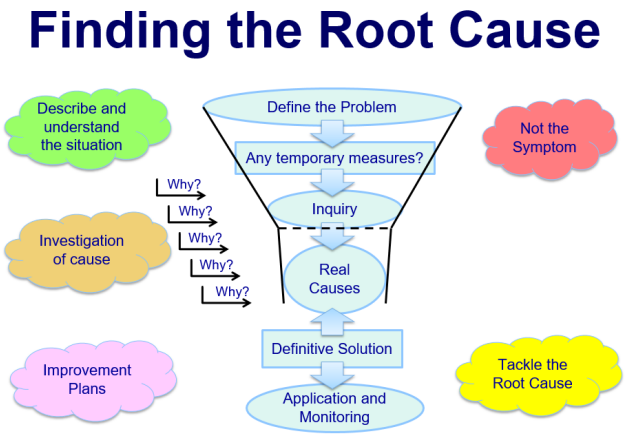
Root Cause Analysis



When things go wrong stakeholders, almost by default, want a quick and simple explanation of the problem which tends to lead to a search for the *'wrong cause'*! Understanding the *'real cause'* needs more work. There are numerous techniques to assist in the process including Ishikawa (fishbone) diagrams that look at cause and effect; and Toyota's 'Five Whys' technique which asserts that by asking 'Why?' five times, successively, can you delve into a problem deeply enough to understand the ultimate root cause of a problem.

These are valuable techniques for understanding the root cause of a problem in simple systems, but in complex systems a different paradigm exists. Failures in complex socio-technical systems[1] such as a project teams do not usually have a single root cause, and the assumption that for each specific failure (or success), there is a single unifying event that triggers a chain of other events that leads to the outcome is unlikely to be completely correct. So whilst these techniques are useful, they may not provide a complete answer.

Ishikawa Diagrams

Dr. Kaoru Ishikawa invented the fishbone diagram, also referred to as the Ishikawa diagram. It is an analysis tool that provides a systematic way of looking at effects and the causes that create or contribute to those effects. Because of this function it may also be referred to as a cause-and-effect diagram.

The underlying assumption is that cause-and-effect relationships govern everything that happens and as such are the path to effective problem solving. By knowing the causes, we can find some that we can change or modify to solve the problem or meet our goals and objectives, as in the example below, quickly locating a drawing.

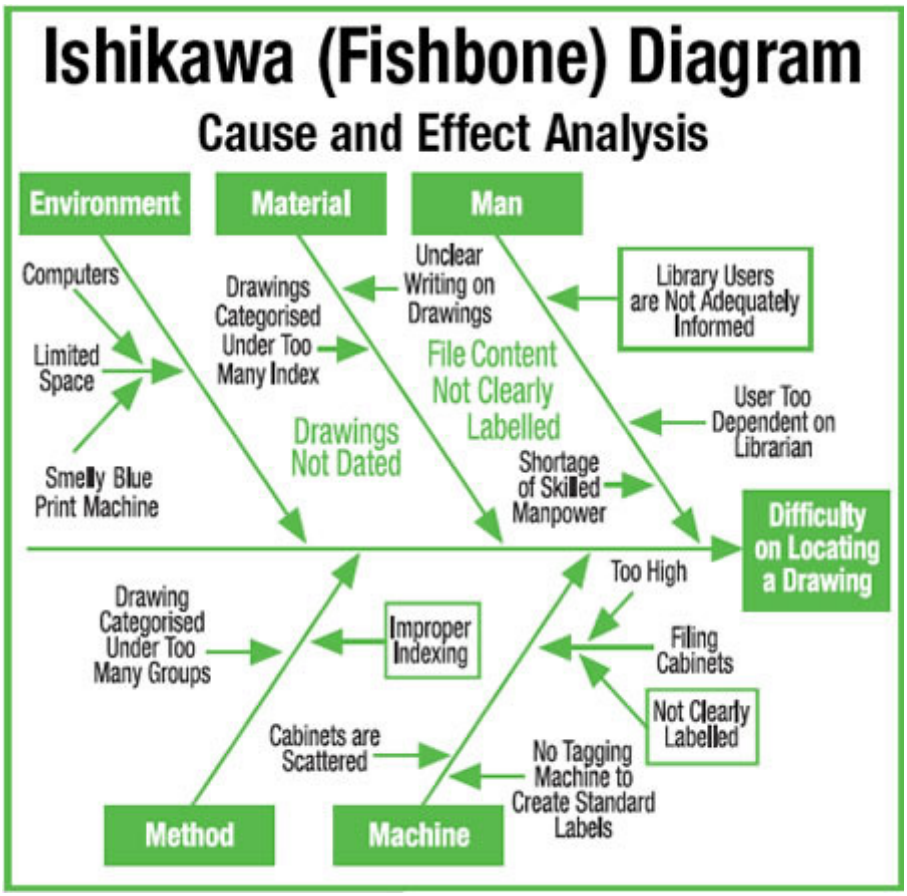
The Ishikawa Diagram is usually constructed by a problem-solving team using the following basic steps:

- Prepare the basic framework of the Ishikawa Diagram on a large writing area, such as a whiteboard or a flipchart;
- Define the problem that needs to be addressed and describe it in clear and specific terms, then write this description in the problem box or fish head of the diagram;
- Finalize the cause categories of the major branches and write these at the tips of the major branches;
- Conduct a brainstorming session using these basic brainstorming guidelines:
    - Each participant will be asked one at a time to give a cause of the problem (only one input per turn!), saying 'Pass' if he or she can't think of any during his or her turn;
    - Each cause identified will be 'hung' on the major branch of the category it belongs to; if it's the cause of another cause that's already on the diagram, then it must be 'hung' on the branch of the latter; if applicable, a cause may be placed on several branches;

[1] For more on complexity theory see ***A Simple View of 'Complexity' in Project Management***: http://www.mosaicprojects.com.au/Resources_Papers_070.html

- The brainstorming session continues until everyone says 'Pass'.

- Interpret the Ishikawa Diagram once it's finished.



There are many ways to interpret the Ishikawa Diagram. The fastest and simplest way to do it is for the group to choose the top five causes on the diagram and rank them, using their collective knowledge and any data available. The selection of the major causes may be done by voting or any other process that allows the group to agree on the ranking[2]. The selected causes are then encircled on the diagram, with their ranks written beside them. The team may then investigate these causes further and use problem-solving techniques such as the 5-Whys technique discussed below.

Toyota's 'Five Whys' technique

The 5-Why analysis method is used to move past symptoms and understand the true root cause of a problem. It is said that by asking 'Why?' five times, successively, you can delve into a problem deeply enough to understand the ultimate root cause and by the time you get to the 4th or 5th why, you will typically be looking at management practices.

Here is an example from a manufacturer:

Symptom: There is too much work in process inventory, yet we never seem to have the right parts.

Why?

[2] For more on ***ranking*** see: http://www.mosaicprojects.com.au/WhitePapers/WP1062_Ranking-Requirements.pdf

Symptom: The enamelling process is unpredictable, and the press room does not respond quickly enough.

Why?

Symptom: It takes them too long to make a changeover between parts, so the lot sizes are too big, and often the wrong parts.

Why?

Symptom: Many of the stamping dies make several different parts, and must be reconfigured in the tool room between runs, which takes as long as eight hours.

Why?

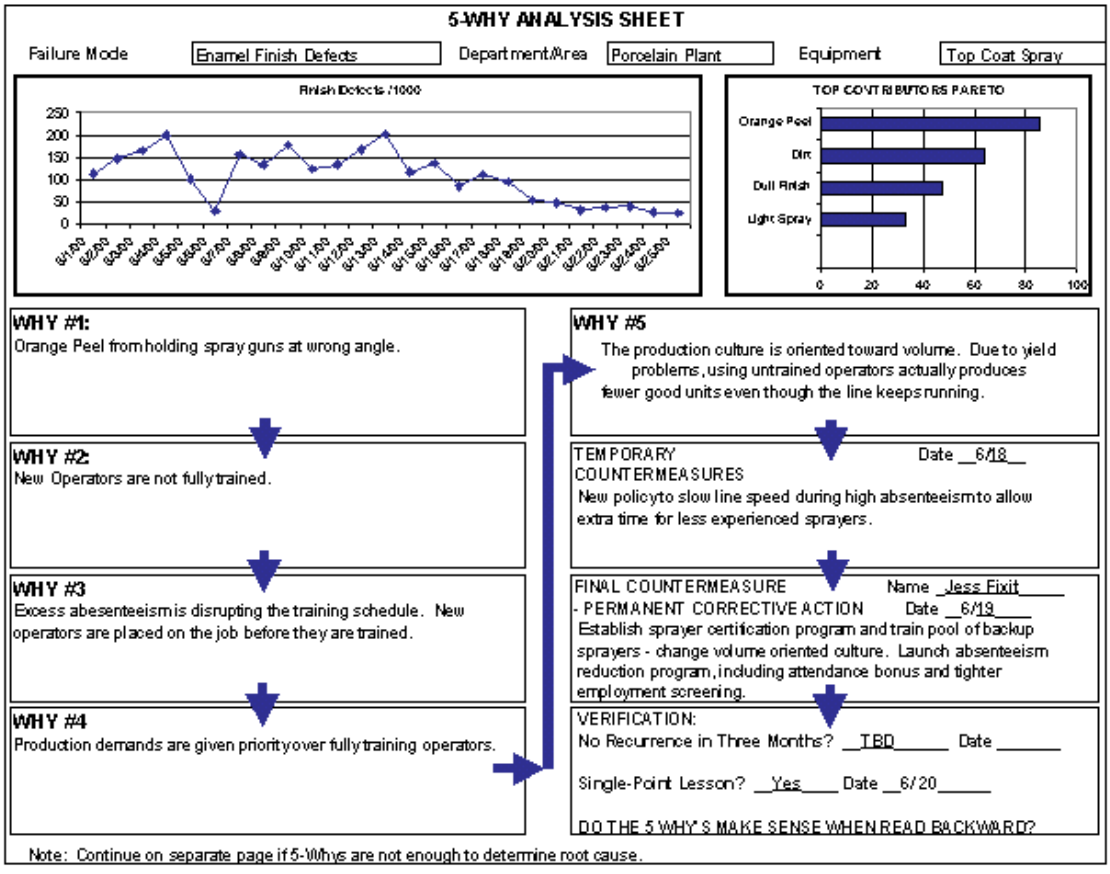
Symptom: The original project management team had cost overruns on the building site work, so they skimped on the number of dies - they traded dedicated dies and small lot sizes for high work-in-process (which was not measured by their project budget).

Why?

Root Cause: Company management did not understand Lean manufacturing, and did not set appropriate project targets when the plant was launched. It is almost universally true that by the time you ask why five times, it is clear that the problem had its origins in management.

Hybrid 5-Why Tools

A hybrid form of 5-Whys that includes a trend chart and a Pareto chart to guide the 5-Why thinking helps problem-solving teams. On one piece of paper, this form captures historical data, problem priorities, root cause analysis, corrective action, and verification. An example of the form is shown below with a hypothetical example from an appliance manufacturer.



Source: http://www.moresteam.com

Dealing with complexity

This assumption that each presenting symptom has only one cause that can be defined as an answer to the 'why?' is the fundamental weakness within a reductionist approach[3] used in the 'Five Whys' chart above. The simple answer to each 'why' question may not reveal the several jointly sufficient causes that in combination explain the symptom.

More sophisticated approached are needed such as the example below dealing with a business problem. The complexity of the fifth 'why' in the table above can be crafted into a lesson that can be learned and implemented to minimise problems in the future but it is not a single 'root cause'!

	Why 1	Why 2	Why 3	Why 4	Why 5
6	There is no computerized solution to handle job	There was staff resistance	They were not explained the full benefits of the	There was a lack of communication.	We assumed that the benefits were obvious.
7			They feared being made redundant	They thought the computer system was designed to replace them.	Because we didn't tell them how it would help make their jobs easier.
8			They were uncomfortable about changing the way they worked	They had always been doing it this way	All the work was done manually prior
9				The positive aspects of the change were not communicated.	We assumed that the benefits were obvious.
10	There was no formal set of procedures to handle job requests, and procedures were passed on by mouth as opposed to being documented.	There was no system in place to do so.	The company grew at an exponential rate that there was no time to document anything.	There was insufficient planning	Top management were too busy fire fighting and dealing with operational work, rather than developing a strategy

Source: http://www.bulsuk.com/2009/07/5-why-analysis-using-table.html

5-Why Summary

An effective 5-Why analysis is more than just an iterative process or a simple question asking activity. The objective of the process should be to get the right people in the room discussing all of the possible root causes of a given defect in a process. A disciplined 5-why approach will push teams to think outside the box and reach a root cause where the team can actually make a positive difference in the problem, instead of treating symptoms.

The 8 Disciplines (8D) methodology

8D requires you to identify and fix the problem immediately by taking steps to address the problem in the short term as well as identifying the Root Cause(s) to implement a long term permanent fix. 8D is focused on product and process improvement[4], and its purpose is to identify, correct, and eliminate recurring

[3] Reductionism is central to the development of project management. for more on this see : ***The Origins of Modern Project Management***: http://www.mosaicprojects.com.au/Resources_Papers_050.html

[4] For more on ***process improvement*** see: http://www.mosaicprojects.com.au/WhitePapers/WP1046_Process_Improvement.pdf

problems. Although it originally comprised eight stages, or 'disciplines', it was later augmented by an initial planning stage. The disciplines are:

D0: **Plan**: Plan for solving the problem and determine the prerequisites.

D1: **Use a Team**: Establish a team of people with product/process knowledge.

D2: **Describe the Problem**: Specify the problem by identifying in quantifiable terms the: who, what, where, when, why, how, and how many (5W2H) for the problem.

D3: **Develop Interim Containment Plan**: Define and implement containment actions to isolate the problem from any customer.

D4: **Determine and Verify Root Causes and Escape Points**: Identify all applicable causes that could explain why the problem has occurred. Also identify why the problem was not noticed at the time it occurred. All causes shall be verified or proved. One can use five whys or Ishikawa diagrams to map causes against the effect or problem identified[5].

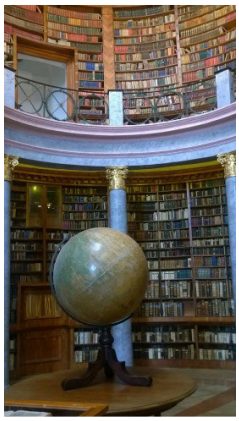
D5: **Verify Permanent Corrections (PCs) for Problem will resolve problem for the customer**: Using pre-production programs, quantitatively confirm that the selected correction will resolve the problem. (Verify that the correction will actually solve the problem.)

D6: **Define and Implement Corrective Actions**: Define and Implement the best corrective actions.

D7: **Prevent Recurrence / System Problems**: Modify the management systems, operation systems, practices, and procedures to prevent recurrence of this and similar problems.

D8: **The team needs to be formally thanked by the organization**. Congratulate main contributors to your team and recognise the collective efforts of the team.

8Ds has become a standard in the automotive, assembly, and other industries that require a thorough structured problem-solving process using a team approach.



[5] Other techniques include ***FMEA and FTA***, see: https://mosaicprojects.com.au/WhitePapers/WP1003_FMEA.pdf