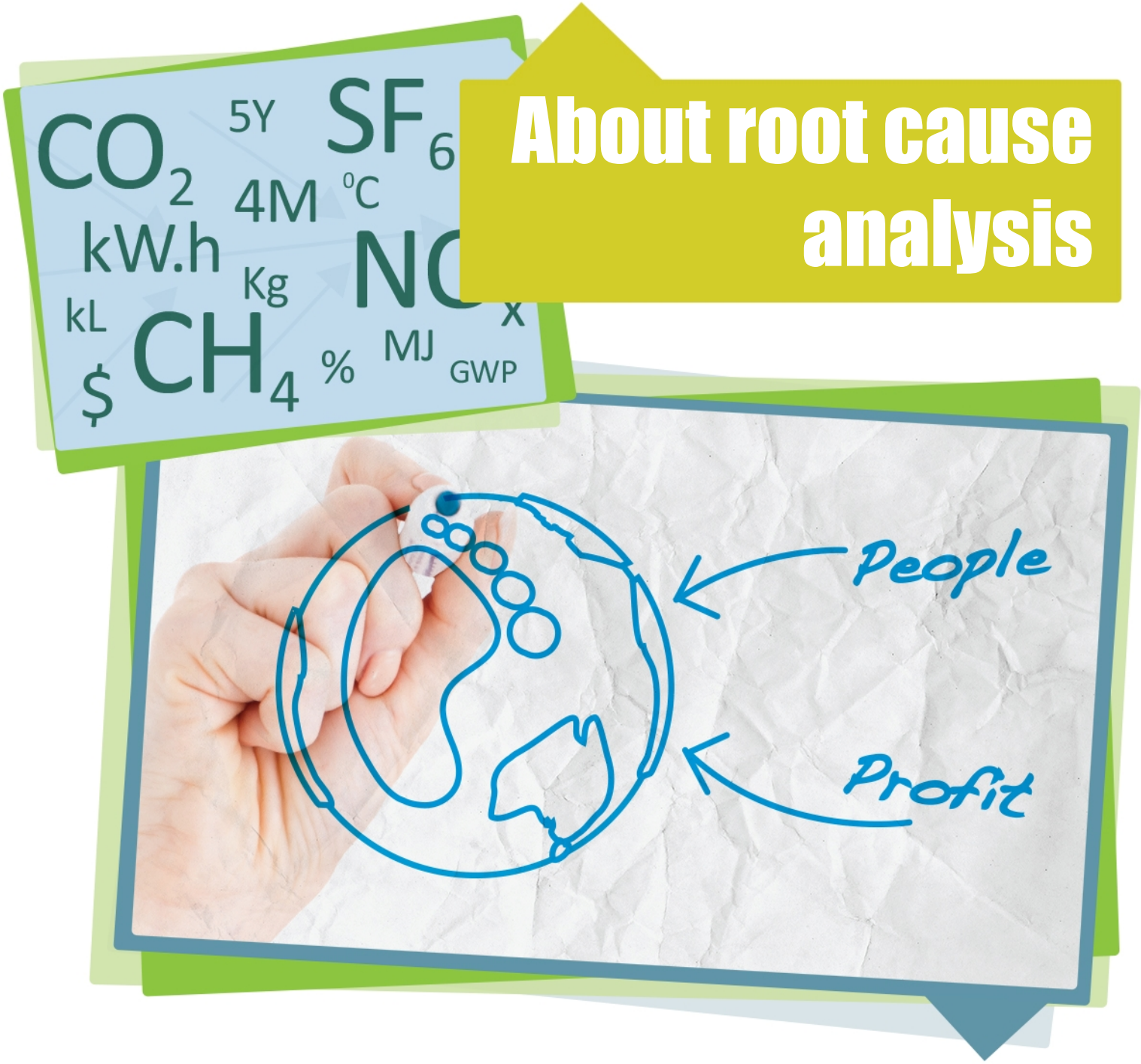
Skills for Sustainability

Manufacturing Skills Australia

About root cause analysis



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About root cause analysis

About root cause analysis (RCA)

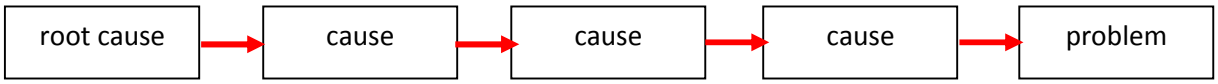
This guide provides general information about root cause analysis (RCA). It explains the basic concepts and demonstrates that a range of options might be relevant, depending on the context. There are many techniques of doing RCA, some simple, some less so. Any technique may be used.

The information is relevant to several units of competency in the MSS11 Sustainability Training Package; however the guide is **not** aligned to a specific unit of competency or AQF level.

What is RCA?

RCA is based on the philosophy that things don't just happen – they all have a cause. In addition, things don't have just one cause, but rather have many causes. Of these many causes, one however is the root cause, i.e. the cause from which all other causes might spring.

RCA is normally applied to finding the cause of a problem. If we eliminate the root cause, then the problem cannot recur. If we simply deal with the symptoms, or with subsidiary causes, then the problem can and will recur.



RCA may be used to find the root cause of any deviation – good or bad. We might want to find the root cause of a good deviation so that we can make sure it always happens.

RCA is also often used as another name for formal problem solving.

The causal tree

Sometimes the term 'causal tree' is used. This is another way of saying there is a chain of causes, or a series of linked causes leading to the problem.

The root cause may not be accessible (or even definable) in the real world, e.g. because the root cause is controlled by some part of the value chain over which you have no control. There are two approaches here (possibly both should be used):

- cut the causal tree as close to the root cause as you can get
- engage with the 'owner' of the root cause to eliminate the problem.

About root cause analysis

Problem definition

All techniques require the definition of the 'problem' before commencing the RCA. The 'problem' may also be called an 'opportunity for improvement' or a 'situation for analysis'. The problem definition should be a blunt statement which does not include any assumptions as to the cause. The following are examples of problem definitions:

- carbon emissions
- water consumption
- electricity use.

Five whys (5Y)

5Y is a simple technique which can be applied to any situation and may be conducted totally verbally (although some record may be desirable as evidence that it has occurred). To apply 5Y:

1. Why does the [defined process or process step] consume water?
   A. Because we need to dissolve material X.

2. Why do we need to dissolve material X?
   A. Because we need it as a solution for the process and we buy it as a solid.

NOTE a possible branching in the questioning here

3. Why do we need it as a solution of that concentration?
   A. It is quick and easy to dissolve at room temperature using that much water.

3a Why do we buy it as a solid?
   A. Because it is cheaper than buying it as a solution.

4. Why don't we dissolve in a lower volume of warm water?
   A. We don't have any means of heating the water.

4a Why do we consider only material costs and not process costs?
   A. We have always done it that way.

5. Why don't we have any means of heating the water?
   A. Because we predissolve in a drum before adding to the process.

5a Why have we always done it that way?
   A. It was simpler back when we used to do our costs by hand.

So, by simply asking 'Why?' five times we have come up with some interesting answers. Note also that in this example, because one of the answers had two parts, we have ended up with two possible lines of attack for the solution. Note that in both cases the answer is potentially simple:

- If heating is available close to where the dissolving takes place, it might be a simple and cheap solution to allow us to dissolve in less water. If the process the solution is used in is heated, then adding an already warm solution may reduce the cycle time/increase throughput.
- With increased ease of doing calculations, we should be doing total system costs, or even better total life cycle costs, and if we do this we may find that it is cheaper to buy the material already dissolved rather than incur the cost of water and the cost of labour to dissolve it.

Have we got to the root cause? Maybe not, but we've gotten far enough back on the causal tree to find some interesting possible solutions to the problem which will make permanent and significant change (and possibly at low cost). Note that these solutions may well also lead to other related improvements.

Cause/effect diagram

Cause/effect diagrams (also known as Ishikawa and fishbone diagrams) are a visual technique of examining multiple possible causes. It is a good technique to use with a group as it brings out and records ideas while simultaneously categorising them for later analysis. Many people start by labelling a few of the key 'ribs' on the fishbone spine. This helps the organisation of ideas and reduces the need to move items around. Ribs can always be added and labelled as the need emerges. Some typical ribs might include:

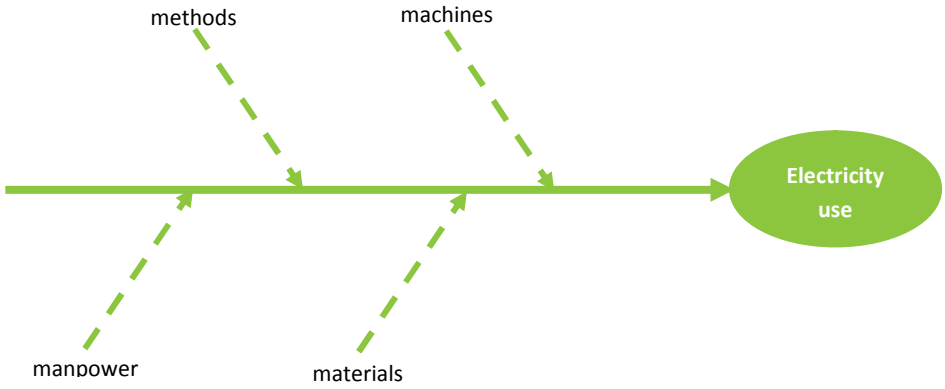
- the 4 M's:
  - Methods, Machines, Materials, Manpower[1]
- the 4 P's:
  - Place, Procedure, People, Policies
- the 4 S's:
  - Surroundings, Suppliers, Systems, Skills
- anything else that seems reasonable.

The 'problem' is always the head of the fish.

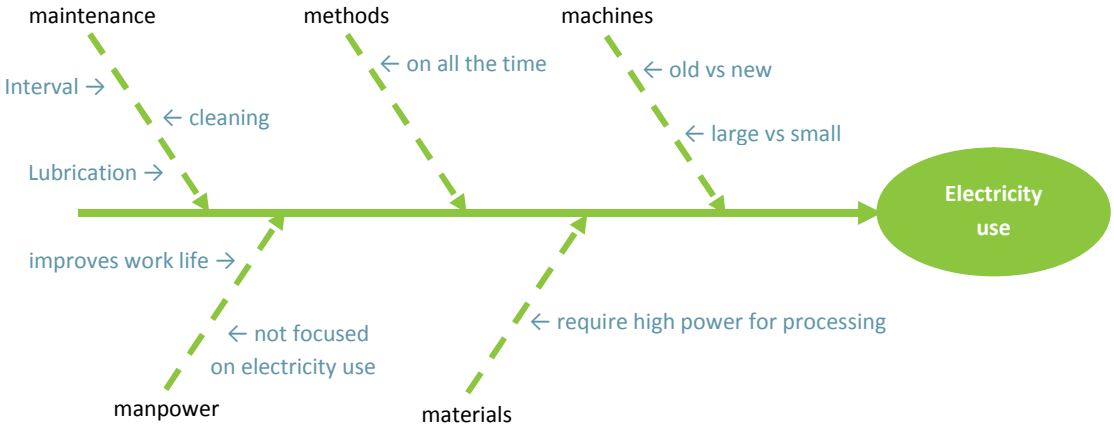
[1] We would not normally use the term 'manpower' these days preferring the term 'personnel' or similar. 'Manpower' has been retained here simply to keep the '4Ms'.

About root cause analysis

A typical initial skeleton might look like this:



Using a brainstorming methodology, ideas can be sought from the group as to why electricity is used and then the ideas categorised. The brainstorming throws up some ideas, but also brings up a fifth 'M', maintenance, which needs to be added. So we might have a cause/effect diagram which looks like the one below part way into the analysis:



Already there are many options to consider, including some which may benefit ecological sustainability (reduced use of machines) *vs* reduced social sustainability (work life of personnel). Generally the brainstorming should be continued until the flow of ideas is greatly slowed and/or few new ideas are flowing.

This does not of itself yield the root cause, but rather yields many possible causes/influences. Further analysis may need to be done to determine 'THE' root cause, or it may be decided that there are several causes which will all benefit from being actioned. Benefit/cost analysis will help determine the priority of actions.

Determining the root cause can also be done by the group answering the question 'if I change that cause, will I prevent the problem from recurring', or in this case 'will I cause a permanent reduction in the electricity consumption'. In the example above, there could be several solutions.

Other methods and units of competency

There is a wide range of problem solving methods and many of these are listed in *MSAPMSUP390A Use structured problem solving tools*. If formal training and assessment in problem solving is required, then this unit should be considered. Some of the methods covered by this unit of competency include:

- brainstorming
- control charts, runcharts and graphs
- flow charts
- force field/SWOT analysis
- logic tree
- Pareto analysis
- process logic/process requirements
- scattergrams
- similarity/difference analysis.

Commercial problem solving/RCA systems

There are many commercial problem solving systems. Some of these are listed here:

- Cause-effect charts
- Eight Disciplines Problem Solving
- GROW model
- How to solve it
- Kepner-Tregoe Problem Solving and Decision Making
- MindTools
- PDCA (plan–do–check–act)
- Productive Thinking Model
- RPR Problem Diagnosis (rapid problem resolution)
- TapRoot
- TRIZ.