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Cause-and-Effect Diagrams

A cause-and-effect diagram, or fishbone diagram, is a variation of brainstorming used for identifying potential causes of a problem. The cause-and-effect diagram was developed by Kaoru Ishikawa, Professor in the Faculty of Engineering at the University of Tokyo. Because of this, cause-and-effect diagrams are also called Ishikawa diagrams.

As you brainstorm potential causes, your ideas are grouped into logical categories. These categories are often referred to as the 6M's: measures (or measurements), materials, manpower (or people), Mother Nature (or environment), methods (or procedures), and machines (or equipment).

But teams can customize the categories to meet their needs. For example, if you are using a cause-and-effect diagram to brainstorm the causes of declining sales, your categories might be pricing, products, and so on. The categories in the diagram help to trigger ideas.

For example, you can ask, "Consider the materials we use. What are the potential causes of the problem that are related to our suppliers or our raw materials?" Each cause can have one or more sub-cause. The final diagram might look something like this, with many causes, sub-causes, and even sub -sub -causes.

Here are the basic steps for creating a cause-and-effect diagram. Define the problem or effect. Define the categories. Brainstorm potential root causes. Identify the most probable root causes. These steps are typically guided by a facilitator.

Let's look at an example. In this scenario, a team uses a cause-and-effect diagram to identify potential root causes of variation in coating thickness. The issue is reviewed and discussed to make sure everyone has a clear understanding of the problem. The problem is written on a whiteboard, and the spine of the diagram is drawn.

Then the team determines the categories of potential root causes. They decide to use the standard categories of measurements, materials, people, environment, methods, and machines. They add branches off of the spine and record the categories.

Next, the team brainstorms potential causes, using the brainstorming ground rules and guidelines provided in a previous video. The causes are recorded in the most appropriate category. As with any brainstorming session, the goal is to generate a lot of ideas. The categories are there to help with idea generation. Thus, the team doesn't spend too much time discussing which category an idea belongs in. For each potential cause, the team asks "Why?" several times to drill down to sub-causes and sub -sub causes.

When the diagram is complete, the team reviews the diagram to make sure that the causes are clearly understood. Then the team identifies the most likely causes of the problem.

Remember that multi-voting can be used to narrow down a list of ideas. This technique can also be used with cause-and-effect diagrams. For this scenario, the team easily reaches a consensus that the most likely causes are related to processing time, part preparation, and deposition rate. The next step might be to verify the most probable causes, using DOE (design of experiments) or other statistical techniques.

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