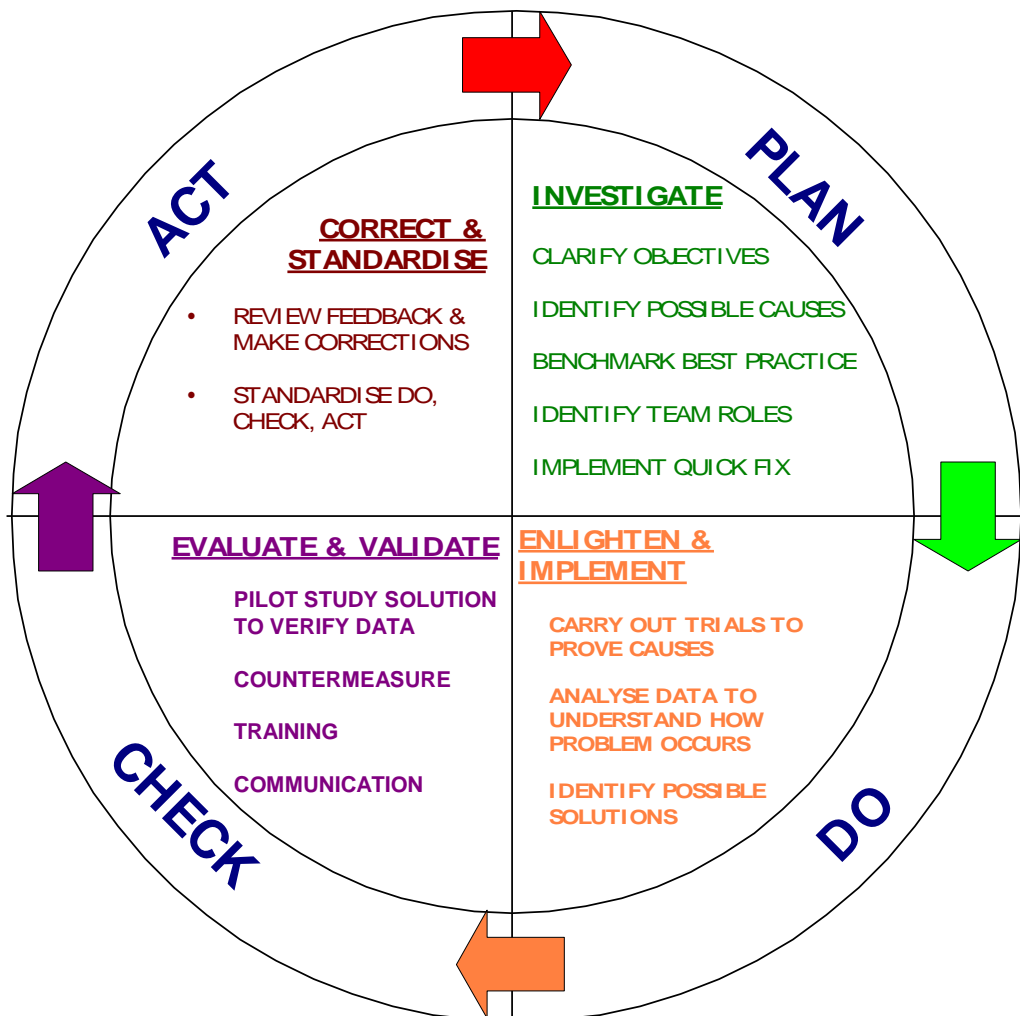
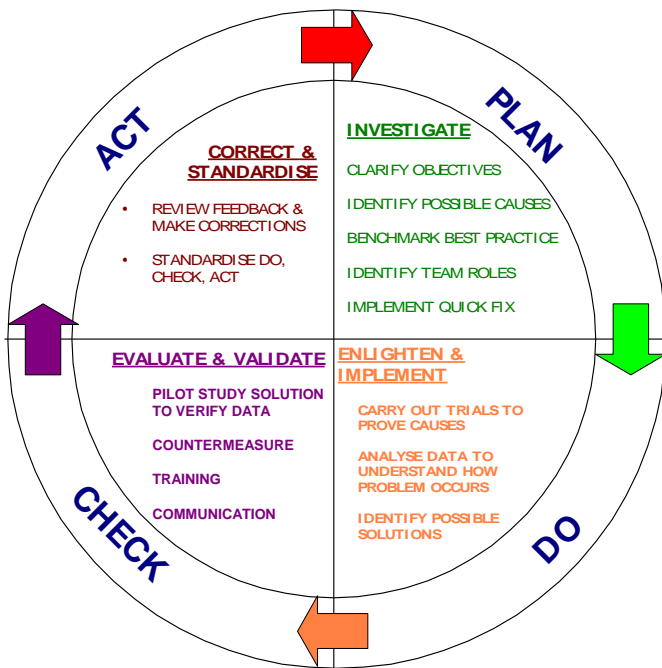


PDCA

Problem Solving Guide

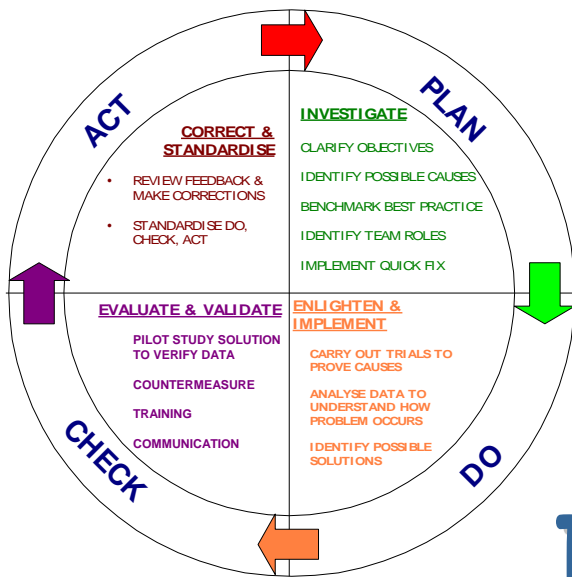


A Guide to a Team Approach to Problem Solving



Contents

- 1 Introduction to PDCA Problem Solving Cycle.
- 2 PDCA Cycle.....
- 3 Key Steps in PDCA.....
- 4 Defining the Problem
- 5 Selection of TQ Techniques used in PDCA.
- 6 Using the 14 Techniques.
- 7 PDCA Reviews - Racetrack.
- 8 Using PDCA Workbook.
- 9 Summary



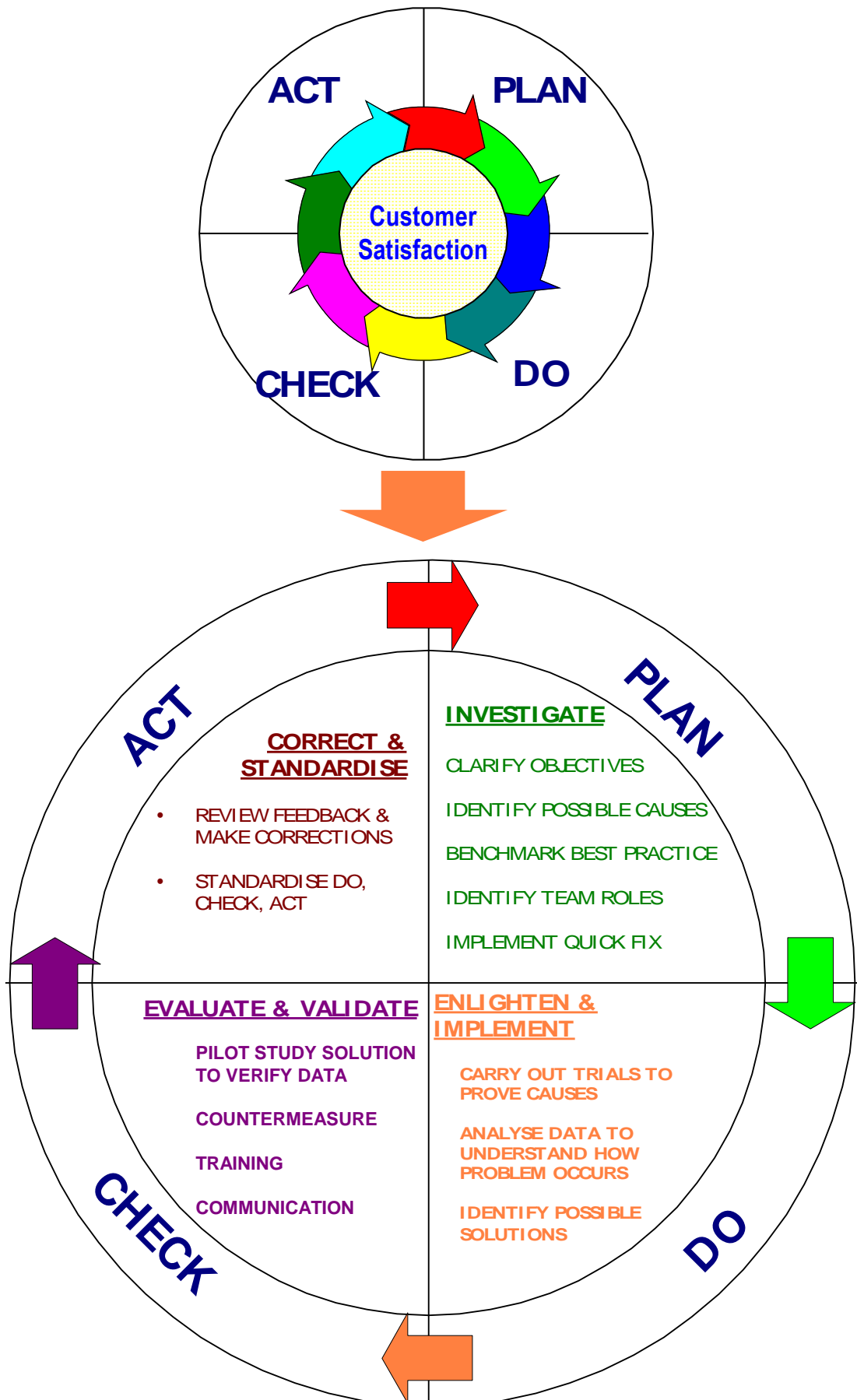
Introduction to PDCA

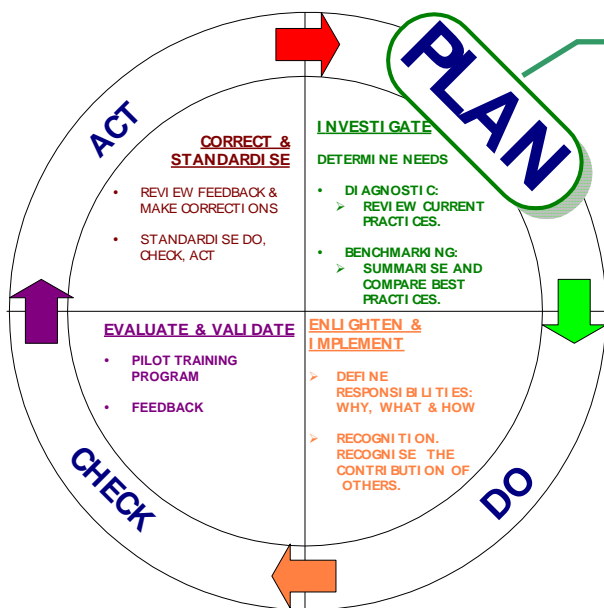
PDCA was created by W Edwards Deming in the 1950's as an easy to follow **Problem Solving** Cycle.

Deming was tasked with helping Japan rebuild its economy in the 1950's.

His purpose was to use **PDCA** with a **Continuous Improvement** process to help rebuild Japanese industries so that they could compete in the world market in the future.

PDCA Problem Solving Cycle





Purpose:- To **INVESTIGATE** the current situation & understand fully the nature of the problem being solved.

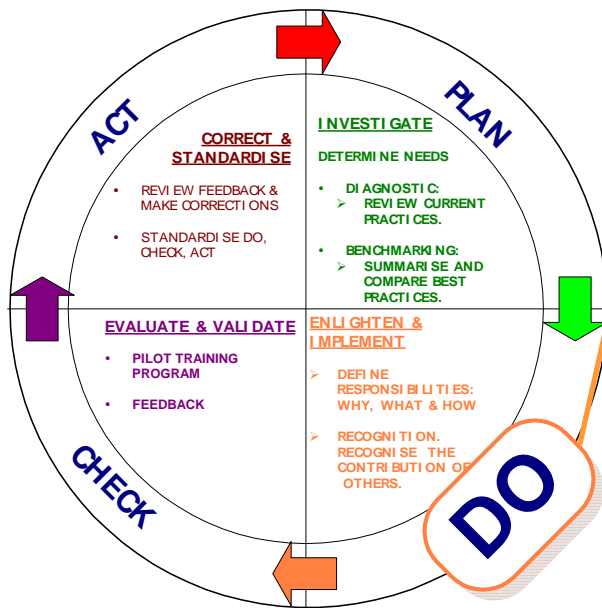
Key Steps:-

Diagnostic - Review Current Practice.

- Define the Problem - **Who, What, Where and When** .
- Write **Team Mission statement**.
- Brainstorm potential causes of problem using simple **Brainstorming** or a **Cause & Effect Diagram**.
- Identify & agree potential **Root Causes** prioritising using **Paired Comparisons** or by **Consensus Rankings** and asking the 5 WHY's
- Set up methods to capture 'REAL' data.
- Implement '**QUICK FIXES**' to protect the customer
- Make **Process Flow Diagram**
- Analyse '**REAL DATA**' & show graphically.

Benchmarking - Compare Best Practices

- Brainstorm where else may they have this problem, find out what they do to resolve it.



Purpose:- To Enlighten the Team as to the Real Problem by analysing the Data and defining and implementing a solution plan.

Key Steps :-

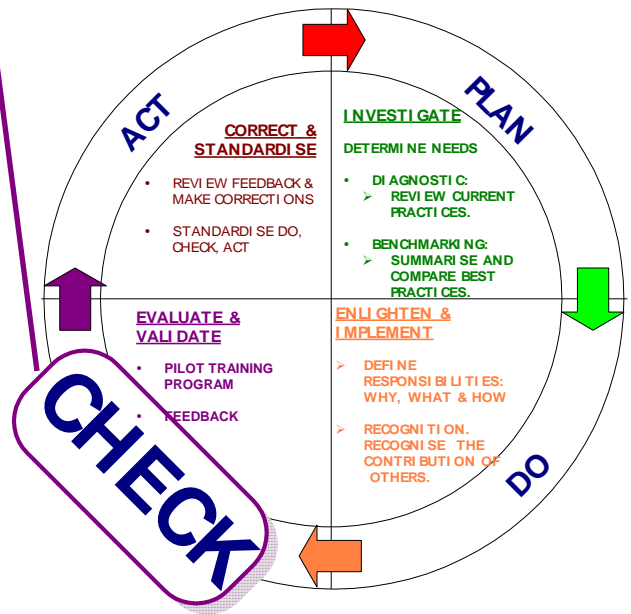
Enlighten

- **Brainstorm** solutions.
- **Rank** solutions to identify best impact.
- Carry out **Failure Prevention Analysis**.
- Carry out **Solution Effect Analysis**.
- Create **Project Plan** to implement solutions.
- Put measures of performance in place using **Control Charts or Check Sheets**.

Implement

- Carry out **Project Plan**.
- Educate, train & communicate

Purpose:- To **monitor** effect of implementation of project plan & find **Countermeasures** to further improve the solution.



Key Steps :-

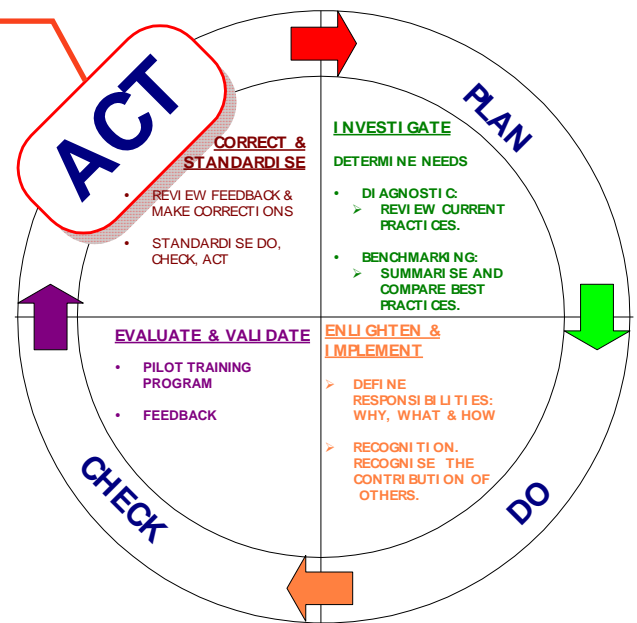
Evaluate

- **Collect data** to monitor performance improvements.
- **Involve & train** those affected by solution plan.
- Communicate & feedback.

Validate

- Resolve any issues by finding **Countermeasures** to ensure solution plan continues.

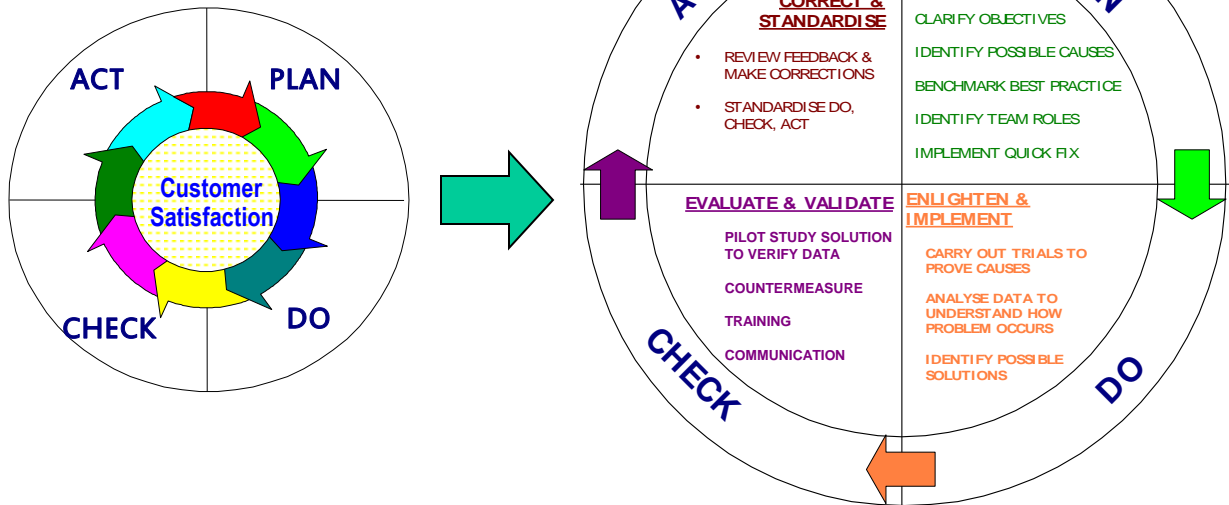
Purpose:- To Review Continuously the Performance Measure & make adjustments as required. Integrate new situation into Normal Working Practice. Start PDCA Cycle again.



Key Actions :-

Correct & Standardise

- Decide if solution is **effective** & either integrate into **normal working practice** or abandon. If plan is abandoned, ask what has been learned by the process and, restart the project.
- Determine **new target** & start PDCA cycle again.



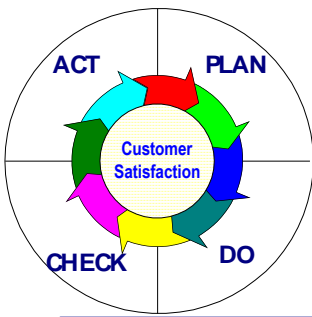
Checklist of PDCA Approach :

Have you got:

- a Sponsor - (Person who instigates the Problem Solving Session)
- b Team Leader.
- c Facilitator
- d Team Members

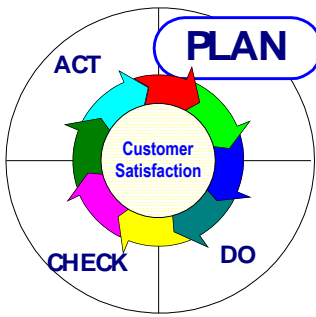
Problem Solving Process:

- P** 1 Define Problem & Objective (& Do Quick Fix)
- P** 2 Identify Likely Causes
- P** 3 Identify Major & Root Causes
- P** 4 Develop Solutions / Agree Action Plans
- D** 5 Implement action Plan
- C** 6 Determine Effectiveness of plan
- A** 7 Standardise Results / Implement in all relevant areas.



Techniques to use with PDCA - Selection Chart

Technique	P	D	C	A
1 BRAINSTORMING	✓	✓	✓	✓
2 CAUSE & EFFECT	✓			✓
3 CHECK SHEETS	✓		✓	✓
4 PARETO ANALYSIS	✓		✓	✓
5 CONCENTRATION DIAGRAMS	✓		✓	✓
6 PROCESS FLOW CHARTS.	✓	✓		
7 PERFORMANCE MEASURING	✓	✓	✓	✓
8 5 WHY'S & 5W1H	✓			
9 PAIRED COMPARISONS	✓	✓		
10 IMPACT DIAGRAMS	✓	✓		
11 FORCE FIELD ANALYSIS		✓		
12 SOLUTION EFFECT DIAGRAM		✓		
13 SCHEDULE or PROJECT PLAN		✓		
14 FAILURE PREVENTION ANALYSIS		✓		



Defining the Problem in SMART form.

What is this ?

It is **the** first step in the PDCA problem solving cycle.

Why do it ?

To ensure that the whole Team is clear about what their Goal is.

When do I use it ?

At the first Team meeting.

Who does this ?

The Team.

How de we do it ?

By considering each of the following aspects of the issue being addressed.

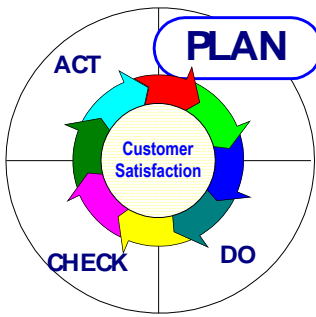
Who is the problem experienced by (Stakeholder)?

What is the problem ?

Where is the problem ?

When is the problem experienced ?

Use these statements as a “Sanity Check” to refer back to at later stages of the project to check if on track.



Writing a Team Mission Statement in SMART form.

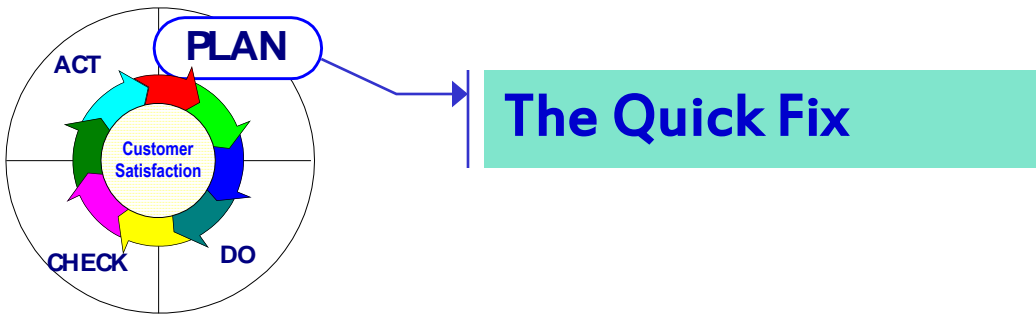
Write a statement using the following **SMART** rules.

Specific
Measurable
Achievable
Realistic
Time based

Examples

To reduce “Annual Lost working Days due to Back related Problems” in the “Stores Department” by 50% in 6 months.

To reduce “Risk of causing Back Related Injuries” in the Packing Department by 30% in 5 days.



What is this ? - This is a way of protecting the Customer from the Effect of the Problem being investigated.

Why do it ? - Because the Cause of the problem may take some time to resolve. (It stops the patient bleeding to death.)

When do I use it ? - Immediately the problem is identified.

Who does this ? - The Team

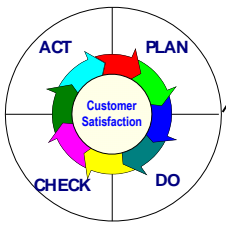
How do we do this ?

Typical Quick Fixes may include for example:-

Several Lifts where one is the normal
Additional but time-consuming lifting gear
100 % Manual Inspection of product on line by operator
Audit Inspection after final Operation.
Multi Pass Operations.
Pre Process Manual Inspection.

They are usually, but not always, **Time Consuming** and **Expensive**.

If , for example, the problem was a “ leaking roof due to a cracked tile “
The quick fix could be
To put a bucket under the leak.
The final solution could be
Replace the Tile, Check condition of other tiles annually.



Technique 1 - BRAINSTORMING

What is it ? - It is a method of generating Ideas or suggestions very quickly and creatively.

Why do it ? - So every member of the Team contributes.

Where is it used ? - Most often in the Team room, and otherwise anywhere that there is a Team and a Flipchart.

When is it used. ? - Usually when the problem being solved is identified and defined.

Who uses it ? - Can involve anyone.

How is Brainstorming Done ? -

STEP 1

- Find a quiet room with a **Flip Chart** and have **Pens , Post Its, Drywipe Markers, Blue Tac** available.
- Decide who will act as the **Team Scribe**.
- Write down the **Problem or Situation** being Studied or Investigated at the **TOP** of a Flip Chart.

STEP 2

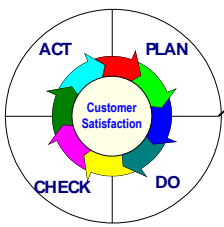
- Give all the Team Members a few Post Its.
- Then **individually** for 5 minutes write down on the Post Its (1 idea per sheet) **any** ideas or suggestions.
- When ideas have dried up, Stick all the ideas onto a Flip Chart and **Group** any similar ideas.
- Then for up to 10 minutes , working around the room , add any further ideas that may have been missed.

STEP 3

- ✓ As a Team discuss each idea and decide if they are **Totally, Partially or Not** in the Control of the Team.
- ✓ Separate out the **"Totally"** ideas.
- ✓ Prioritise them using **" Impact Diagrams" or "Paired Comparisons"**.

STEP 4

- ✓ The Team must decide if there is a need to involve someone else, in the Team, to resolve the **Partially or Not in Control** items.



Technique 2 - CAUSE & EFFECT

What is it ? - It is a method of **Brainstorming Causes** of a problem or situation.

Why do it ? - To help the Team can focus on specific themes and groups of causes .

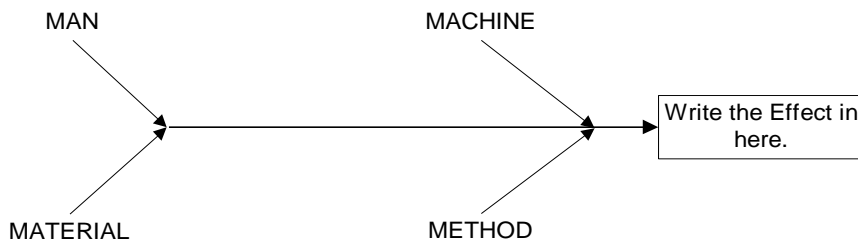
Where is it used ? - In the team room or at place of work

When do we use it ? - When a problem or effect is defined and possible causes are needed.

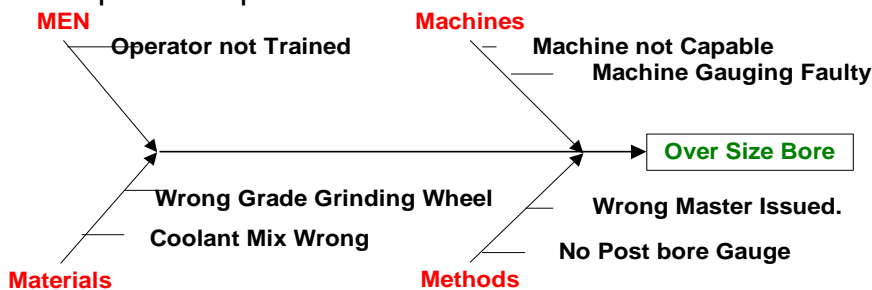
Who uses it ? - Everyone.

How do we use them ? -

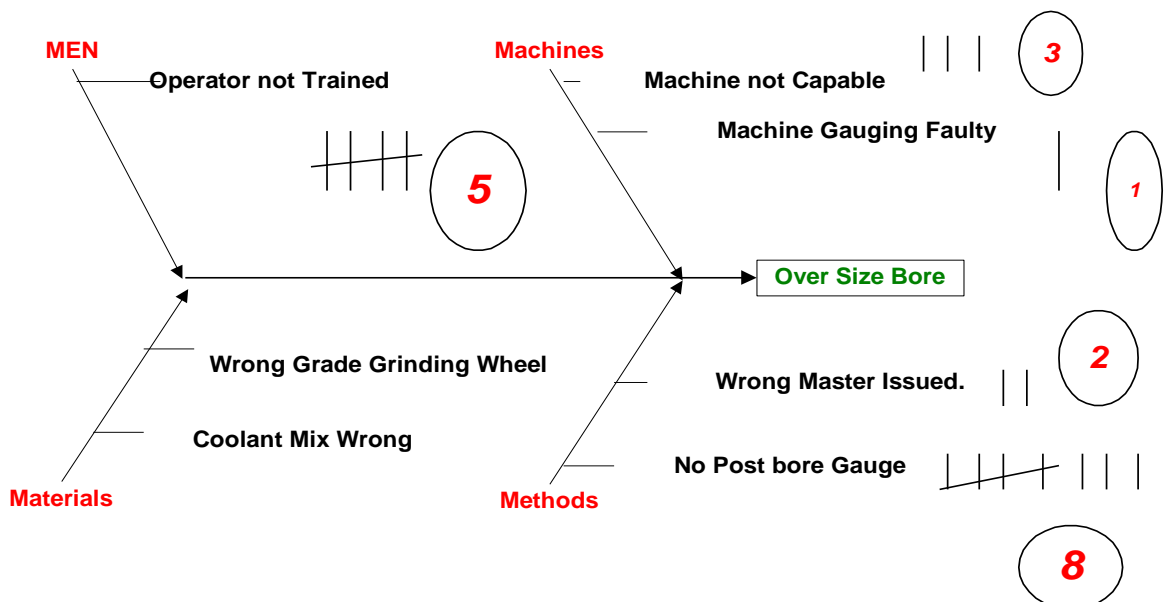
Step 1 - On a large board or flip chart . Construct the diagram below.

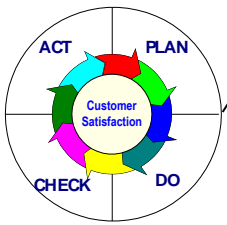


Step 2 - A Scribe Will take **POSSIBLE CAUSES** from round the table in Turn until Dried up. As per example below.



Step 3 - **Prioritise and Select** those to be investigated, by allocating **VOTES** to each Team member who add their choices to the Diagram . As per Diagram Below.





Technique 3 - CHECKSHEETS

What are they ? - They are a method of recording **factual data** over a period of **time**.

Why do it ? - So you will be able to confirm the **Causes** of the problem.

Where is it used ? - At the place where the investigation is taking place.

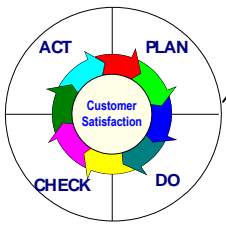
When is it used ? - After the initial brainstorming, when real data is required to confirm initial ideas.

Who uses it ? - The team should nominate and train volunteers to fill the sheet in.

How is it used ? -

Design a sheet similar to the one below, decide on data to be collected and when. Train the person who will collect the data.

	Week	Week	Week	Week		Cumulative
Cause	1	2	3	4	Total	Total
Weights too Heavy	53	43	42	61	199	199
Reach too far	24	29	27	27	107	306
Incorrect Posture	5	28	13	30	76	382
Previous Injury	24	20	2	29	75	457
Frequency of Lifts	8	31	15	11	65	522
Cold Workplace	21	9	7	16	53	575
Wrong Footwear	22	4	10	6	42	617
Accidental Twists	1	12	26	3	42	659
Total	158	176	142	183	659	



Technique 4 - PARETO ANALYSIS

What is it ? - A method of showing a table of data in graphical format to aid understanding.

Why do it ? - The visual impact is greater than a table of numbers. Can be filled in real time.

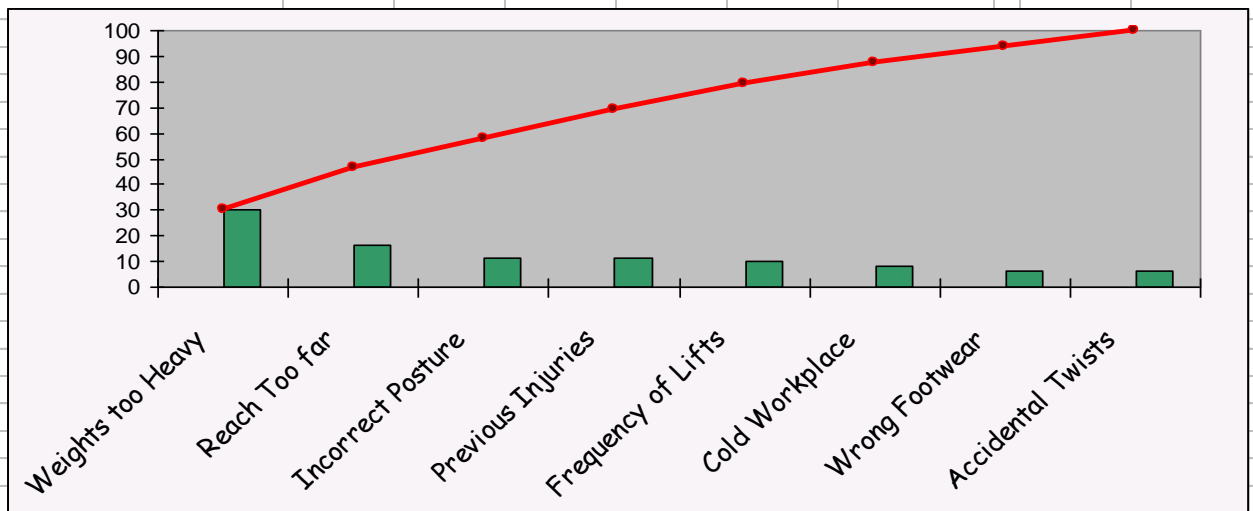
Where is it used ? - On notice boards, in departments at place of work.

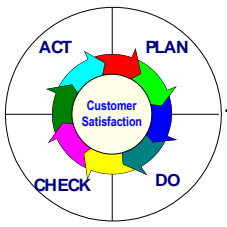
When is it used ? - After you have collected real data in checksheet form.

Who uses it ? - Anyone.

How do we use it ? -
(Using data in technique 3.)

	Week 1	Week 2	Week 3	Week 4		Cumulative		Cumulative
Reject	1	2	3	4	Total	Total	%	%
Weights too Heavy	53	43	42	61	199	199	30.19727	30.1972686
Reach Too far	24	29	27	27	107	306	16.23672	46.4339909
Incorrect Posture	5	28	13	30	76	382	11.53263	57.9666161
Previous Injuries	24	20	2	29	75	457	11.38088	69.3474962
Frequency of Lifts	8	31	15	11	65	522	9.863429	79.2109256
Cold Workplace	21	9	7	16	53	575	8.042489	87.2534143
Wrong Footwear	22	4	10	6	42	617	6.373293	93.6267071
Accidental Twists	1	12	26	3	42	659	6.373293	100
Total	158	176	142	183	659			





Technique 5 - **CONCENTRATION** **DIAGRAMS**

What is it ? - a simple visual aid to collect data about an area or idea you are investigating.

Why use it ? - It is easy to use and train

Where is it used? - at the place of investigation

when is it used? - When the team wants to know the what the real situation is, or to confirm a hunch about the investigation.

Who uses it? - Anyone

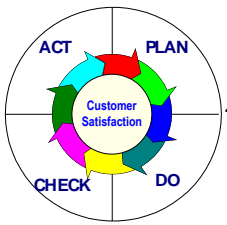
How do we use it? -

1) Make a sketch of the item or area you are investigating.



Simply make a mark everytime there is an occurrence of a problem in that location.

The resulting visual impact is easy to see



Technique 6 - PROCESS FLOW CHARTS.

What is it ? - It is a visual diagram of how the process being investigated operates.

Why do it ? - To clarify and understand how a process works and to investigate if there are any holes in it

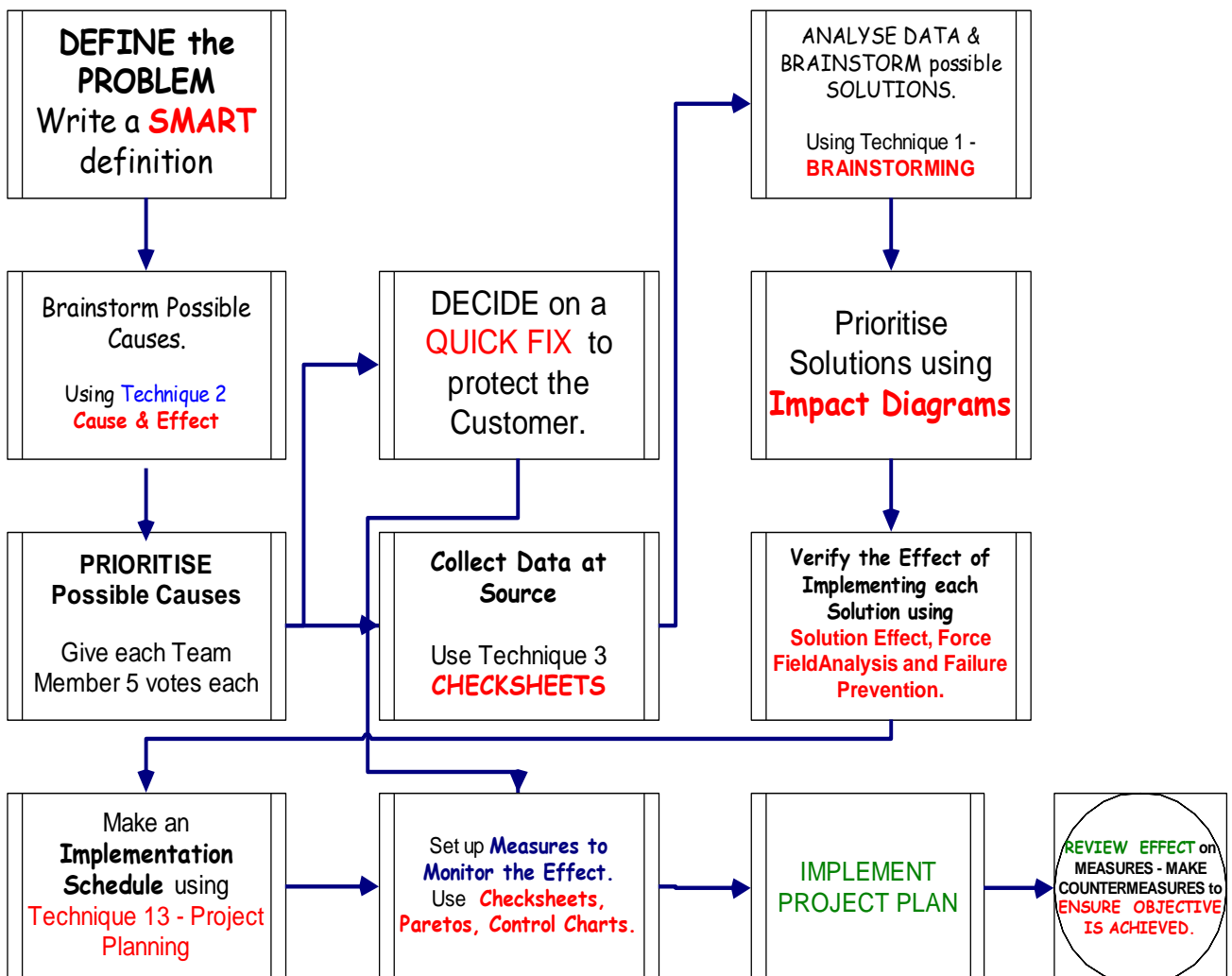
Where is it used ? - It can be used at any stage by the team to understand a situation.

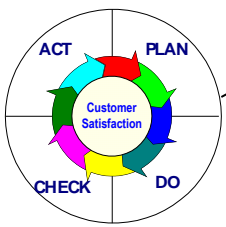
When is it used ? - Mostly during the planning phase and occasionally in the do act phase.

Who uses it ? - The team investigating the problem

How do we use it ? -

The example below shows PDCA in a Flow Chart form.





Technique 7 - Measuring Performance.

What is it? - It is a way of showing the Results and effects of changes made to a process.

Why use it? - To understand the current performance and to chart improvements and progress towards a target.

Where is it used? - Usually at the place of work or on the process being monitored.

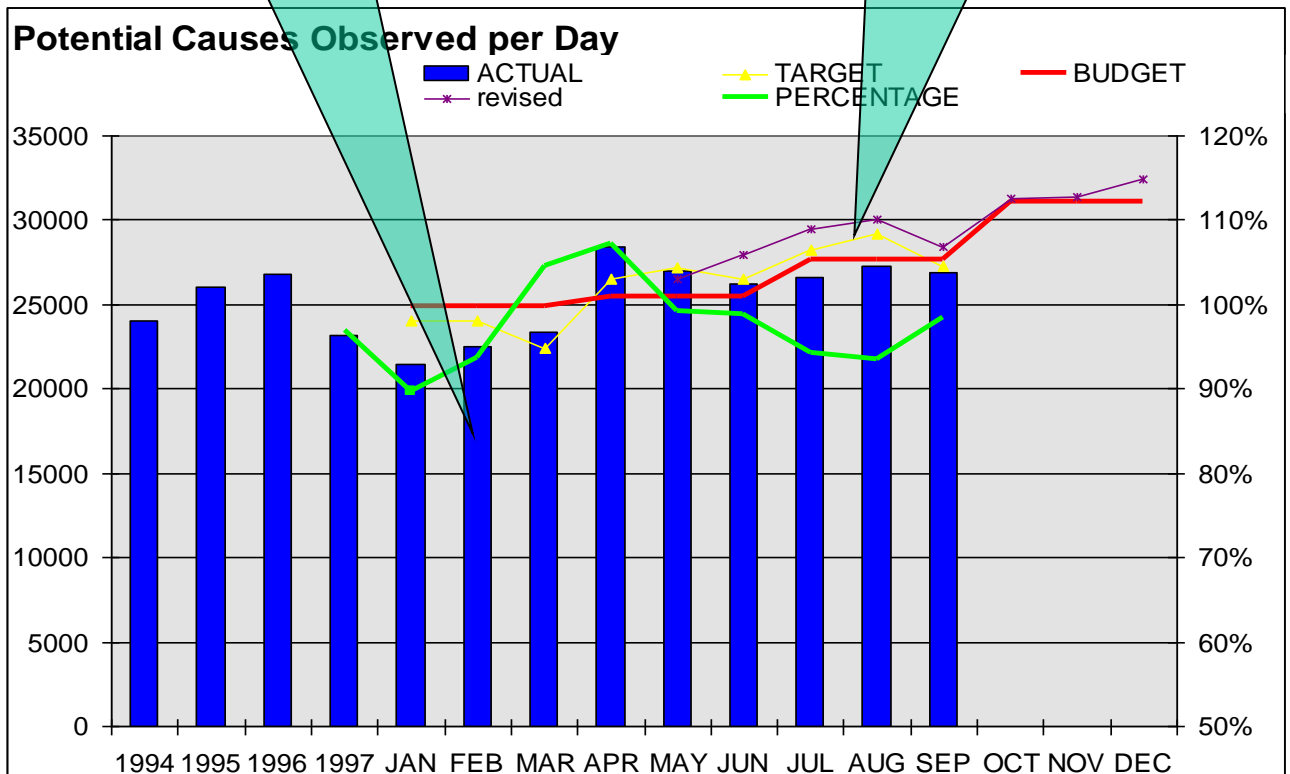
When is it used? - From the start of a project right , through to the end. Data is usually added every day , week or month.

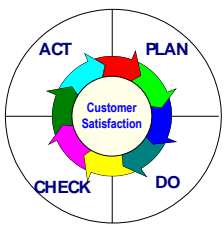
Who uses it? - The Team.

How is it used? -

Show the actual **"output"** achieved as a column.

Show **"Targets"** as lines





Technique 8 - a) 5 WHY's b) 5W1H.

What are they ? - A very simple way of finding out if the team has reached the ROOT CAUSE of a problem.

Why use them ? - To confirm the team perception

Where is it used ? - As part of a team problem solving sessions

When is it used ? - After initial brainstorming and defining a problem.

Who uses them ? - The team.

How do we use them ? -

a) 5 - Why's

Simply ask the question "**WHY**" 5 times

- 1) **WHY** will TV not come on ?
Because there is no power.
- 2) **WHY** is there no power ?
Because the fuse has blown.
- 3) **WHY** has the fuse blown ?
Because the fuse amp rating is too low.
- 4) **WHY** was the fuse amp rating too low ?
Because it was incorrectly selected.
- 5) **WHY** was it incorrectly selected ?
Because the house holder was ignorant understanding)
of the need for correct selection.

b) 5W1H

Simply ask

What ?

Why ?

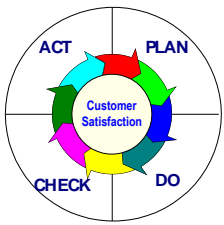
Where ?

When ?

Who ?

How ?

(When looking at a problem to clarify



Technique 9 - Paired Comparisons.

What are they ? - They are a method of Helping the team priorotise a number of potential causes and solutions.

Why use them ? - To get a team consensus.

Where is it used ? - In team meetings

When is it used ? - When the team wishes to know the priority of a number of causes or solutions before proceeding to the next stage.

Who uses it ? - The Team.

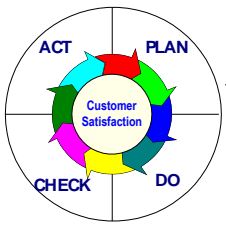
How is it used ? - The example below show how the Teams decided on a preferred action to improve heat treatment roundness

No 2 Item is **more likely** than No1 Item

No 6 Item is **more likely** than No3 Item

No	Item	Comparison						Total
1	Reduced Lifting Weights	1	(1)	(1)	(1)	(1)	(1)	5
		(2)	3	4	5	6	7	
2	Provision of Appropriate Footwear	(2)	(2)	(2)	(2)	(2)		6
		3	4	5	6	7		
3	Frequent back Health Checks	(3)	3	3	3			1
		4	(5)	(6)	(7)			
4	Reduced Lifting Reach	4	4	4				0
		(5)	(6)	(7)				
5	Increased Room Temperature	5	5					2
		(6)	(7)					
6	Propper Training	(6)						4
		7						
7	More Breaks							3

ADD up all the No 6's that have been circled and put the number in this column. And so on...



Technique 10 - **IMPACT DIAGRAMS.**

What are they? - They are a method by which the Team can identify the priorities of a large list of Ideas/actions or Causes...

Why use them? - To get a Team Consensus and get the greatest Impact with least effort.

When is it used? - In cases where there is a long list of items.

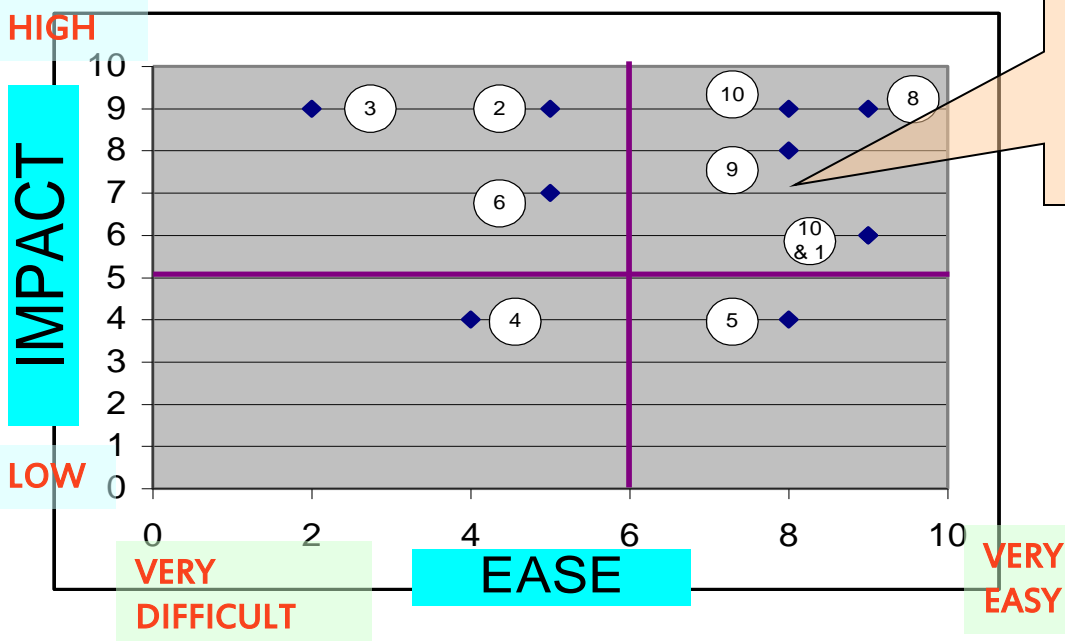
Where is it used? - Team Meetings

How is it done? -

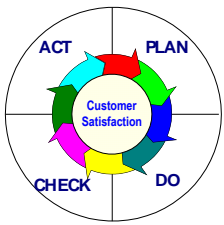
Step 1 Each Team Member should Rank against 2 - Criteria

- 1 The **EASE** of achieving (1 = Very Difficult to 10 = Very Easy), and
- 2 The **IMPACT** of the result (1 = Very Low to 10 = Very High) on the problem.

No.	Idea , Action or Cause.	EASE	IMPACT
1	Training	9	6
2	New Gauge	5	9
3	New Machine	2	9
4	Change Coolant Supplier	4	4
5	Change Coolant Mix	8	4
6	In Process gauge	5	7
7	Air Plug on Line	8	9
8	SOP	9	9
9	100% checking by hand	8	8
10	Communication	9	6



These items should be done first as **High Impact / Easy to do**



Technique 11 - FORCE FIELD DIAGRAMS.

What are they ? - A method of considering the positive and negative effects of implementing solution,

Why use them ? - To evaluate the possibilities of additional outcomes to the proposed solution.

Where is it used ? - Team room

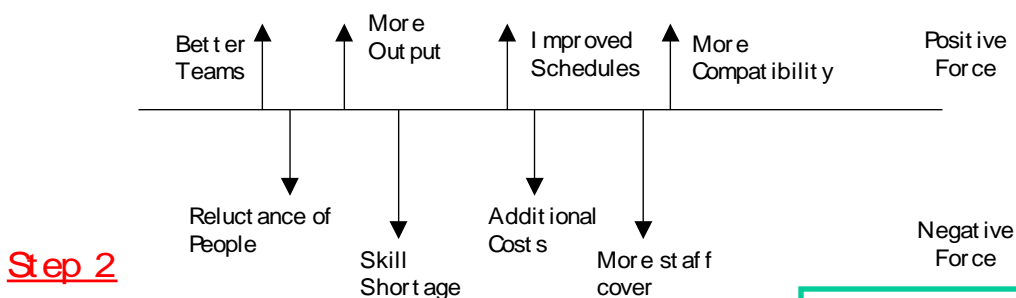
When is it used ? - When the team is discussing plans to implement a solution.

Who uses it ? - The team

How is it used ? -

Step 1 Write at the top of a flip chart the solution being discussed then draw diagram below.

Example Implement 3 - Shift working



Step 2

Transfer onto analysis sheet

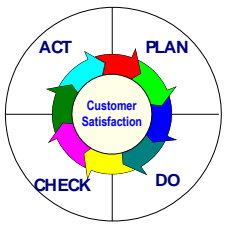
KEY

1 = LOW to 10 = HIGH

POSITIVE FORCES				NEGATIVE FORCES			
FORCE	Ability to Influence	Effect	Total	FORCE	Ability to Influence	Effect	Total
Better Teams	5	5	25	Reluctance of People	3	5	15
More Output	8	7	56	Skill Shortage	7	6	42
Improved Schedules	6	6	36	Additional Costs	5	4	20
More Capability	7	7	49	More Staff Cover	4	6	24

This highest number in the column indicates the **HIGHEST** benefit

This highest number indicates the worst **Negative** aspect that needs a countermeasure.



Technique 12 - SOLUTION EFFECT DIAGRAMS

What is it? - It is a way of Brainstorming the consequences of implementing a solution..

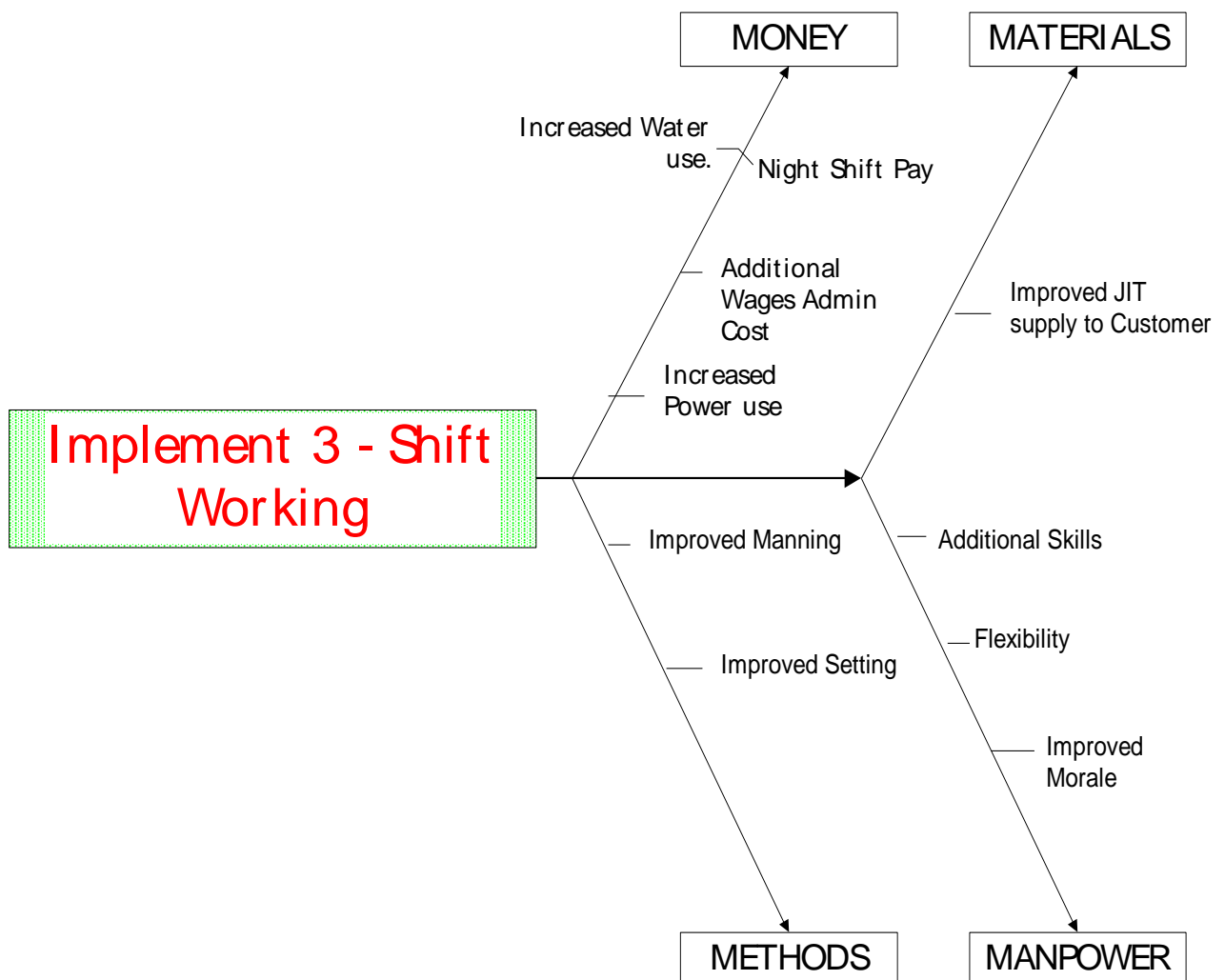
Why use it? -The Team should be aware of any side effects that implementing a solution may have.

When is it used? - When a solution has been determined , but prior to implementation.

Where is it used? - Team Meetings

How is it done? -

- 1 Construct the Diagram Below



From this diagram, the key actions to ensure success can be identified and any potential “downsides” to the solution can be highlighted.

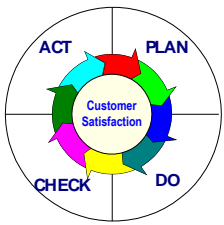


How is it done? -

- 1 Brainstorm all the actions required to implement the project.
- 2 Allocate responsibility for seeing a project through.
- 3 Decide the sequence that the actions must occur in.
- 4 Agree the Implementation dates.

The project can then be arranged in Gantt Chart form as shown below using Microsoft Project.

[illegible]



Technique 14 - **FAILURE PREVENTION ANALYSIS.**

What is it? - A technique that allows you to anticipate and counter problems before the implementation of a solution.

Why use it? - To be proactive. Putting countermeasures in place to prevent a project going wrong.

When is it used? - When a solution has been determined , but prior to implementation.

Where is it used? - Team Meetings

How is it done? -

- 1 Brainstorm what could go wrong.
- 2 Rank the possible failure by designating potential and consequence of going wrong.

Potential Failure	Potential	Consequence	Overall Rating	Ranking
A. New Business will not fit the Line	4	5	20	6
B. Late Delivery will mean loss of orders	5	5	25	4
C. The quality Standard is not met.	6	6	36	2
D. The Line is too slow.	3	3	9	7
E. The project is over budget.	7	3	21	5
F. It is too long for the building.	1	8	8	8
G. The machine is not Safe.	4	8	32	3
H. The machine is not CE marked.	9	8	72	1

Score Potential and Consequence on a scale of 1 to 10 and multiply together to give overall Rating