Variation in process output and other quality problems can occur for a variety of reasons, such as materials, machines, methods, people, and measurement. The goal of problem solving is to identify the causes of problems in order to correct them. The cause-and-effect diagram is an important tool in this task; it assists the generation of ideas for problem causes and, in turn, serves as a basis for solution finding.

The cause-and-effect diagram was introduced in Japan by Kaoru Ishikawa. It is referred to as Ishikawa diagram due to its originator or as a fish-bone diagram because of its structure.

Cause-and-effect diagrams are indispensable tools in allowing a team to identify, explore, and graphically display, in increasing detail, all of the possible causes related to a problem or condition to discover its root cause(s).
What does it do?

• Enables teams to focus on the content of the problem, not on the history of the problem or differing personal interests of team members
• Creates a snapshot of the collective knowledge and consensus of a team around a problem. This builds support for the resulting solutions
• Focuses the team on causes, not symptoms

How do I do it?

1. Select the most appropriate cause-and-effect format. There are two formats:
   - Dispersion Analysis Type is constructed by placing individual causes within each “major” cause category and then asking of each individual cause “Why does this cause (dispersion) happen?” This question is repeated for the next level of detail until the team runs out of causes.
   - Process Classification Type uses the major steps of the process in place of the major cause categories. The root cause questioning process is the same as the Dispersion Analysis Type.

How do I do it? contd...

2. Generate the causes needed to build a Cause & Effect Diagram. Choose one method:
   - brainstorming
   - check sheets based on data collected by team members before the meeting

How do I do it? contd...

3. Construct the Cause & Effect diagram
   - Place the problem statement in a box on the right hand side of the writing surface.
   - Draw major cause categories or steps in the production or service process. Connect them to the “backbone” of the fishbone chart.
Major types of causes

- **Production Process**
  - machines (equipment)
  - methods (how work is done)
  - materials (components or raw materials)
  - people (the human element)

- **Service Process**
  - policies (Higher level decision rules)
  - procedures (steps in a task)
  - plant (equipment and space)
  - people

In both types of processes, *environment* (buildings, logistics, and space) and *measurement* (calibration and data collection) are also frequently used.

Remember: There is no perfect set or number of categories of causes. The user must make them fit the problem at hand.
**Fishbone Diagram**

- **Quality Problem**: Faulty testing equipment, Incorrect specifications, Improper methods, Out of adjustment, Tooling problems, Defective from vendor, Not to specifications, Ineffective quality measurement, Poor process design, Ineffective quality management, Deficiencies in product design.
- **Environment**: Inaccurate temperature control, Defective from vendor, Not to specifications, Ineffective quality measurement.
- **Materials**: Out of adjustment, Tooling problems, Old / worn, Defective from vendor, Not to specifications, Ineffective quality measurement.
- **Process**: Ineffective quality management, Poor process design, Out of adjustment, Tooling problems, Inaccurate temperature control, Defective from vendor.
- **Human**: Poor supervision, Inadequate training, Lack of concentration, Poor process design.
- **Machines**: Faulty testing equipment, Incorrect specifications, Improper methods, Out of adjustment, Tooling problems, Defective from vendor, Not to specifications, Ineffective quality management.

**Problems with Airline Customer Service**

- **Main Cause**
  - Inadequate supervision
  - Inadequate training

- **Main Cause**
  - Inadequate supervision
  - Inadequate training

**Effect**

- Customer dissatisfaction
- Loss of business
- Damage to reputation
Cause and effect analysis of Bed Assignment delay in a hospital

Process Classification Type of Cause & Effect Diagram

It uses the major steps of the process in place of the major cause categories. The root cause questioning process is the same as the Dispersion Analysis Type.

Illustration
Parking Garage Operation

Next slide shows the customer system portion of a flowchart used to improve the parking garage operation. Potential contributors to poor quality are listed on the chart in a manner similar to the dispersion analysis type of a cause & effect diagram.