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Fishbone Diagram

Sometimes it is difficult to spot problems and only symptoms will be acted on leaving the real causes intact. This indicates lack of information and poor understanding of the problem and leads usually to a weak solution. A **Fishbone Diagram** is often used to identify and organize the potential causes of a business problem in an easy and understandable format. It is used to identify the sources of process variation which caused the problem to occur. It is called this way because of its shape that looks like a fishbone. It is also called **Ishikawa Diagram** and **Cause and Effect Diagram**.
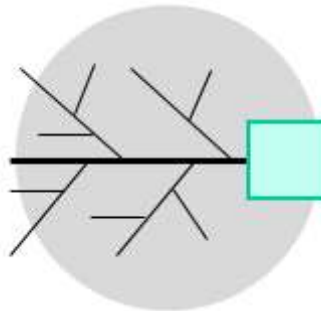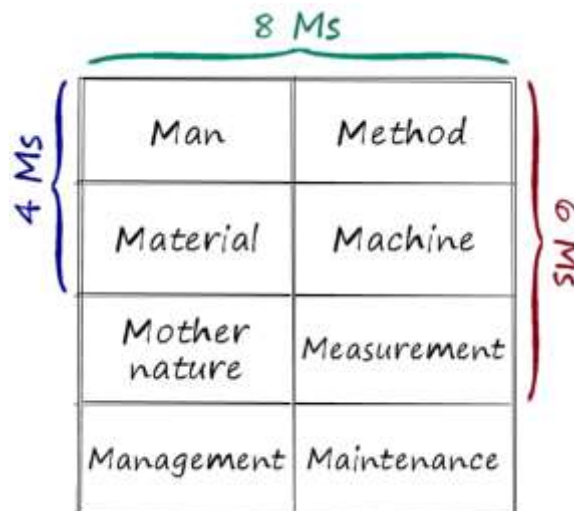
A fishbone diagram is often used during brainstorming sessions to identify the causes of an undesirable effect of a problem. It is also possible to identify the hierarchy of causes including the possible root causes which are the real sources of variation within a process. This brings attention to the primary factors affecting the quality of a product or service. These factors are the variables that need to be optimized in

order to reduce the amount of process variation, and therefore improve the process. Hence, the outcome of a fishbone diagram can provide initial information to later problem solving tools.

By going through the process of constructing the diagram with your team, everyone gains insight into the cause and effect, which makes the solution easier to find later on. A fishbone diagram will also help to create ideas about the possible causes of a problem before it happens. It is an effective cause prevention tool that helps to identify the potential factors causing an effect to prevent future problems. It can also be used in product design and to plan new processes.

Potential causes (or process input variables) in a fishbone diagram are normally grouped into categories for easier sharing and reference. These categories typically include: man, machines, materials, methods, measurements and environment. These are often called the **6 Ms** and are used to label the different branches on the diagram:

- **Man** – anyone involved with the process and contributes to the effect.
- **Methods** – how the process is performed and the specific requirements for doing it, such as: the policies, procedures, rules and common practices.
- **Machines** – including the equipment and tools required to do the process.

- **Materials** – including the raw materials, parts, papers, packing and consumables needed to produce the product or provide the service.
- **Measurements** – including the data that are used to evaluate the performance of the process.
- **Environment** (or Mother Nature) – the conditions in which the process operates, such as: the location, time, temperature, and culture.
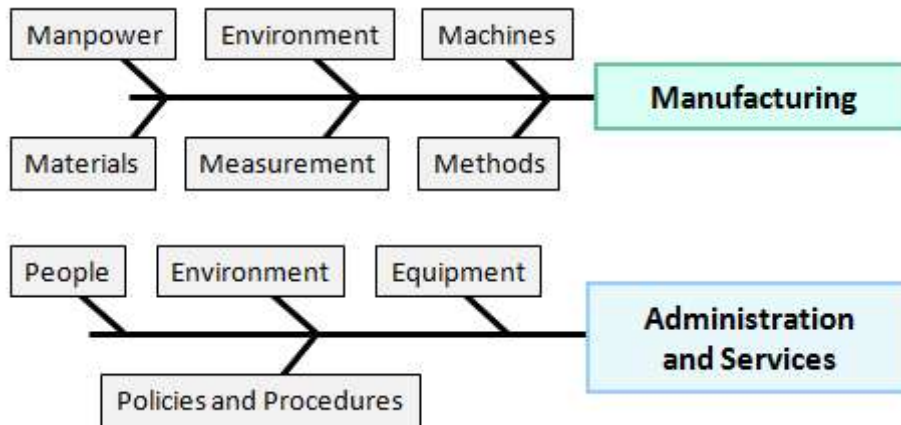
Typical Fishbone Diagrams for Manufacturing and Non-manufacturing Processes

How to Construct a Fishbone Diagram:

The following steps explain how to construct a fishbone diagram:

- With your team, clearly define the effect of the problem then write it down at the center right (fish head) of a large piece of paper.
- Determine the major categories of causes then write them on the branches of the diagram. The 6 Ms provides a good start.

- Use brainstorming to log all possible causes under the appropriate branches.
- Use **5 Whys** to search for root causes then add them to the diagram.
- Take time to ensure the appropriateness of the recorded information and update the chart as new causes become apparent. Ways of finding more causes include:
  - Keep asking questions to encourage everyone to participate.
  - Involve other people, especially those who have experience in the process.
  - Leave the chart on the wall for few days and encourage passers-by to contribute.
  - Take a break or do something to take the team's mind off the current thoughts.
- Mark or assign numbers near to the key causes to show their relative priority.
- Collect data and investigate to verify the key causes are actual.
- Plan and implement actions to address the key causes.
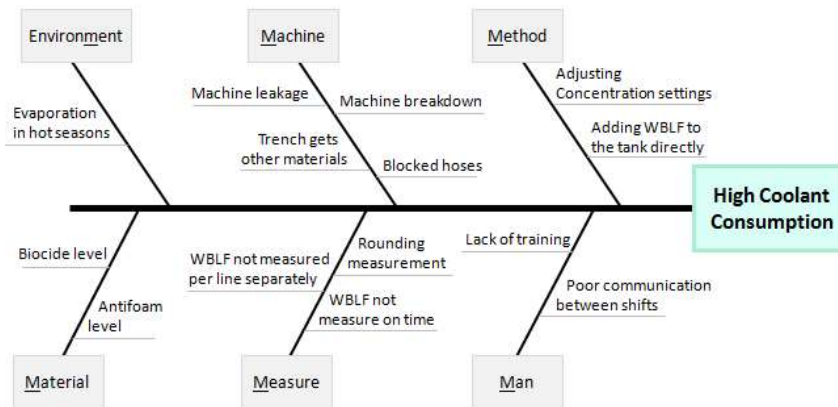
Example 1:

The example shown here is the output of a brainstorming session on the causes of the increased

invoice errors for a particular company.
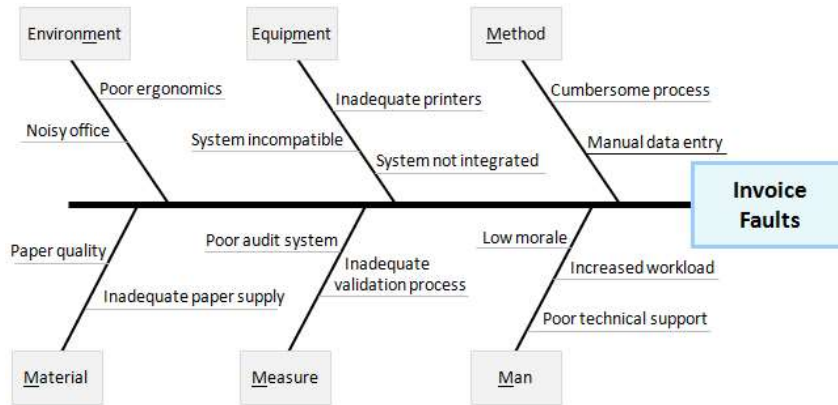
Example 2:

The following is an example of a fishbone diagram that has been drawn for the causes that increased the coolant consumption in a manufacturing plant. This fishbone diagram is labeled with the 6 Ms.

Further Information:

- Different names may be used for the same category depending on the situation. For example, "Procedures" could be used instead of "Methods" and "Equipment" could be used instead of "Machines".
- You may even create your own branches that suit your needs.

- An affinity diagram could be used to create the branches of the diagram from the titles of the affinity sets.
- Don't overload categories. Establish another category if needed.
- You could also create sub categories under the main categories. For example, under "Man" there might be "Poor Communication", "Absenteeism", and "Lack of Training". You should, however, avoid writing real names of persons under the "Man" category.
- Beware of adding causes which are actually solutions.
- A **Cause and Effect Matrix** could be used to prioritize the causes of the problem.
- Prioritizing and selecting the key causes will minimizes the need for more statistical evaluation of inputs that are unlikely to have an impact on the output.

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