

Brainstorming Activity

Instructor Guide

Note to Instructor

This activity is intended to give participants practice in effective brainstorming and evaluating the results of a brainstorming session. Participants will participate in two brainstorming sessions and work with the brainstorming team to evaluate the results of one of the sessions. The second brainstorming results will be evaluated in the Step 4 of *Systematic Approach to Problem Solving PK*. This activity is intended to be completed during the reading of the PK, specifically during Step 3. By splitting up the PK with this activity, the participants can immediately apply what they are learning.

The *Systematic Problem Solving Learning Module* consists of the following:

- Activity: Thinking Creatively
- A Systematic Approach to Problem Solving PK (Reading material)
- **Brainstorming Activity**
- Problem Solving Activity – The Lawn
- Problem Solving Tools PK (Reading Materials)
- Problem Solving Activity – A MEMS Process Problem

This Instructor Guide (IG) contains all of the information in the Participant Guide (PG) as well as answers to the activities. A short Powerpoint is provided as a review of the Brainstorming process and rules

Activity Description

In this activity you will participate in two brainstorming sessions. During each session, you are to apply the rules for brainstorming and help the group generate as many ideas as possible. In Part II of this activity you will evaluate the results of the first session. The result of the second session will be evaluated during the discussion of Step 4 in the reading material *A Systematic Approach to Problem Solving*.

Objectives

- Given a problem, work with at least one other person to develop possible solutions or causes of the stated problem.
- Evaluate the possible solutions for a problem for the best and most practical solution.

Introduction

Many times, when solving a problem, the cause of the problem is not obvious. When the cause is not obvious, then BRAINSTORMING is a way to generate possible causes (solutions) so that everyone can better evaluate and identify the probable causes (solution).

Brainstorming is a method used by two or more people to generate ideas and possibilities. The goal is to come up with as many ideas as possible, focusing on quantity, not quality. As a person throws out an idea, others can build on it.

When it comes to brainstorming - NO IDEA IS STUPID.

Criticizing one's idea inhibits free expression. The best ideas are likely to come from people who work well together and feel free to speak their mind. Group brainstorming sessions lead to more good ideas than an individual working alone. People expand on the ideas of others and new ideas evolve as the team works it way through the process.

During a brainstorming session, there are many phrases that are not allowed. Such as...

It's a good idea, but...
It won't work
It's too expensive
We've never done it that way.
We've already tried that.
It's not in the budget.
Let's be practical

A brainstorming session is no time to be negative. ALL ideas are accepted because the purpose of brainstorming is to come up with a list of all possible and probable ideas. Once the list is created, duplicate ideas are eliminated or combined. The team discusses the ideas and determines which ones are worth further investigation.

There are rules to brainstorming and it is important that these rules are followed. If they aren't followed, then the creative process can fail.

Rules for Brainstorming

- Freewheel – Don't hold back any ideas, even if they seem silly at the time. The more ideas, the better. (However, keep it real.)
- Hold discussion of an idea until later.
- Don't make judgments. Don't criticize another's idea, not even with a groan or a grimace!
- Piggyback – build off the ideas of others.
- Write down ALL of the ideas on the board so everyone can see them.

EXERCISE 1: Brainstorming for Bathtubs

1. You need **at least** three people for this exercise (including yourself).
2. Designate a recorder. This person will list the items on the board or on a screen for everyone to see. The recorder will also participate.
3. Make sure everyone can see the board or screen.

Scenario: You are to create a business that recycles old bathtubs. As a group you are to generate as many possible uses, reuses, modification, etc. for the used bathtubs.

To provide organization to your session and to ensure that everyone is allowed input, take turns. Go around the circle. If you don't have an idea, say "Pass." The recorder will list ALL items as they are spoken. Once everyone passes and no more ideas are being generated, it's time to evaluate the results (Part II of this activity).

Questions (Answer AFTER your brainstorming session is complete):

1. Did everyone participate?
2. Did you see anyone "piggyback" off another's idea? Do you "piggyback"?
3. Did the group generate more ideas than you would have generated if you had worked alone?
4. How many ideas did you generate as a group?

Part II – Evaluate Your Ideas

Step 4 of Problem Solving is to evaluate the ideas generated in the brainstorming session. During this evaluation, you see that most of the ideas can be discarded because it's a duplication of another idea, it's impractical or impossible, it's too costly, or other ideas are much better.

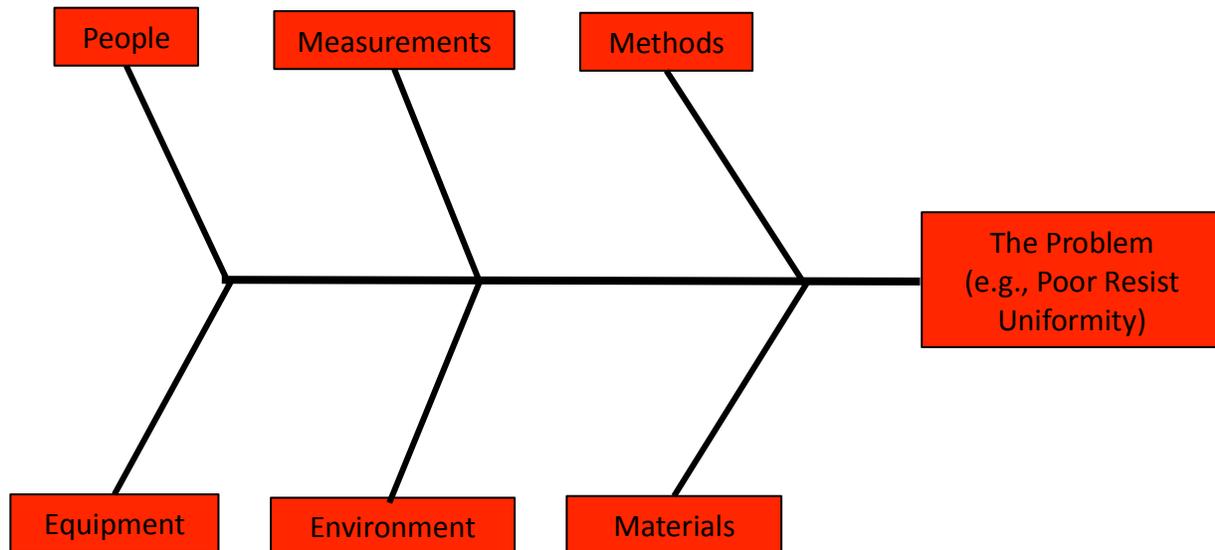
Let's evaluate your bathtub recycling ideas. As a group, narrow your list down to the BEST two ideas. Keep in mind that you are a business, so use the same criteria that a business would use in your evaluation – practicality, cost, customers, and viability. Discuss each of the items in your list and reach a consensus on the best two ideas.

Cause & Effect (C&E) Diagrams

In the 1960's Kaoru Ishikawa of Japan developed several problem-solving tools to be used by quality improvement teams. The cause and effect diagram was one of those tools. Other tools included checksheets, histograms, Pareto diagrams, control charts and scatter diagrams.

The purpose of a C&E diagram is to illustrate various sources or possible causes of a problem relative to specific areas (such as equipment and people) and identify relationships between different areas relative to the problem. It is a tool that helps the problem solvers to structure their ideas in specific categories and generate new ideas through brainstorming.

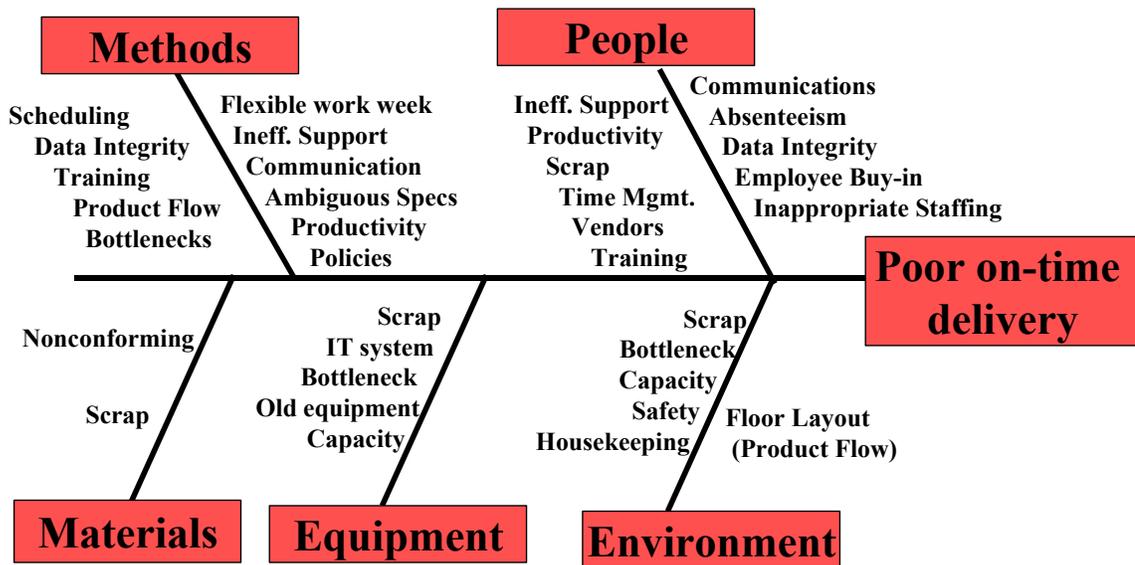
A C&E (also called an Ishikawa diagram or fish bone diagram) usually has five to six major stems or *fish bones*. In manufacturing, these fish bones are normally labeled *materials, methods, measurements, machine, personnel, and environments*, the six major areas that affect most manufacturing problems. The head of the “fish” is the Problem.



During the brainstorming session, team members generate possible “causes” under each heading that could have an “effect” on the problem. For example, if the problem is “poor resist uniformity” a possible cause could be “non-calibrated equipment” under “Measurements”. As with any brainstorming session, the team continues to add “causes” to the diagram until no more ideas can be generated. Once the diagram is complete, the data collected in Problem Solving Step 2 (Analyze the Problem) is used to eliminate many of the possible causes. For example, maintenance records may show that the measuring equipment had just been calibrated, allowing the team to assume that this is not the cause of the problem.

The team continues to evaluate the C&E data until no more causes can be eliminated. The remaining causes are then prioritized from the easiest to eliminate to the hardest. More questions are asked and more data is collected until the root cause of the problem is identified.

The diagram below is an example of a C&E diagram that was generated to identify factors affecting "on-time delivery of customer orders".



NOTE: Measurements was eliminated for this particular problem because the team did not see a cause and effect relationship between measurements and poor on-time delivery.

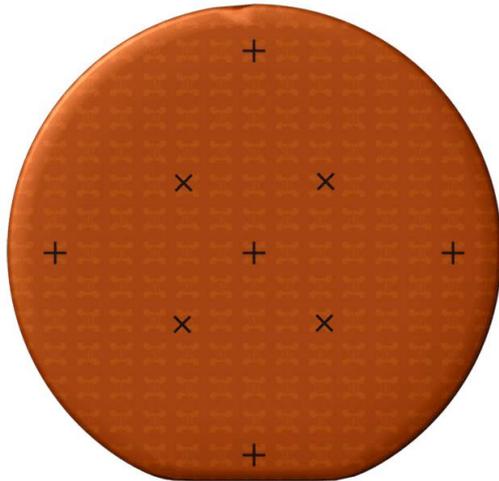
Once the C&E diagram was completed, the team applied the information from its initial problem analysis and identified the causes by the *degree of effect* on the problem. The *degree* ranged from negligible to major effect. The final analysis identified the areas of *scheduling, product flow, and factory layout* as having the "most" effect on late deliveries. At this point, the problem-solving team began to develop solutions followed by action plans.

In the next part of this activity, you will use a C&E diagram during your brainstorming session.

EXERCISE 2: Brainstorming for Possible Causes of Poor Photoresist Uniformity

Problem Statement:

(Microtechnology processing example) The photoresist uniformity data on the last batch of wafers is outside acceptable limits; therefore, the process needs to be halted and the uniformity problem corrected.



A photoresist uniformity test involves measuring the photoresist thickness at several points on the wafer, as shown in the left image with an “x” and “+”. The range (thickest point – thinnest point) and the mean (sum of all measurements / # of measurements) are calculated. This data is then compared to what is acceptable to determine if the thickness is correct and uniform.

(NOTE: At the end of this activity is a flowchart for the manufacturing process of a micro-pressure sensor as well as a graphic showing the steps of the photolithography process. A review of this information may help you remember many of the factors that could affect photoresist uniformity. Therefore, take a few minutes and review this material.)

Brainstorming Session:

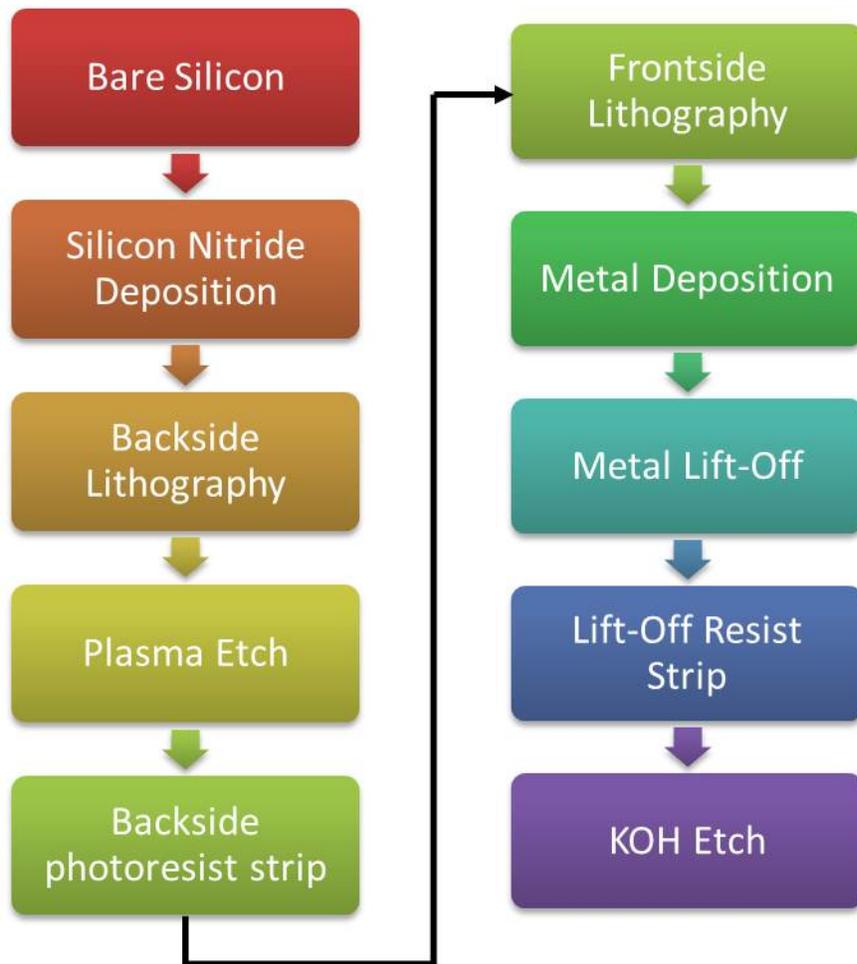
Following the rules for brainstorming, brainstorm for possible causes of the uniformity problem describe in our problem statement. Use a Cause & Effect Diagram to record and organize your items. The recorder needs to draw the C&E diagram where everyone can see it and record items as they are identified.

A change for this session is to include the “area” in which the possible cause falls. For example, “bad resist” under “Materials” or “new operating technician” under “personnel”.

Once you have completed your brainstorming session, return to the reading material (*A Systematic Approach to Problem Solving*) for the next step to problem-solving. Keep these results handy, because you will need them again.

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Quick Review of MEMS Pressure Sensor Process Steps



Photolithography Steps – Coat, Expose, Develop

