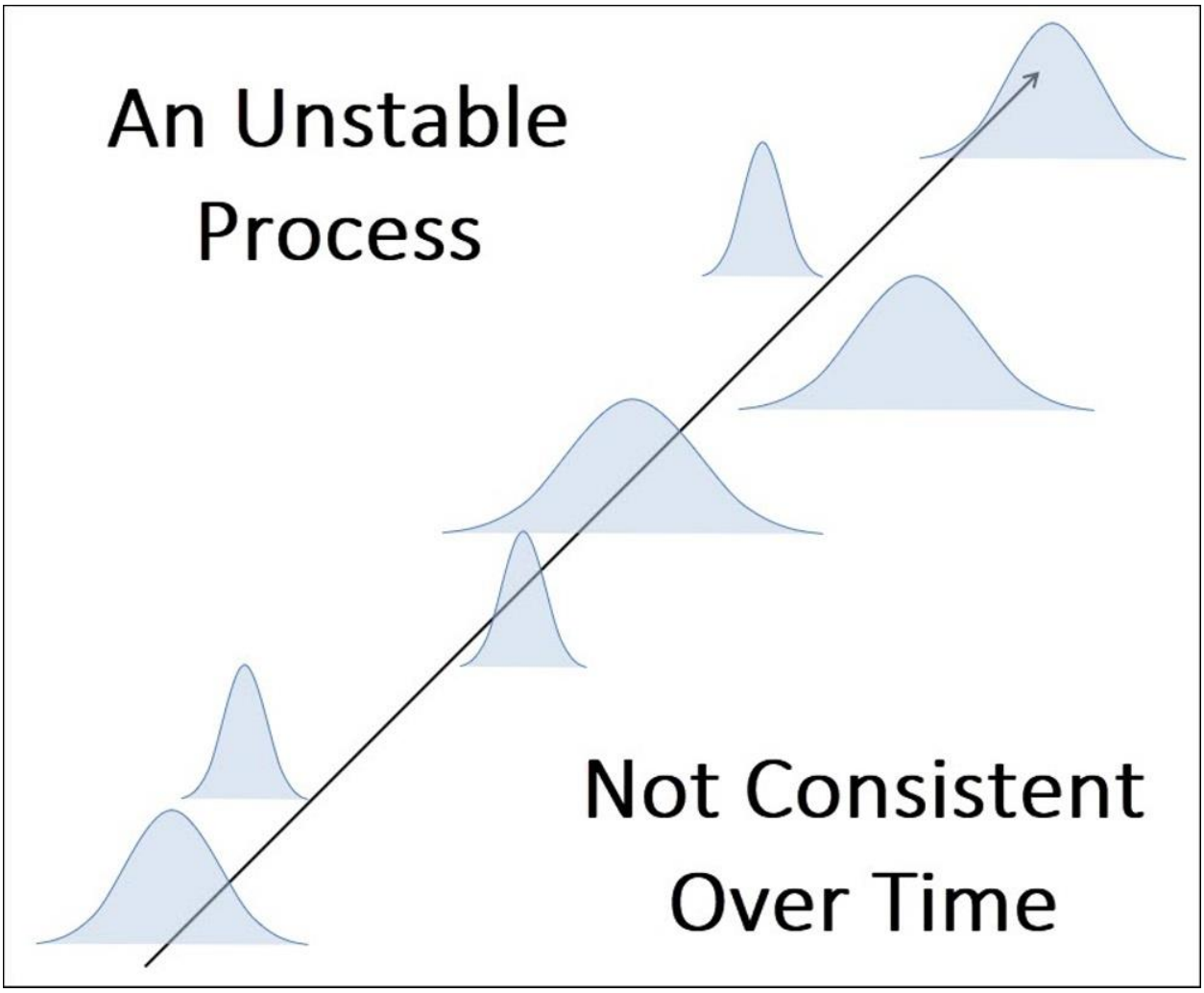



You can see here we've excluded maintenance, machines and management, and identified potential causes and contributing factors in other areas.

We can also prioritize the most likely contributing factors which should give the investigation actions to conclude the root cause of the problem.

For example, we agree that the most likely root cause is a faulty heating element, and we will focus our investigation here first.

# Control Charts




**A Control Chart** is a statistically based tool that **analyzes the variation of a process**.

A Control Chart is a *time-based line graph* that reflects the behavior of a process over time including normal variation and any special cause variation.

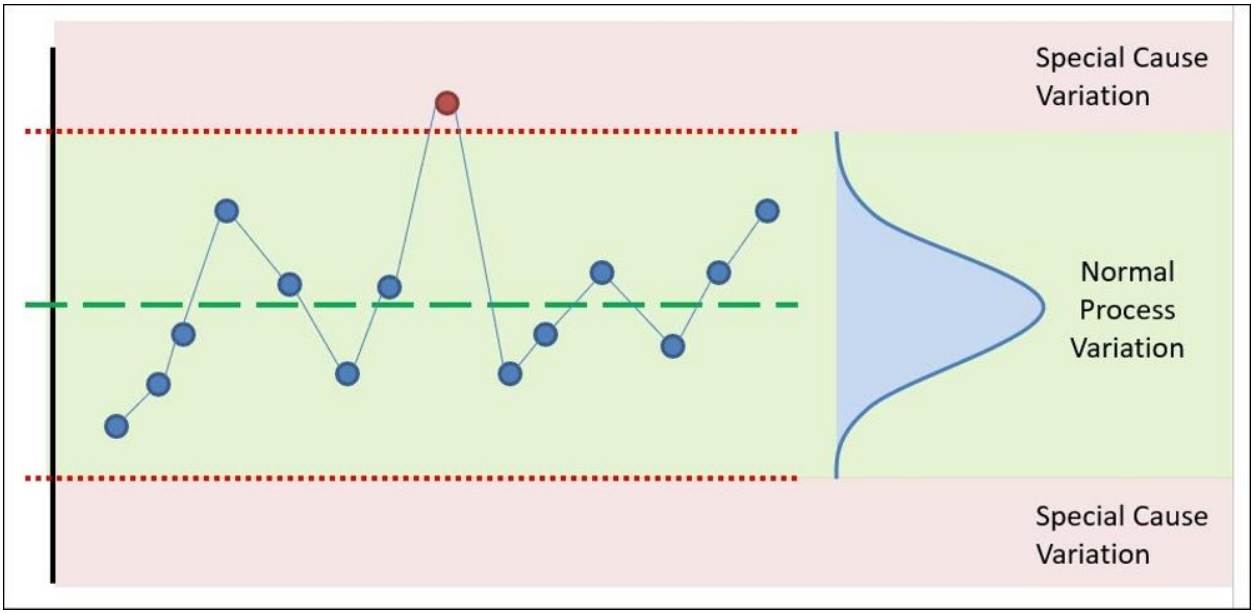
A Control Chart can also be described as a **visual communication tool** that **graphs analyzed data** in real-time and reflects the **stability of a process**.

Remember - A good process is a stable process – we want stability.

An unstable process is unpredictable and results in both problems, and is a clear opportunity for improvement.

The details of the control chart, including the various kinds, how to create them, and how to analyze them can be found in the **Statistical Process Control** chapter.

This section is a high-level summary of **the Control Chart**, along with how it can be used to solve problems and improve processes.




The Control Chart contains **upper and lower control limits** that are statistically based, which allow the user to identifying instances where the process appears to be behaving abnormally.

These **control limits and centerline represent the "voice of the process"** and are simply a reflection of the process – both the average value of your process and the natural variation of the process.

The primary benefit of a control chart is its unique ability to **separate the normal variation** within your process from the **special cause variation.**

**Special cause variation causes problems**. It represents an **opportunity for improvement**.

Normal cause variation can also be an opportunity for improvement, however reducing normal cause variation can be difficult because it can often require making substantial changes to the process itself.

Using control charts allows you to **proactively monitor your process**, **detect when a problem is occurring** (or has occurred), which is the starting point for an improvement project.

A Control Chart is like a **scoreboard**. It can be used at the end of an improvement project to indicate if an improvement was successful or not.