national highways

Practical Problem Solving

Guide

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1

Purpose of the guide

This guide is designed to support you and your teams to undertake practical problem solving using Lean techniques. It is designed to provide you with structure to make your problem solving sessions more effective.

There are some suggested tools and techniques for each stage of problem solving. You do not need to use them all on every problem but understanding and using a range of tools and techniques will give you and your teams the best opportunity to solve problems permanently, take control of your processes and eliminate reactive fire-fighting.

At the end of this guide is the Practical Problem Solving Assessment. Which will help you understand your maturity in problem solving. It is designed to support the development of your problem solving capability and identify where you need to focus to make your problem solving more effective.

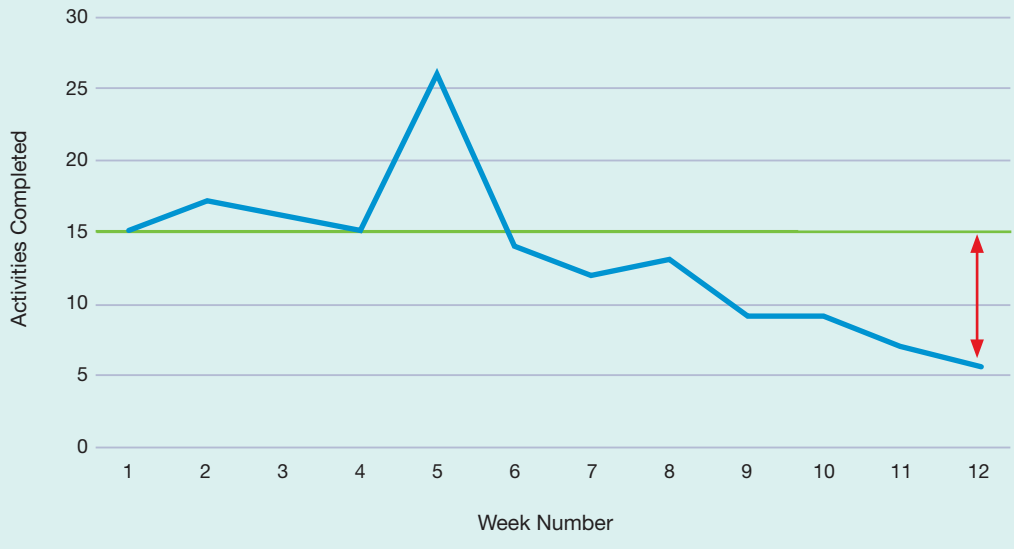
2

Problem solving at a glance

What is a Problem?

A problem is anything that fails to meet the expected standard or target.

Our Performance



What is Problem Solving?

Problem solving is a structured team process, to identify and resolve root causes to stop the problem reoccurring. It has clear sponsorship accountability, team responsibilities and structured process.

3

The right approach for problem solving

3Cs (Concern, Cause, Countermeasure)

The 3Cs process is a visual management tool that allows concerns and suggestions to be progressed methodically. By using this process, the originator and the wider team can follow the progress of the concern through to resolution.

3Cs addresses immediate, urgent, short-term problems, where the root cause is known. By recording the concern on a 3Cs visual, if the issue keeps recurring a more in-depth approach is needed.

Eight Steps

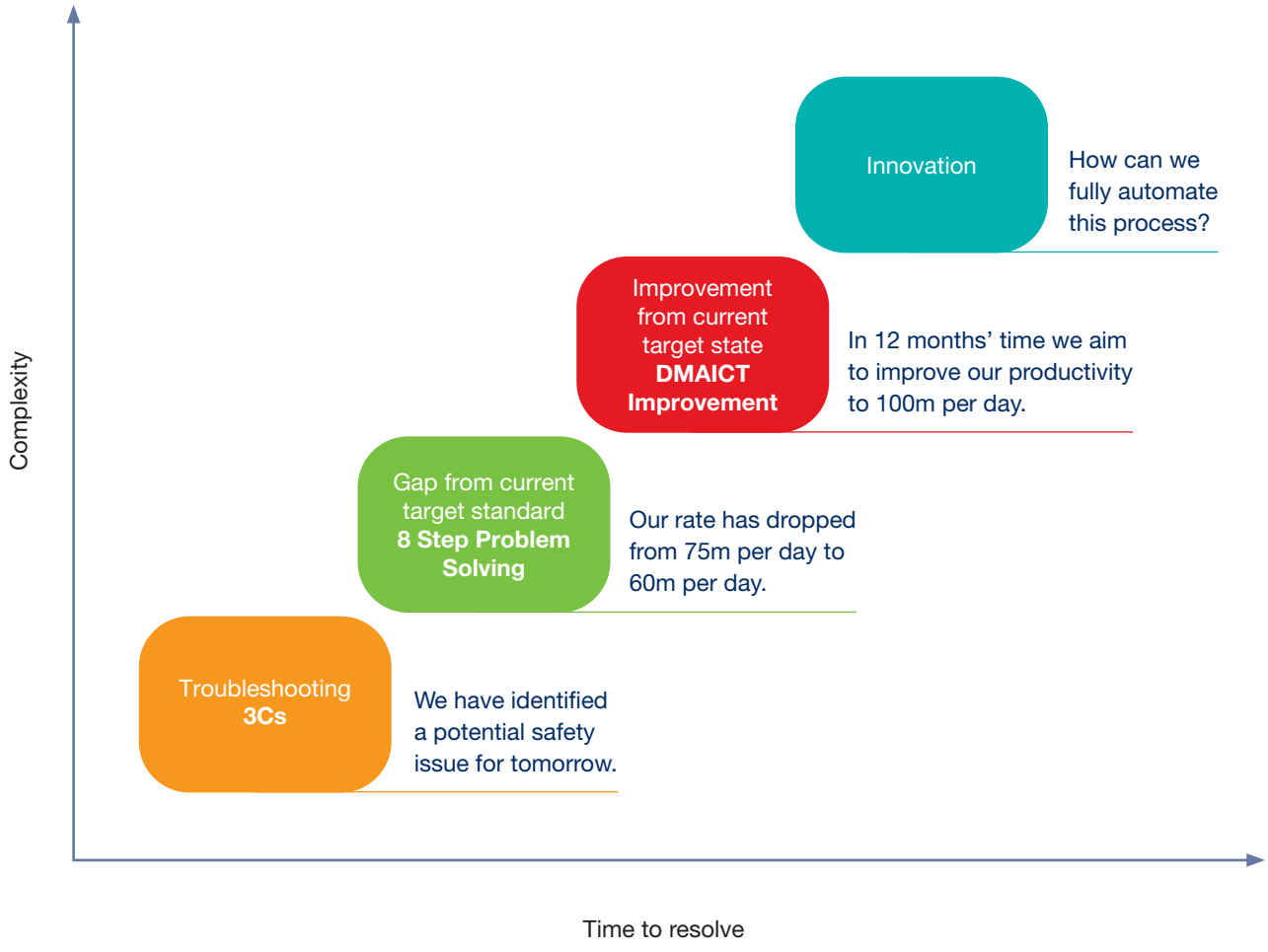
For recurring problems raised on 3Cs or where your performance is below the standard needed look at applying Eight-step problem solving.

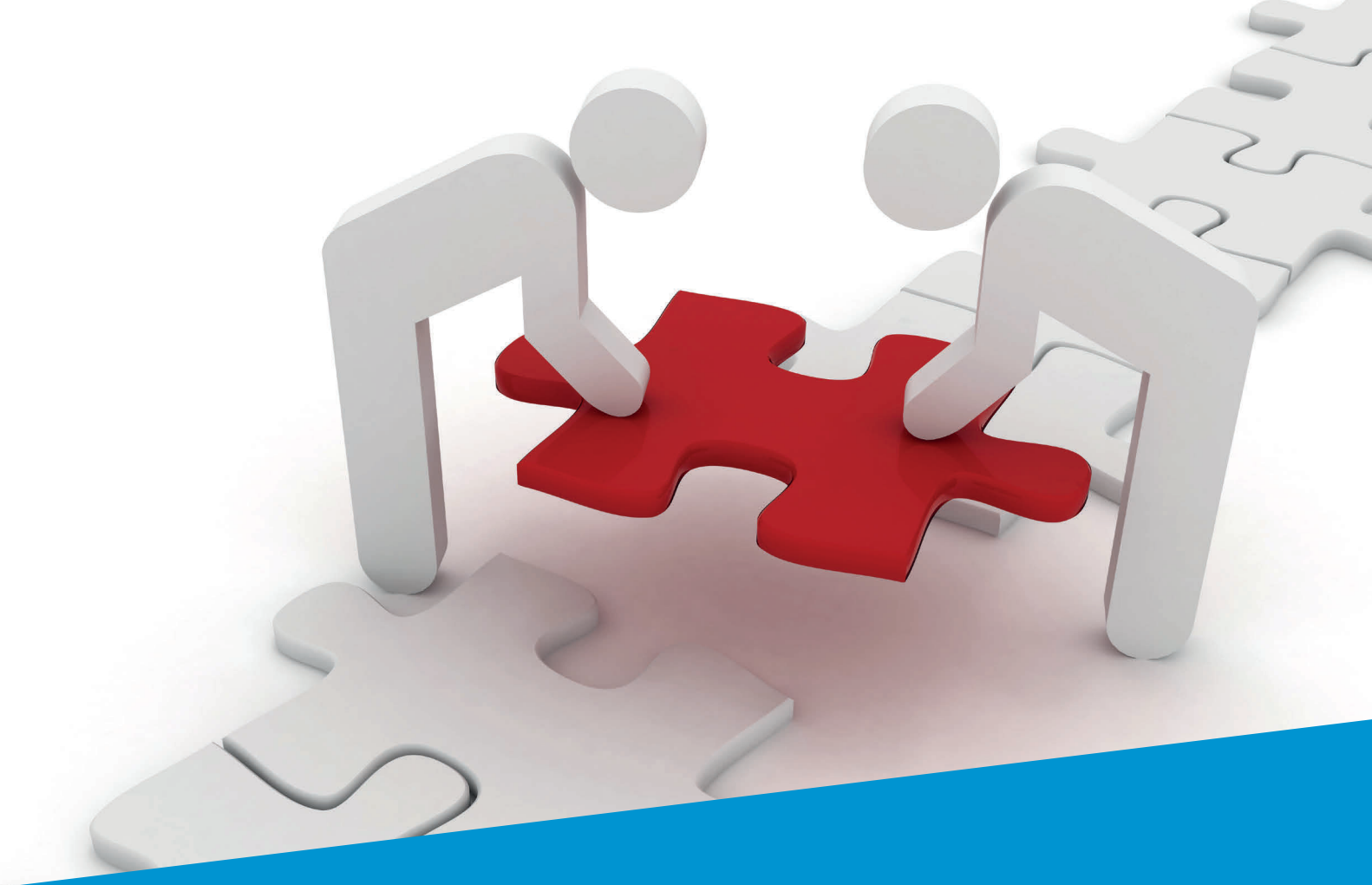
Eight-step problem solving helps you to narrow down your focus onto the root cause of the problem and find a long term solution that stops it happening. This is CONVERGENT thinking.

DMAICT Improvement

Where you are meeting your current target but want to improve, a DMAICT approach allows you to think more creatively, finding a range of possible solutions to try. This is DIVERGENT thinking.

Innovation is not discussed in this guide but is here to help you visualise where it fits in your thinking.

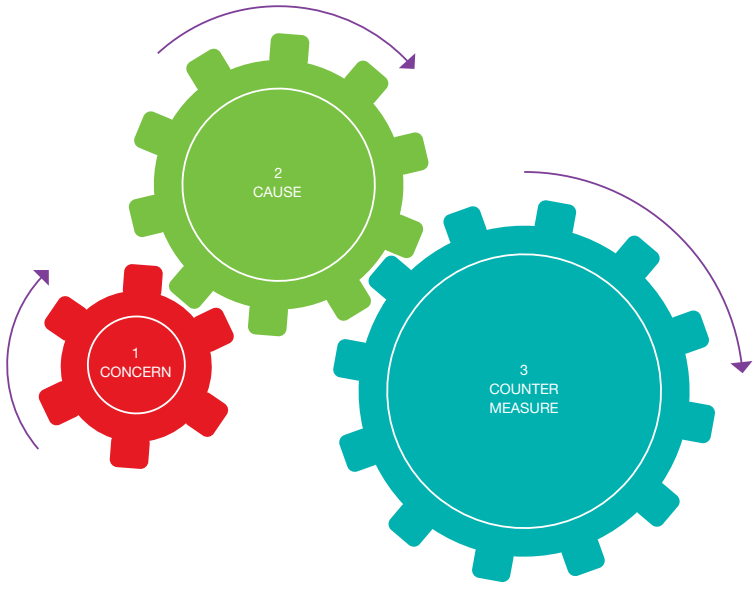

Complexity
Innovation
How can we fully automate this process?
Improvement from current target state
DMAICT Improvement
In 12 months' time we aim to improve our productivity to 100m per day.
Gap from current target standard
8 Step Problem Solving
Our rate has dropped from 75m per day to 60m per day.
Troubleshooting
3Cs
We have identified a potential safety issue for tomorrow.
Time to resolve



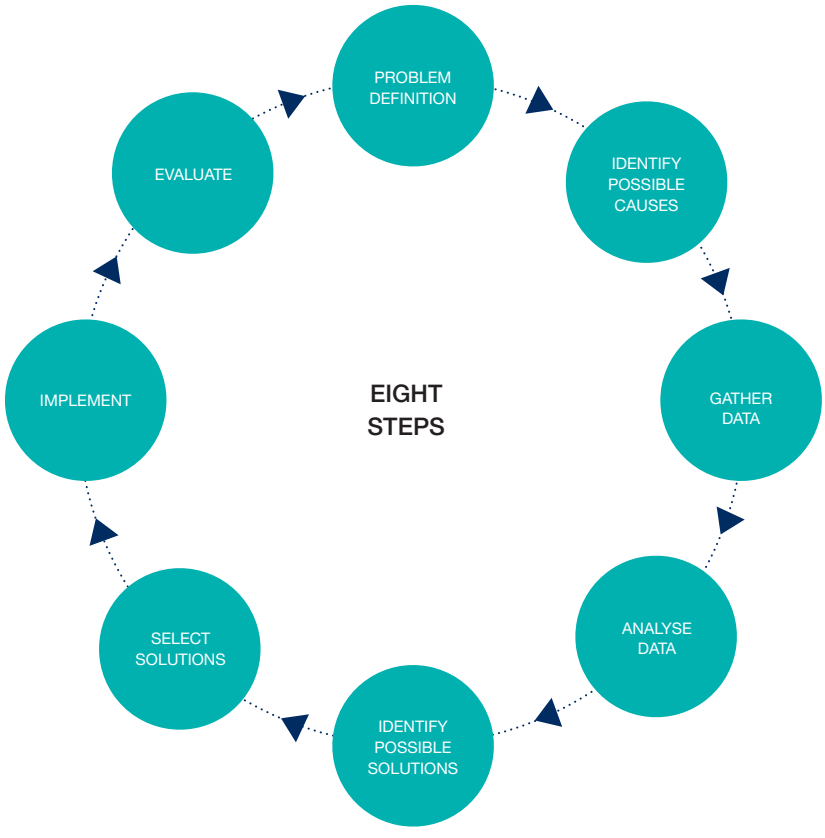
3.1 Alternative approaches to problem solving and improvement

There are many approaches to problem solving and improvement. The National Highways Lean preferred structured approach to problem solving is 3Cs, Eight Steps and DMAICT; however you may use an alternative approach as long as you can demonstrate that it provides structure and convergent or divergent thinking as appropriate to your problem.

3Cs



Eight Steps



DMAICT Improvement

3.2 Problem solving approach summary

Confirm:

- A clear understanding of the problem definition.
- The team can articulate whether it is a problem or an improvement.
- Approach selection is always considered and correctly applied.
- Problem solving is a team exercise with clear sponsorship.

4

Problem solving tool 3Cs

The 3Cs process is a tool that provides structure to allow everyday problems or concerns to be progressed, ensuring that root causes are identified, and solutions are put in place rather than short term containments or workarounds that do not resolve the problem permanently.

Immediate, day-to-day concerns identified through Collaborative Planning (CP) and Visual Performance Management (VPM) should be dealt with in 'real time' at the lowest level appropriate to the issue.

3Cs should be:

- Logged with a unique identification number.
- Clearly defined and have an accountable person allocated.
- Review dates and who is providing the update, must be visible.
- Managed by exception. Only discuss the new 3Cs and those with a current review date.
- Time-bound, including an 'escalation date' if appropriate.
- Displayed on a physical or virtual visual performance management board.
- Checked against previous 3Cs to identify reoccurrence.
- Re-occurring 3Cs must be moved into a structured problem approach such as 8 Step Problem Solving.

Leaders should create an environment that enables all team members to have the capability to solve problems in a structured way by providing support, time, tools and systems that are readily available.

4.1 The 3Cs standard template - recording concern, cause, countermeasure

3Cs should be recorded using a standard template for your organisation that everyone can see and has access to. This may be physical or virtual but should include the information shown below:

3Cs Problem Follow-up Sheet					Owner		
					Activity		
Ref No.	Concern Description	Cause	Countermeasure	Who	When	Cat	Status
1 13 Dec NH20 22001	There is water dripping from the roof in building 2C, 3rd Floor, Design area, printer desk. Initial containment: Moved the printer to a safe location and water contained using a suitable container.	After investigation, facilities determines that a hole was made in the roof during the aircon move. The aircon unit punctured the roof, because it was dragged on the roof, because the fitters have not been made aware of the potential concern, because there are no Work Instructions for work on the roof.	Facilities to repair the damaged roof and complete a Work Instruction Sheet for roof work. This will include distribution list, signage en route to the roof and on the roof itself.	MC	22 Dec	5	

Your 3Cs should be retained and reviewed to identify whether the solution selected has resolved the problem permanently. If the problem reappears, a more complex project may be needed to identify the root cause.

4.2 Completing a 3Cs template

3Cs Problem Follow-up Sheet					Owner		
					Activity		
Ref No.	Concern Description	Cause	Countermeasure	Who	When	Cat	Status
1 13 Dec NH20 22001	There is water dripping from the roof in building 2C, 3rd Floor, Design area, printer desk. Initial containment: Moved the printer to a safe location and water contained using a suitable container.	After investigation, facilities determines that a hole was made in the roof during the aircon move. The aircon unit punctured the roof, because it was dragged on the roof, because the fitters have not been made aware of the potential concern, because there are no Work Instructions for work on the roof.	Facilities to repair the damaged roof and complete a Work Instruction Sheet for roof work. This will include distribution list, signage en route to the roof and on the roof itself.	MC	22 Dec	5	

Ref No.

Allocate the concern a unique identity number. This will allow the logging, tracking and processing of all concerns raised.

Concern Description

Provide enough detail so someone can understand the problem easily.

Implement containment if needed.

Cause

Determine the root cause(s) and record how you identified it.

Countermeasure

Describe the countermeasure and explain what has been implemented to resolve the problem permanently. Give enough detail that it can be easily understood.

Who/When/Cat/Status

The “who” is the person who will feedback progress to the group. They do not have to resolve the problem themselves but they must be aware of the activities and be able to discuss progress in the review meetings.

The “when” is the date they will feedback to the team.

You may wish to assign categories to help you group and manage your 3Cs. The status box is a visual representation of progress.

Owner/Activity

Identify the ‘owner’ of the problem/concern. The owner will sponsor the activity and ensure that resource is made available and that progress is made.

4.3 Use visual management to support your 3Cs

Your visual management of 3Cs may be physical or virtual but all team members should be able to see the 3Cs, 3Cs performance and be able to update the information as progress is made.

Our 3Cs

New

Any new 3Cs raised since last meeting:
Talk about these!

In Progress

All ongoing 3Cs not due for review today.

In Test

All currently being tracked to ensure solution is effective.

3Cs for Review

All with review date for today:
Talk about these!

Actions Log

These are actions raised in CP meetings that are NOT part of a 3C.

4.4 Using 3Cs summary

Confirm:

- 3Cs process is understood and accessible for everyone.
- Logged and tracked using visual management (physical or virtual).
- The approach is used by all to solve less complex, day-to-day concerns.
- Managed by exception with regular reviews
- Is actively sponsored by leadership.
- Escalates to more complex Problem Solving approach when appropriate.
- The root cause is always identified and resolved by the countermeasure.

5

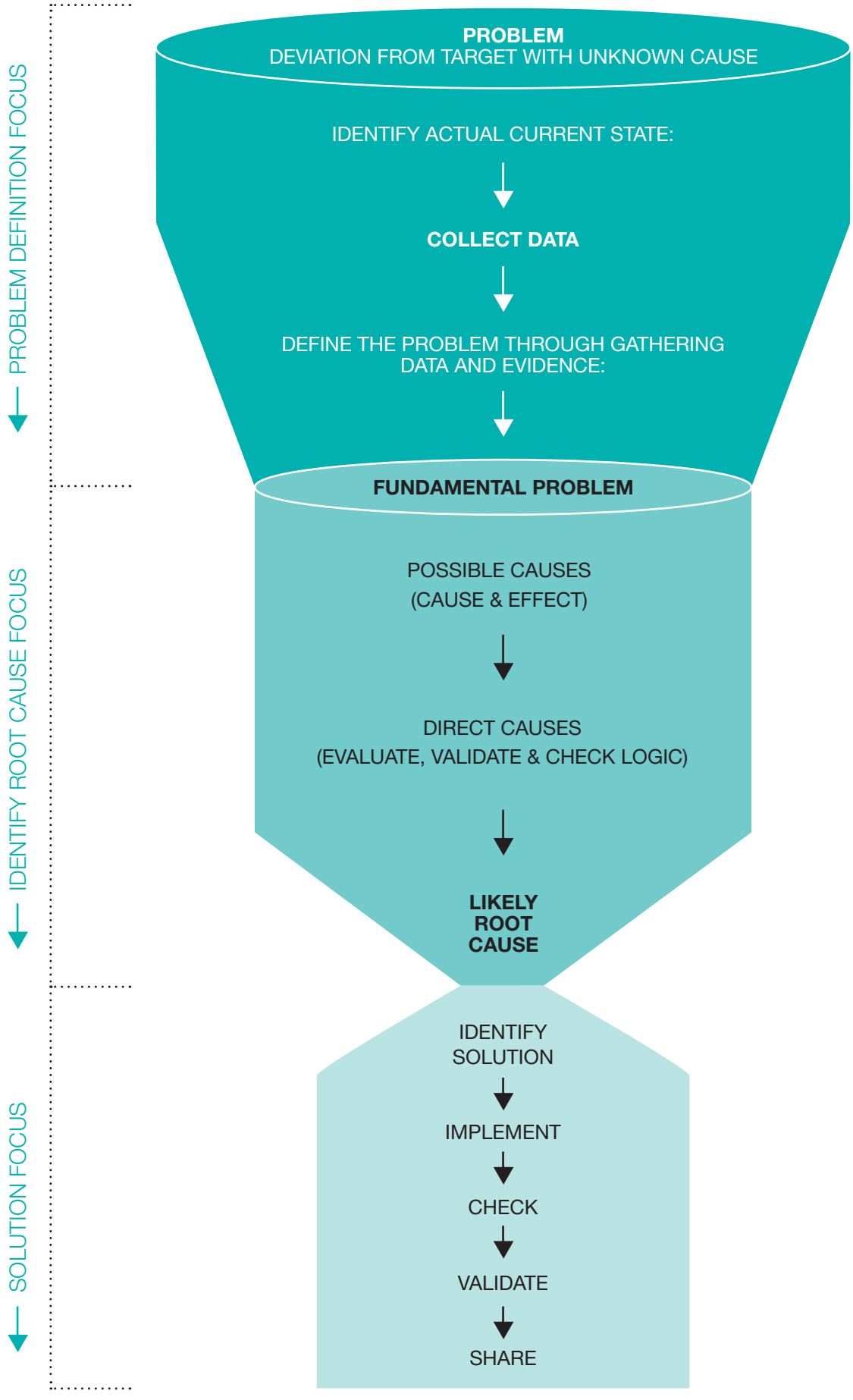
Problem solving tool 8 steps

Eight-step problem solving is a method to structure your activity to ensure that the result of your activity resolves a problem permanently by identifying and resolving the root cause of the issue. Involve the wider team, the people who actually do the job, to identify what happens in the real world, not what the process documentation says.

We have a tendency to leap to solution mode. Using a structured approach ensures our activity is driven by evidence, not opinion. It makes sure we fully understand the problem and its cause, so that we can resolve it fully, not just mitigate symptoms.

This approach focuses on identifying the root cause through convergent thinking – the “problem solving funnel” is shown on the following page.

Note that the majority of effort is focused on identifying the root cause.


PROBLEM DEFINITION FOCUS
IDENTIFY ROOT CAUSE FOCUS
SOLUTION FOCUS
PROBLEM
DEVIATION FROM TARGET WITH UNKNOWN CAUSE
IDENTIFY ACTUAL CURRENT STATE:
COLLECT DATA
DEFINE THE PROBLEM THROUGH GATHERING DATA AND EVIDENCE:
FUNDAMENTAL PROBLEM
POSSIBLE CAUSES (CAUSE & EFFECT)
DIRECT CAUSES (EVALUATE, VALIDATE & CHECK LOGIC)
LIKELY ROOT CAUSE
IDENTIFY SOLUTION
IMPLEMENT
CHECK
VALIDATE
SHARE

5.1 Step 1

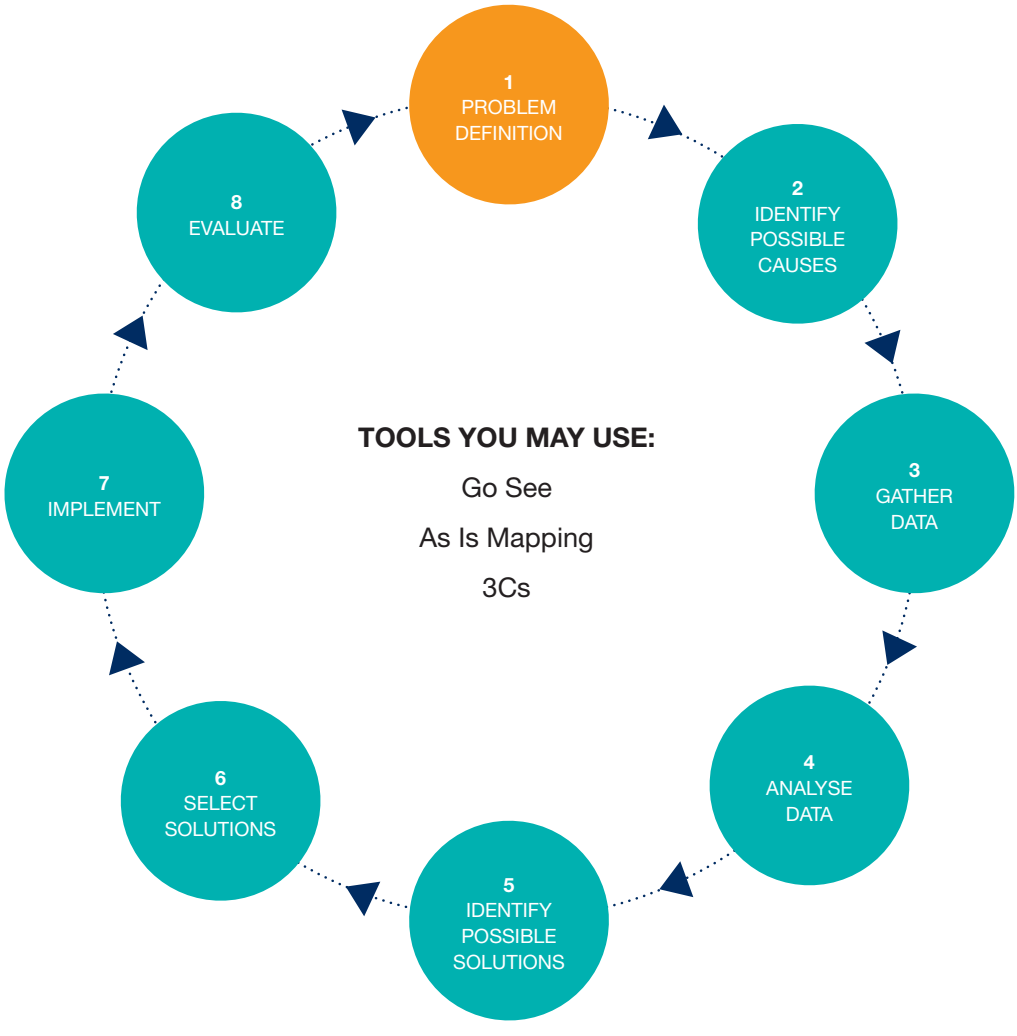
Define your problem in terms of “how can we improve from [current position] to [desired position] by [date]”

Use data to evidence that there is a problem, this removes speculation and helps to focus the team on what the problem is.

Include a range of metrics where possible e.g volumes, rework, resource levels etc.

The data must be meaningful and valid. The collection must be user friendly and time based. You could use collection tools such as tally charts, data collection sheets, process activity maps. It’s good practice to develop a data collection plan.

Remember that this data collection will form the basis of your BASELINE and this is VERY important as it helps in quantifying the benefits from implementation of the solutions identified.



5.2 Step 2

Investigate and document the root cause of the problem, not just the surface symptoms. By identifying and solving the root cause of a problem, we are more likely to prevent the problem re-occurring.

Use techniques such as:

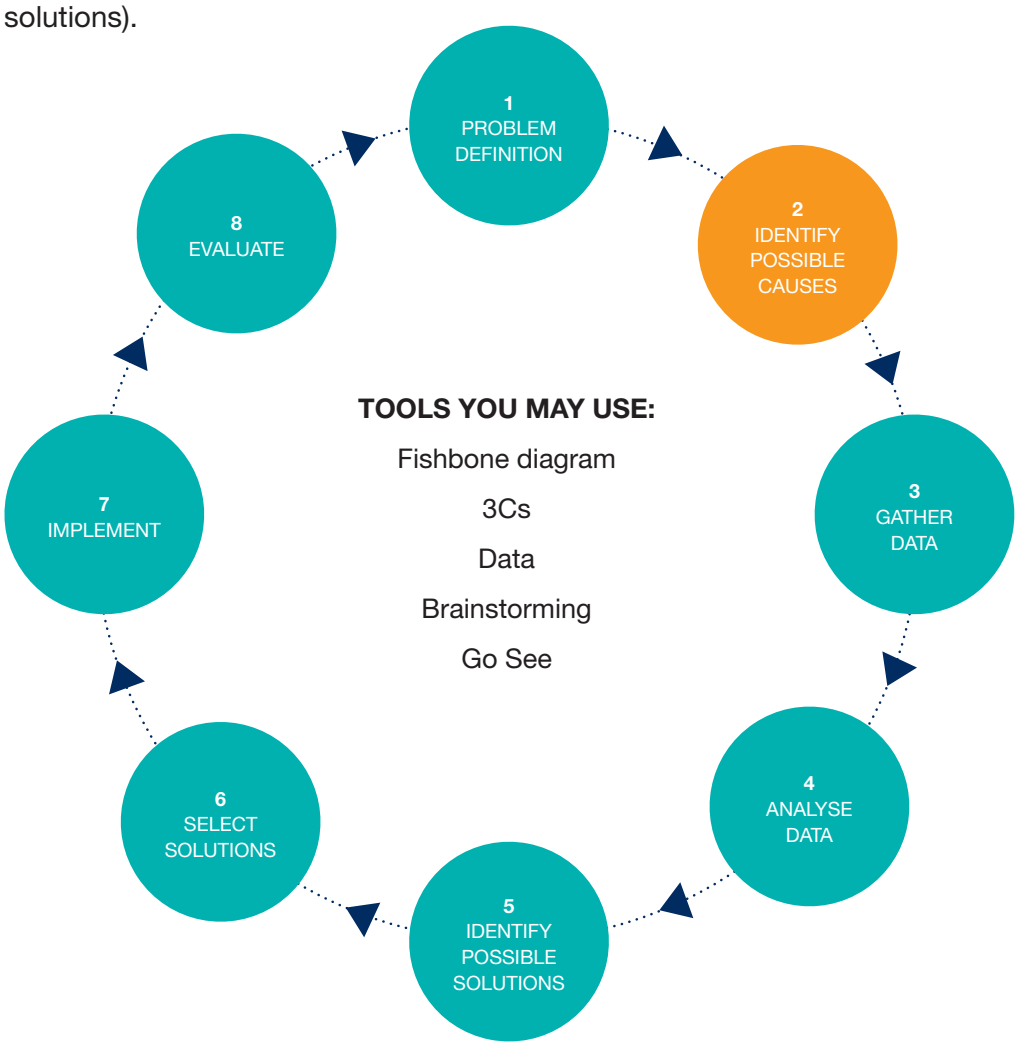
Go and see – the best place to go and find improvement opportunities. It is a walk or observation at the place where the activity happens.

Fishbone – a visual tool which is used to structure discussions around possible causes of the problem (can also be used to identify solutions).

3Cs document – has the team already tried to find a solution? What happened?

Brainstorming possible causes is really engaging and allows a team to provide all their ideas. These can then be grouped into themes and taken further.

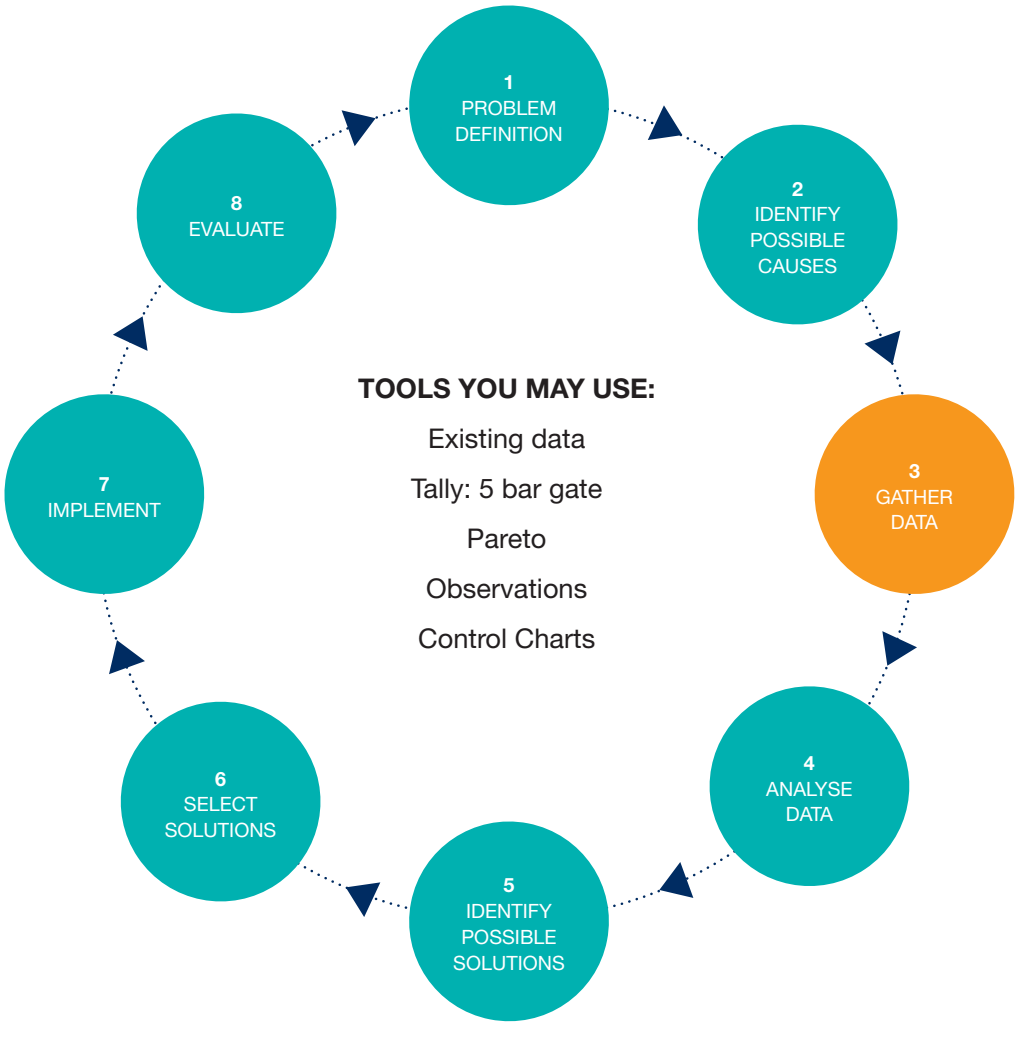
You should always use data when problem solving. Data will validate any 'feelings' that there is a problem and allow for a baseline to be captured in order to analyse the effect that any solutions may or may not have had.



5.3 Step 3

The key here is that the data being gathered is meaningful and tells the story of what is really happening.

If you are going to collect data by observing, take care that the people who are being observed carrying out the process do not feel that they are being watched. It is the **process** that is being observed and not the person.



QUALITATIVE

SUBJECTIVE

EXPLORATORY

OBSERVATIONAL

DYNAMIC VIEW OF CHANGE

NARRATIVE DESCRIPTIONS

QUANTITATIVE

OBJECTIVE

TESTING

CAN BE GENERALISED

PRE AND POST CHANGE

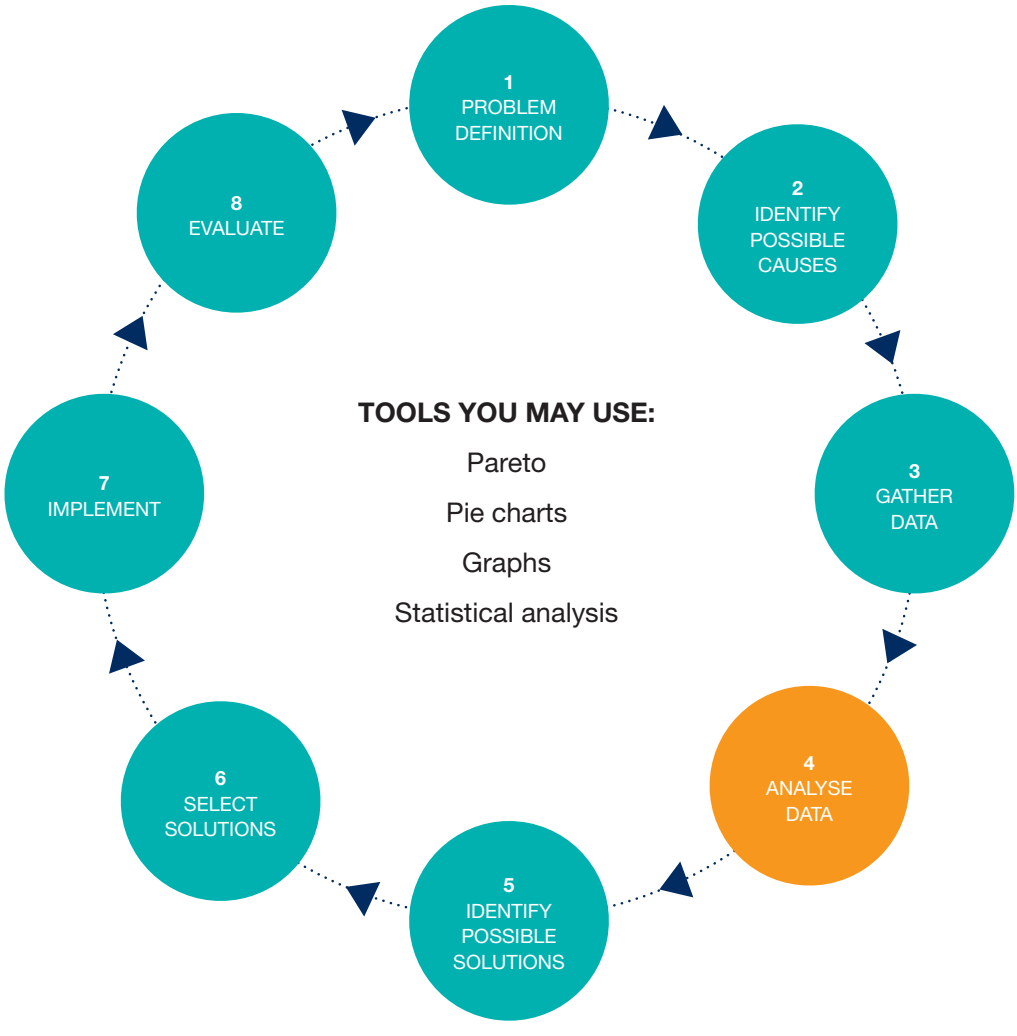
MEASUREMENT STATISTICS

5.4 Step 4

The analysis will either confirm that there is a problem or suggest that the problem was down to perception or a blip.

It's good to display your data visually as this is very powerful...

When using a traffic light system (Red, Amber, Green) to report on performance data remember red is good. Red & the letter "R" tells us at a glance visually where a problem is and gives us the opportunity to use our Lean skills to improve!



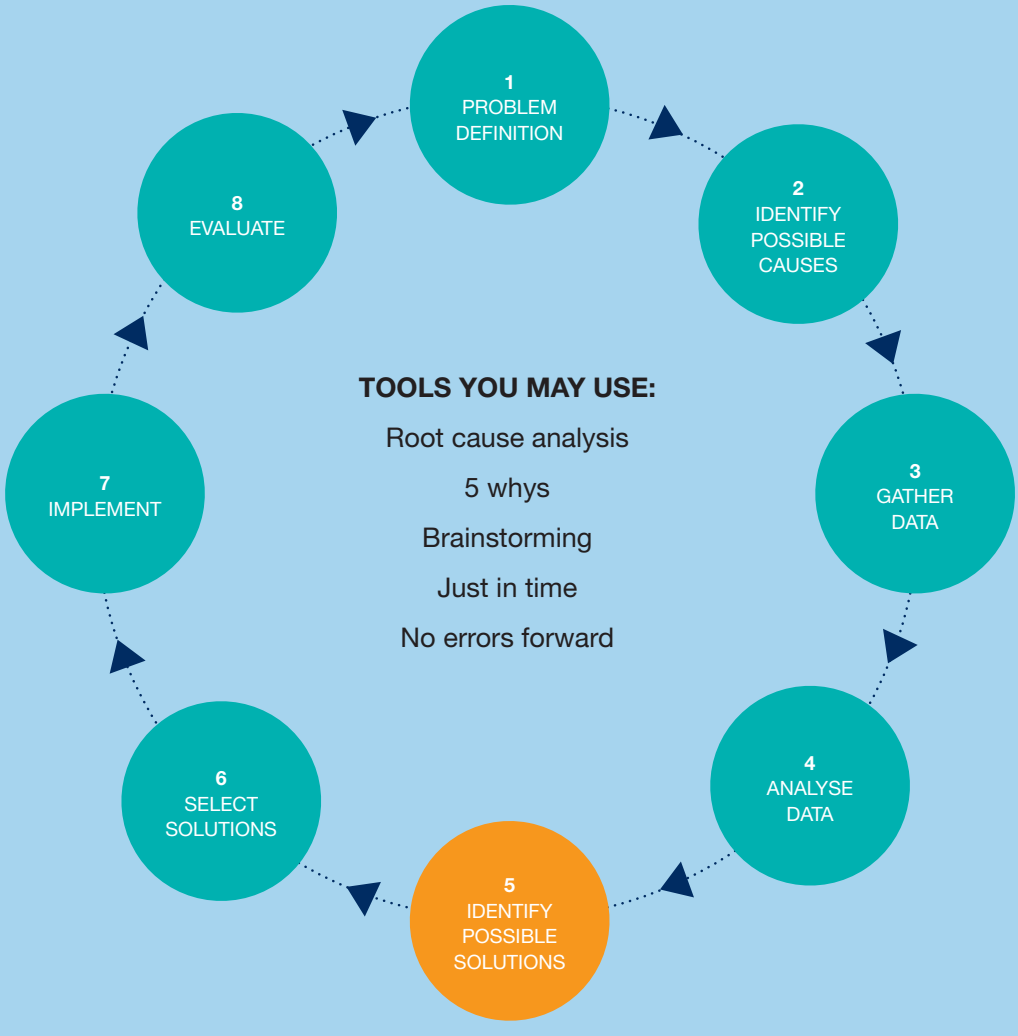
5.5 Step 5

Identifying possible solutions is often the exciting bit of problem solving for people and this is one reason why we have to ask people to stop from going into ‘solution mode’ before the time is right.

It is logical to start this phase after the data has been gathered as the data focuses the discussion.

There are structured tools to help identify appropriate solutions and this helps to get to the root of the problem and prevents us ‘sticking a plaster’ over an issue for it to reappear later on.

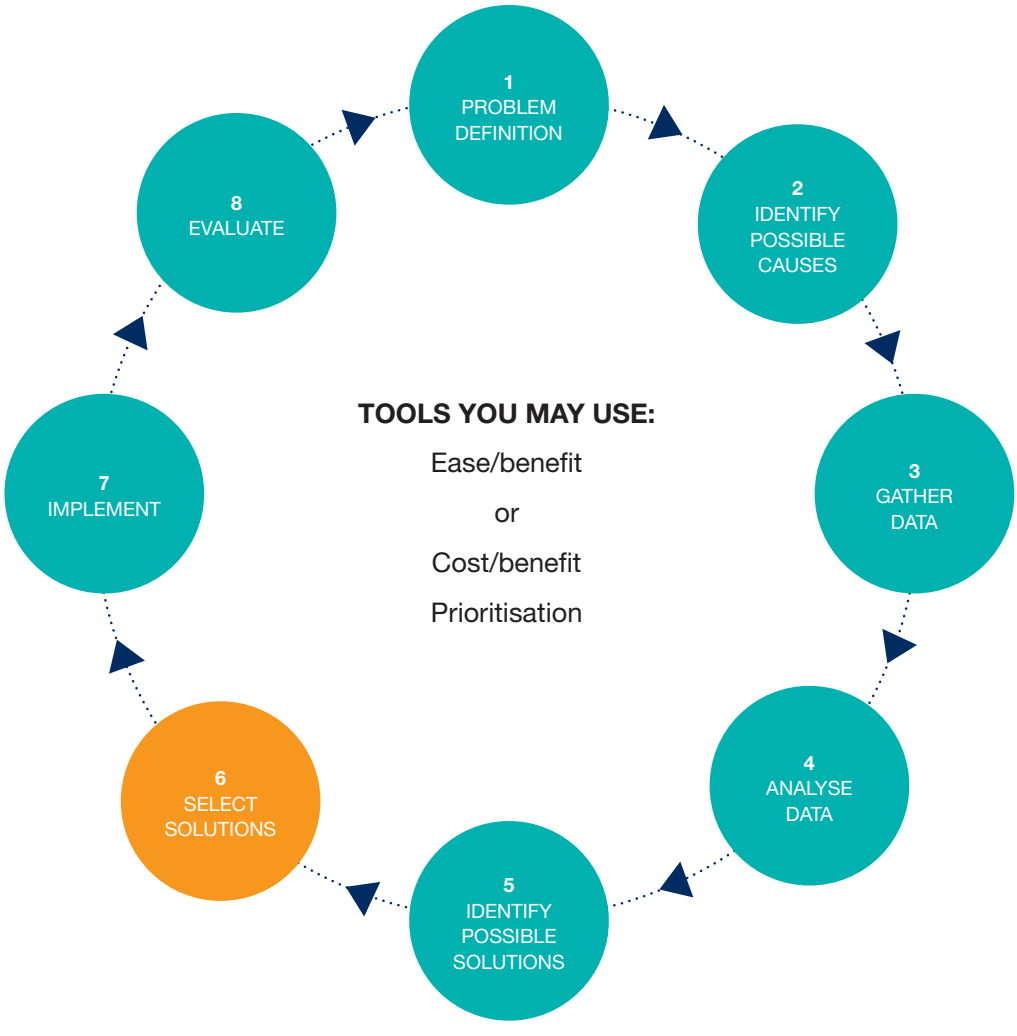
If people do try to jump to solutions before the time is right, it’s a good idea to have a ‘car park’ where they can note down their idea so it is out of their mind but not lost and it §can be referred to later.



5.6 Step 6

You will now have a list of possible solutions to your problem. How do you know which one to try?

Use the tools listed to help you decide which to prioritise. Do not leap to pick a solution without structured prioritisation!



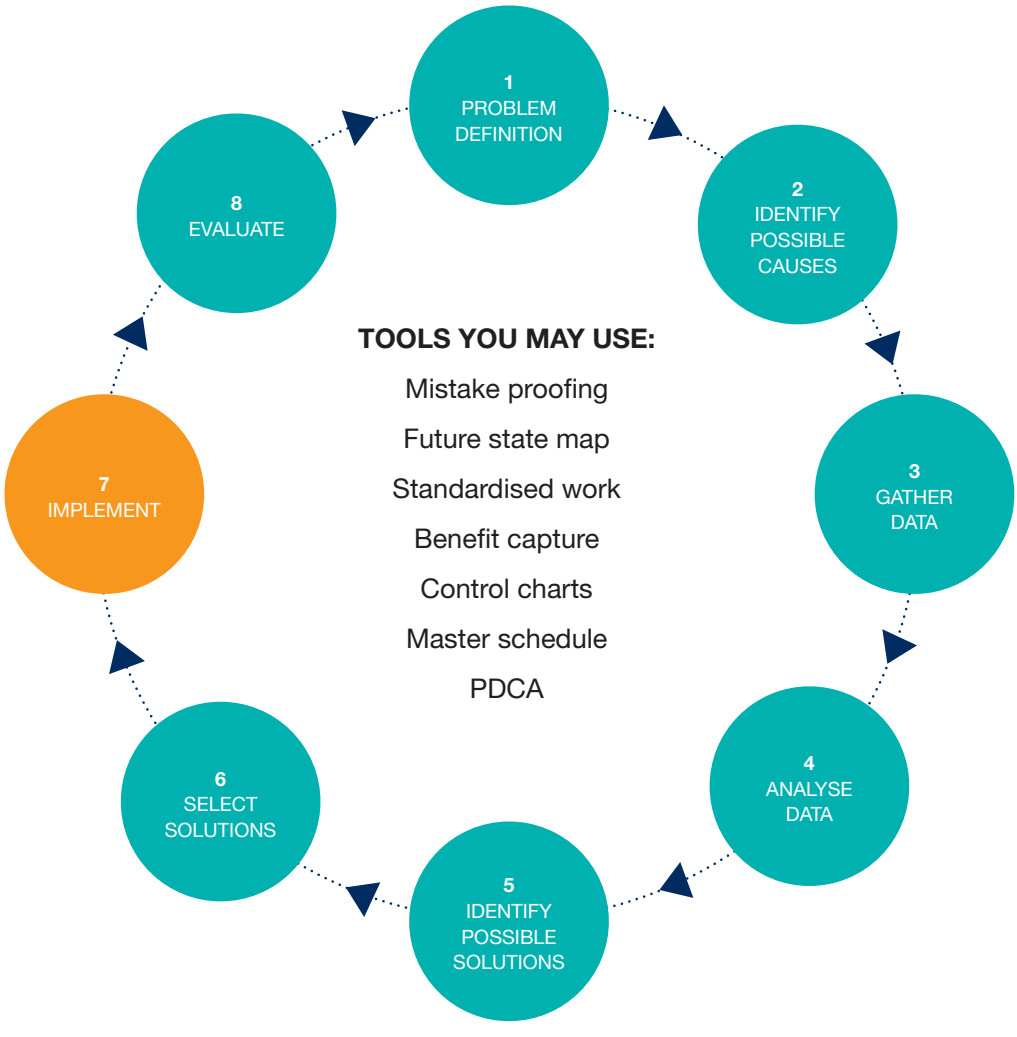
5.7 Step 7

This is where you methodically implement and test your solution.

Some things to consider here:

- Have you amended the Standard Operating Procedures?
- Have you communicated the changes to everyone who is impacted?
- Have you set up a plan for capturing the performance of the new process?
- Is there a clear route for concerns to be raised?
- How long will you test the process until you evaluate it?

Let the process embed for a while before any decisions are made to allow people to become familiar before trying to measure the outcome.



5.8 Step 8

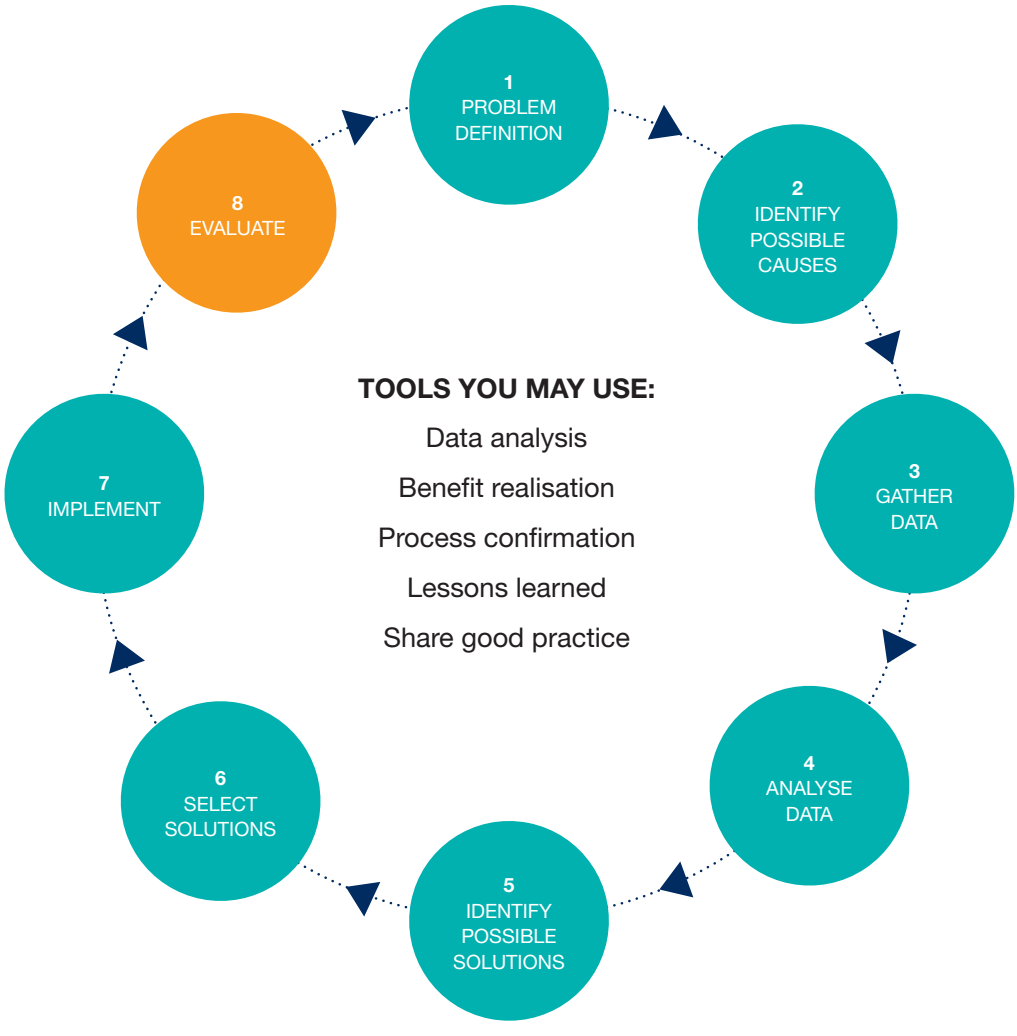
Reconvene as a group and objectively evaluate how the solution performed.

Refer back to your problem statement from step 1, have you solved the problem?

If you have, how can you share that learning with others? Report your benefits. Celebrate your success!

If not, review whether to keep the change or revert to the original process. This is not failure! It is the first stage in learning how to solve the problem. Don't be afraid to learn from the data and outcomes and step back if need be.

Look again at your problem definition and try again!



5.9 Using eight steps problem solving summary

Confirm:

- 8 Step Problem Solving process is understood and accessible for everyone.
- Training on specific tools is available at the time they are needed.
- Problems are clearly defined and agreed by the team.
- The approach is used by all to solve issues that are a gap from the current standard.
- Is actively sponsored by leadership.
- The root cause is always identified and resolved by the countermeasure.

6

Problem solving tool DMAICT

Process improvement provides a structure to identify and remove waste in a process to become more effective and efficient, increase productivity and capacity and deliver benefits.

DEFINE	MEASURE	ANALYSE	IMPROVE	CONTROL	TRANSFER
					
Establish and launch the team Quad of aims Plan the project Gather the voice of the customer Plan for change	Document the current process Collect baseline data	Analyse data Identify root cause Identify and remove waste	Generate possible solutions Evaluate solutions Identify most likely solution Pilot Plan and implement	Document new process Check the solution is being implemented Measure and validate project benefits.	Share lessons learnt across the organisation and sector, to maximise benefits.

6.1 Define

WHAT

Define your process:

- Develop a problem statement
- Develop quad-of-aims or project charter
- Develop as is process maps
- Define the customer and their critical requirements
- Keep the team and stakeholders informed

HOW

Some tools that you could use:

- Project charter
- Quad of aims
- SIPOC (suppliers, inputs, process, outputs, customers)
- Process mapping as is
- Value stream mapping as is
- Voice of the customer
- Communication plan

6.2 Measure

WHAT

Measure your process:

- Determine current process performance
- Plan data collection
- Verify data reliability
- Establish ‘baseline’ data
- Update project charter

HOW

Some tools that you could use:

- Data collection plan
- Operational definitions
- Check sheet
- Project charter
- Stakeholder analysis

6.3 Analyse

WHAT

Analyse your process:

- Detailed process examination
- Display the data in a graphic form
- List potential causes
- Determine the root cause of the problem and verify
- Update quad of aims

HOW

Some tools that you could use:

- Value stream map
- Value added analysis
- Root cause analysis
- Pareto charts
- Fishbone diagram
- Histograms
- 5 Whys
- Run charts

6.4 Improve

WHAT

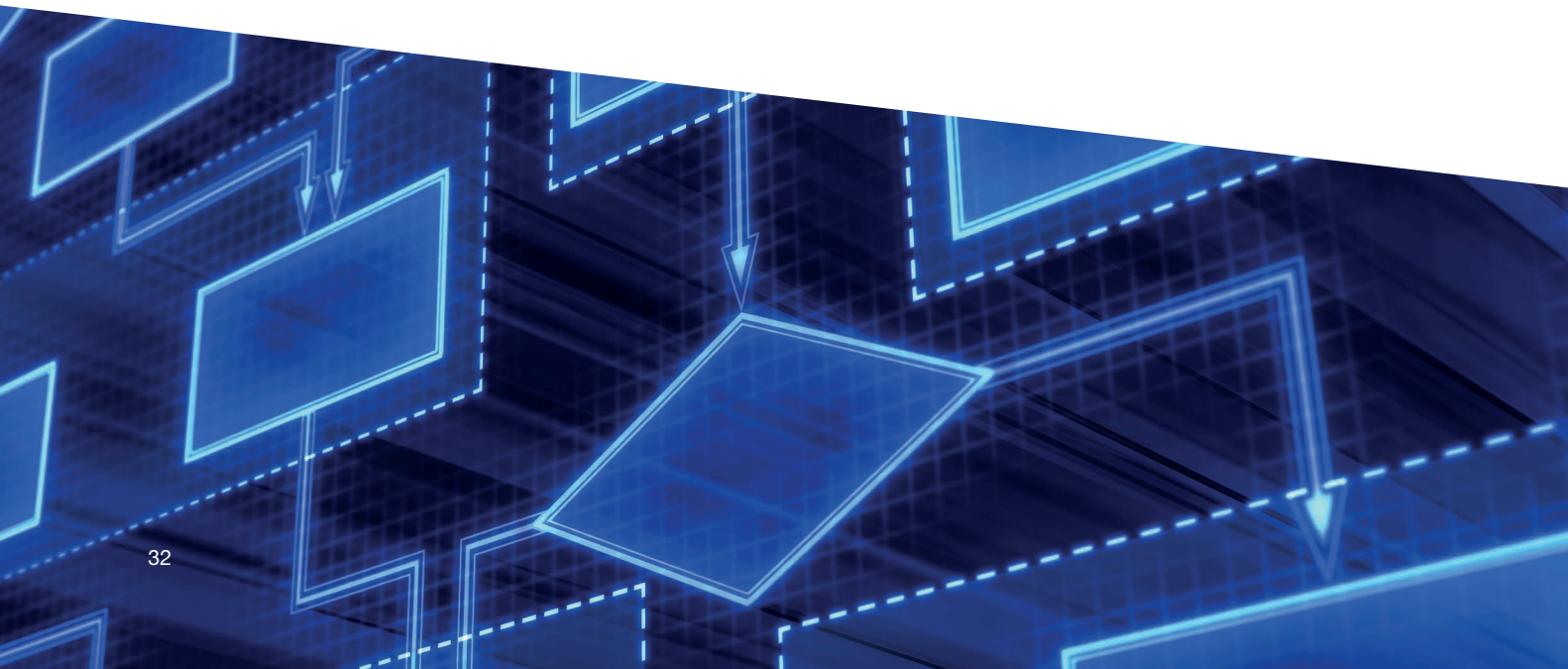
Improve your process:

- Explore potential countermeasures
- Select best countermeasures
- Plan and implement the countermeasures
- Estimate expected benefits

HOW

Some tools that you could use:

- Brainstorming
- Process mapping to be
- Value stream mapping to be
- Ease benefit matrix
- Implementation plan



6.5 Control

WHAT

Control your process:

- Document the improved process
- Communicate the improved process
- Embed the process
- Ensure correct control and management
- Confirm benefits delivered

HOW

Some tools that you could use:

- Control/monitoring plan
- Process documentation
- Standardised operating procedures
- Communications plan
- Visual performance management

6.6 Transfer

WHAT

Transfer your process:

- Complete knowledge transfer pack (KTP)
- Record benefits
- Celebrate and share success

HOW

Some tools that you could use:

- Knowledge transfer pack
- Digital efficiency register
- Lean tracker
- Department/company-wide presentation
- Lessons learned and shared
- Company social media/newsletters

6.7 DMAICT improvement projects summary

Confirm:

- DMAICT structure is understood and accessible for everyone.
- Training on specific tools is available at the time they are needed.
- Problems are clearly defined and agreed by the team.
- The approach is supported by sufficiently trained and skilled Lean people.
- Is actively sponsored by leadership.
- Benefits are measured against a robust baseline.
- Success is recognised and celebrated.

7

Structured problem solving assessment

The National Highways Structured Problem Solving Assessment has been developed to allow you to undertake an unbiased and objective assessment of your organisational maturity in structured problem solving.

The assessment is based on evidence across a range of problem solving activities. For this, the assessor will require evidence that the right approach has been identified as appropriate to the complexity and aim of the activity and that a standard structure has been followed. The assessment can be used for any of the structured approaches discussed in the guide and can be applied to any structured problem solving activities:

- Discovery
- Investigation
- Solutions
- Evaluate the process and results

The assessment is designed to provide a step-by-step guide for the assessor to come to a fair and realistic score for the organisation or team that is being assessed and to prompt focused recommendations to improve structured problem solving.

Like the National Highways Collaborative Planning and Visual Performance Management assessments, this Structured Problem Solving Assessment can be completed by a competent Lean practitioner, as a self assessment at any level within their organisation, from team or department to the whole organisation.

Moderated assessments may be completed with observation of evidence by the National Highways Lean team.

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