Tools & Techniques for Process Improvement

Understanding processes so that they can be improved by means of a systematic approach requires the knowledge of a simple kit of tools or techniques. The effective use of these tools and techniques requires their application by the people who actually work on the processes, and their commitment to this will only be possible if they are assured that management cares about improving quality. Managers must show they are committed by providing the training and implementation support necessary.

The tools and techniques most commonly used in process improvement are:

- Problem solving methodology, such as DRIVE
- Process mapping
- Process flowcharting
- Force field analysis
- Cause & effect diagrams
- CEDAC
- Brainstorming
- Pareto analysis
- Statistical process control (SPC)
- Control charts
- Check sheets
- Bar charts
- Scatter diagrams
- Matrix analysis
- Dot plot or tally chart
- Histograms

DRIVE is an approach to problem solving and analysis that can be used as part of process improvement.

Define   the scope of the problem the criteria by which success will be measured and agree the deliverables and success factors

Review   the current situation, understand the background, identify and collect information, including performance, identify problem areas, improvements and "quick wins"

Identify   improvements or solutions to the problem, required changes to enable and sustain the improvements

Verify   check that the improvements will bring about benefits that meet the defined success criteria, prioritise and pilot the improvements

Execute   plan the implementation of the solutions and improvements, agree and implement them, plan a review, gather feedback and review

One of the initial steps to understand or improve a process is **Process Mapping**. By gathering information we can construct a "dynamic" model - a picture of the activities that take place in a process. Process maps are useful communication tools that help improvement teams understand the process and identify opportunities for improvement.

ICOR (inputs, outputs, controls and resources) is an internationally accepted process analysis methodology for process mapping. It allows processes to be broken down into simple, manageable and more easily understandable units. The maps define the inputs, outputs, controls and resources for both the high level process and the sub-processes.
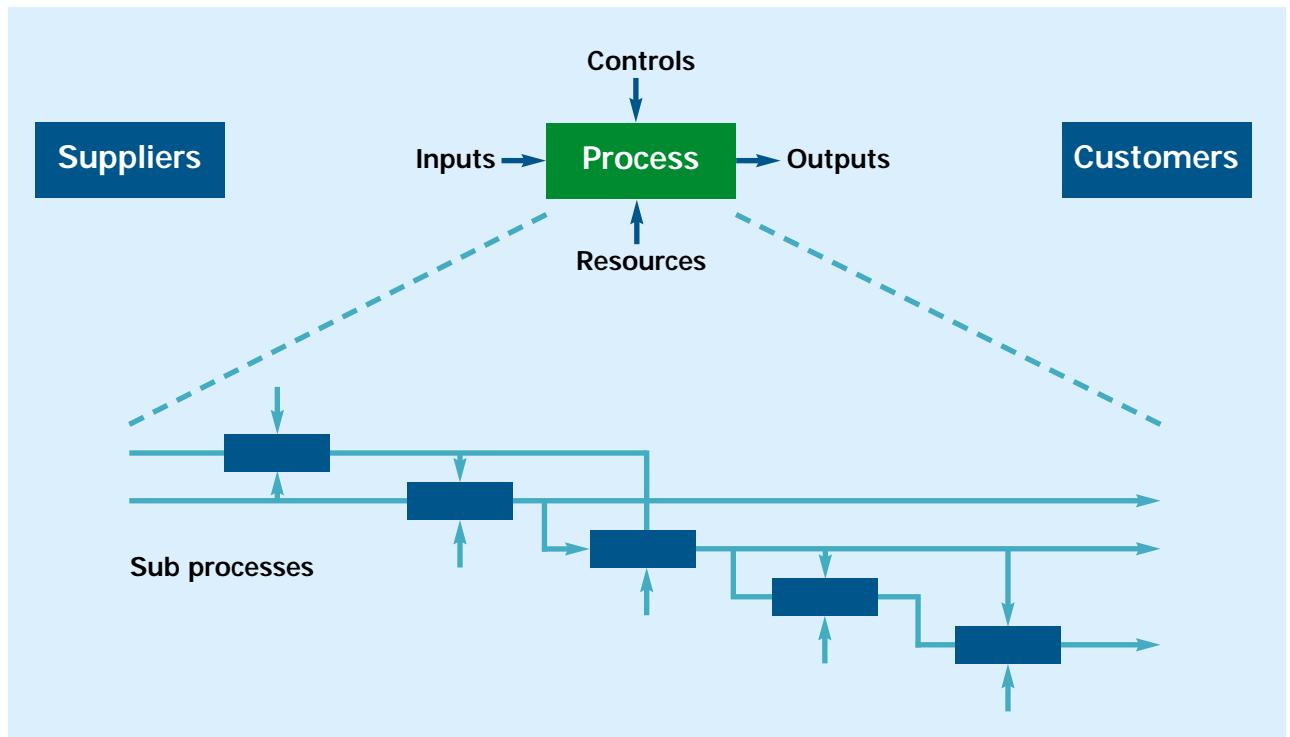

Process mapping provides a common framework, discipline and language, allowing a systematic way of working. Complex interactions can be represented in a logical, highly visible and objective way. It defines where issues or "pinch points" exist and provides improvement teams with a common decision making framework.

To construct a process map:

- Brainstorm all activities that routinely occur within the scope of the process
- Group the activities into 4-6 key sub-processes
- Identify the sequence of events and links between the sub-processes
- Define as a high level process map and sub-process maps using ICOR

Process maps provide a dynamic view of how an organisation can deliver enhanced business value. "What if" scenarios can be quickly developed by comparing maps of the process "As is" with the process "To be".

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Another tool used in the construction of process maps is **Process Flowcharting.** This is a powerful technique for recording, in the form of a picture, exactly what is done in a process.
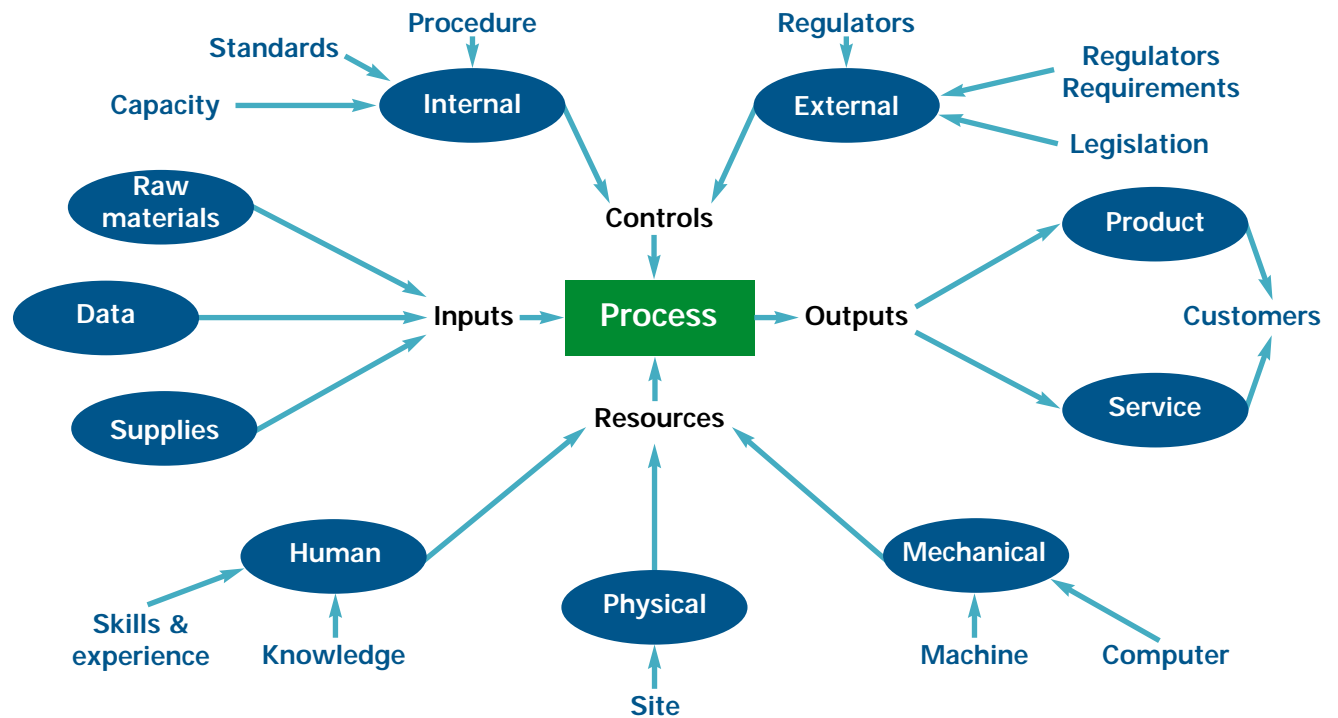

There are certain standard symbols used in classic flowcharts, and these are:
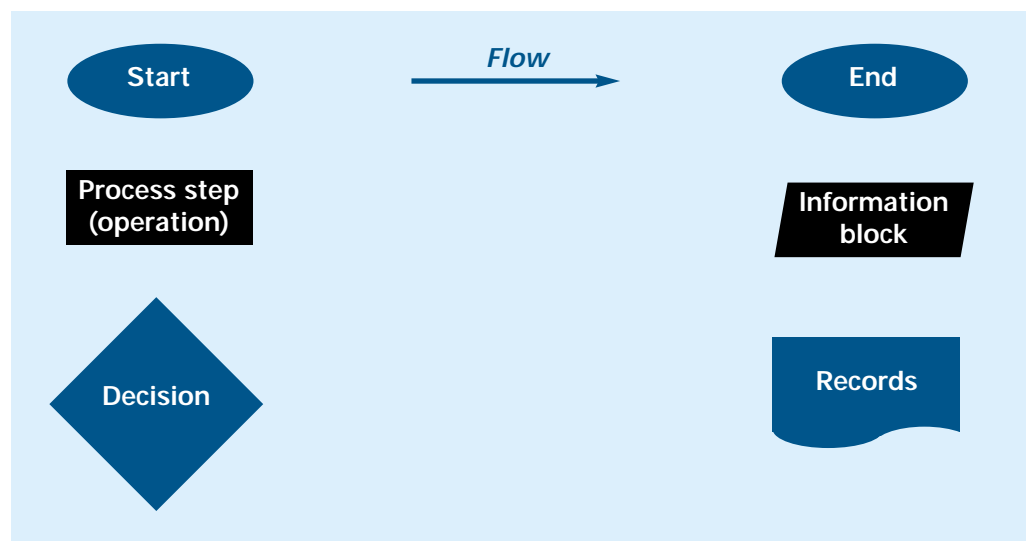

If a flowchart cannot be drawn using these symbols, then the process is not fully understood. The purpose of the flowchart is to learn why the current process operates the way it does and to conduct an objective analysis, to identify problems and weaknesses, unnecessary steps or duplication and the objectives of the improvement effort.

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Force Field Analysis is a technique for identifying forces which may help or hinder achieving a change or improvement. By assessing the forces that prevent making the change, plans can be developed to overcome them. It is also important to identify those forces that will help with the change. Once these forces have been identified and analysed, it is possible to determine if a proposed change is viable.

Driving forces

Restraining forces
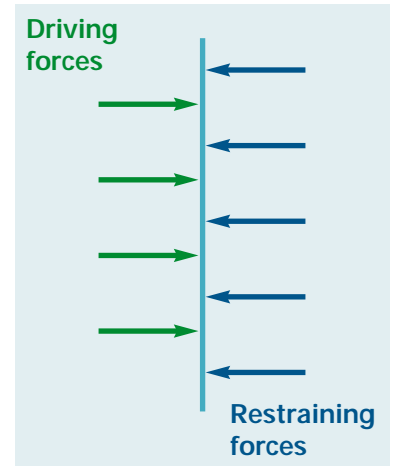
A useful way of mapping the inputs that effect quality is the **Cause & Effect Diagram**, also know as the **Fishbone** or **Ishikawa Diagram**. It is also a useful technique for opening up thinking in problem solving.

Problem

or Effect

Factors or Concerns
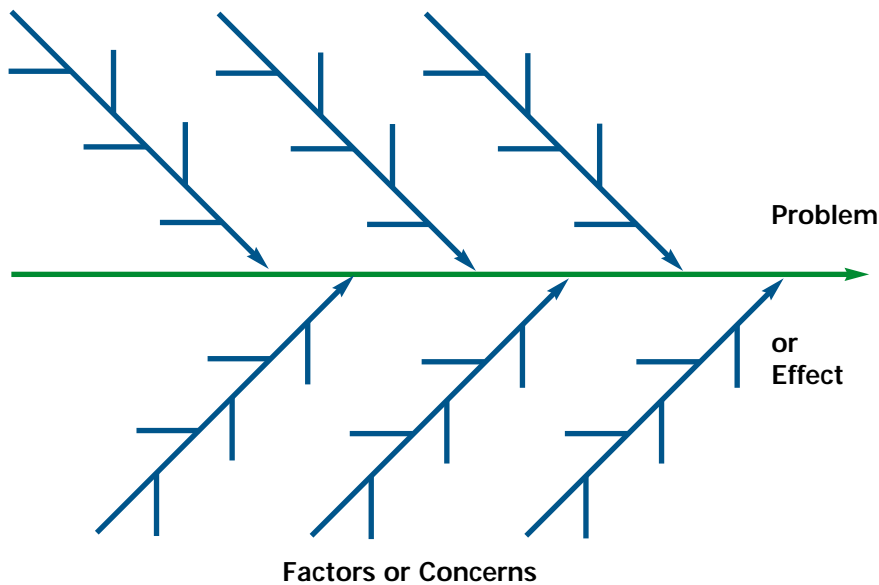
The effect or problem being investigated is shown at the end of a horizontal arrow; potential causes are then shown as labelled arrows entering the main cause arrow. Each arrow may have other arrows entering it as the principal causes or factors are reduced to their sub-causes; brainstorming can be effectively used to generate the causes and sub-causes.

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With **CEDAC – Cause and Effect Diagram with the Addition of Cards**, the effect side of the diagram is a quantified description of the problem, and the cause side of the diagram uses two different coloured cards for writing the *facts* and the *ideas*.

The *facts* are gathered and written on the left of the spines, and the *ideas* for improvement on the right of the cause spines. The *ideas* are evaluated and selected for substance and practicality.

Fact or Problem card

Improvement card
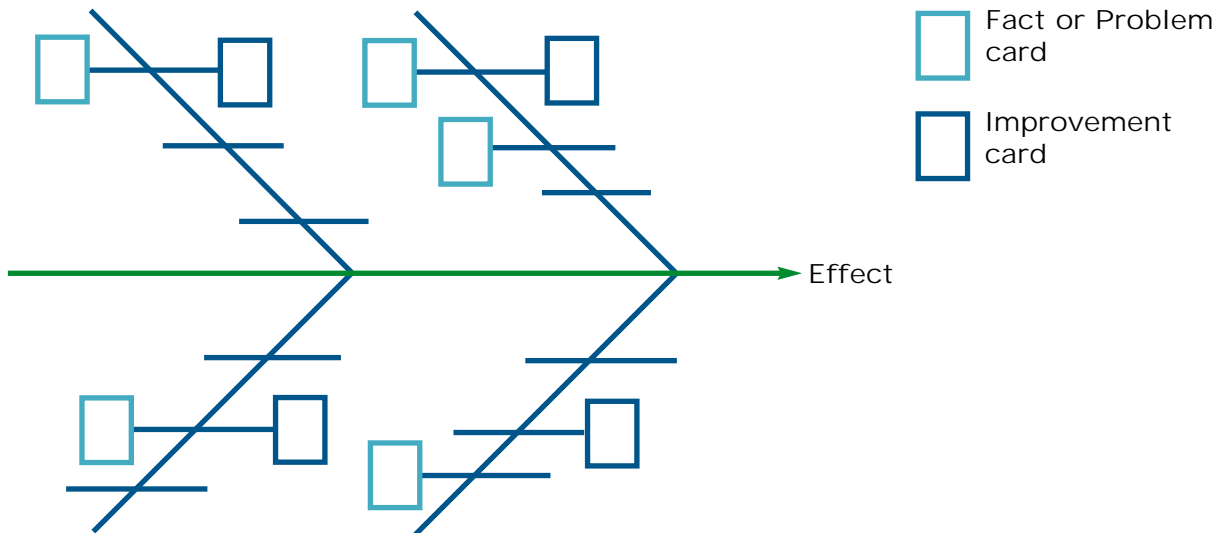
Effect

Brainstorming can be used in conjunction with the Cause and Effect tool. It is a group technique used to generate a large number of ideas quickly and may be used in a variety of situations. Each member of the group, in turn, can put forward an idea concerning the problem being considered. Wild ideas are welcomed and no criticism or evaluation occurs during brainstorming, all ideas being recorded for subsequent analysis. The process continues until no further ideas are forthcoming and increases the chance for originality and innovation. It can be used for:

* Identifying problem areas
* Identifying areas for improvement
* Designing solutions to problems
* Developing action plans

Pareto Analysis can be used to analyse the ideas from a brainstorming session. It is used to identify the vital few problems or causes of problems that have the greatest impact. A Pareto diagram or chart pictorially represents data in the form of a ranked bar chart that shows the frequency of occurrence of items in descending order. Usually, Pareto diagrams reveal that 80% of the effect is attributed to 20% of the causes; hence, it is some-times known as the 80/20 rule.
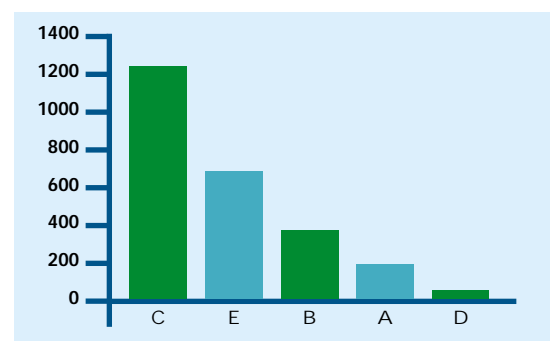
Statistical Process Control (SPC) is a toolkit for managing processes. It is also a strategy for reducing the variability in products, deliveries, materials, equipment, attitudes and processes, which are the cause of most quality problems. SPC will reveal whether a process is "in control" – stable and exhibiting only random variation, or "out of control" and needing attention. It also automatically warns when performance deteriorates, and can assist with long-term defect reduction, identification of special or assignable causes, reduction or elimination of causes of variation and achievement of a level of performance as close to target as possible.

In SPC, numbers and information form the basis for decisions and actions, and a thorough data recording system is essential. In addition to the tools necessary for recording the data, there also exists a set of tools to analyse and interpret the data, some of which are covered in the following pages. An understanding of the tools and how to use them requires no prior knowledge of statistics.

One of the key tools of SPC is a **Control Chart**. It is used to monitor processes that are in control, using means and ranges. It represents data, e.g, sales, volume, customer complaints, in chronological order, showing how the values change with time. In a control chart each point is given individual significance and is joined to its neighbours. Above and below the mean, Upper and Lower Warning and Action lines (UWL, LWL, UAL, LAL) are drawn. These act as signals or decision rules, and give operators information about the process and its state of control. The charts are useful as a historical record of the process as it happens, and as an aid to detecting and predicting change.


Time
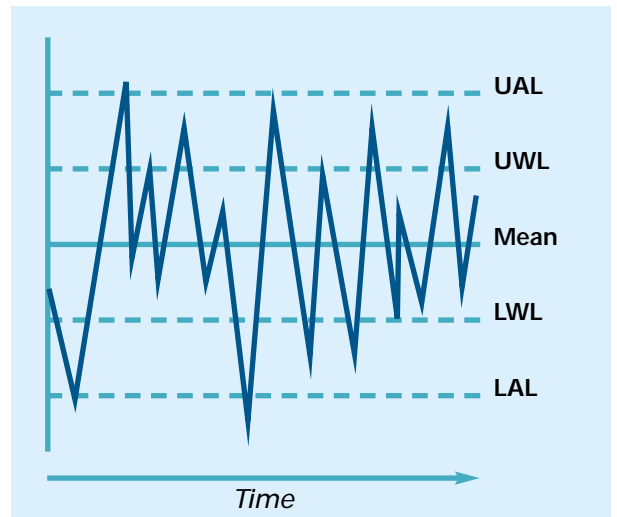
	Total
IIII II IIII III II I	X
II II II II III II II	Y

A **Check Sheet** is an organised way of collecting and structuring data, its purpose is to collect the facts in the most efficient way. It ensures that the information that is collected is what was asked for and that everyone is doing it the same way. Data is collected and ordered by adding tally or check marks against predetermined categories of items or measurements. It simplifies the task of analysis.

Bar Charts are visual displays of data in which the height of the bars is used to show the relative size of the quantity measured. The bars can be separated to show that the data is not directly related or continuous. They can be used to give visual impact to data, compare different types of data and compare data collected at different times.
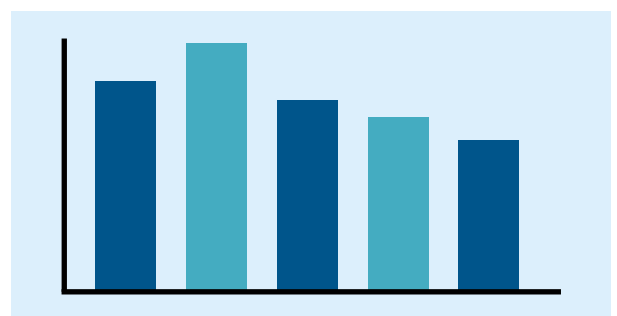
A **Scatter Diagram** is a graphical representation of how one variable changes with respect to another. The variables are plotted on axes at right angles to each other and the scatter in the points gives a measure of confidence in any correlation shown.
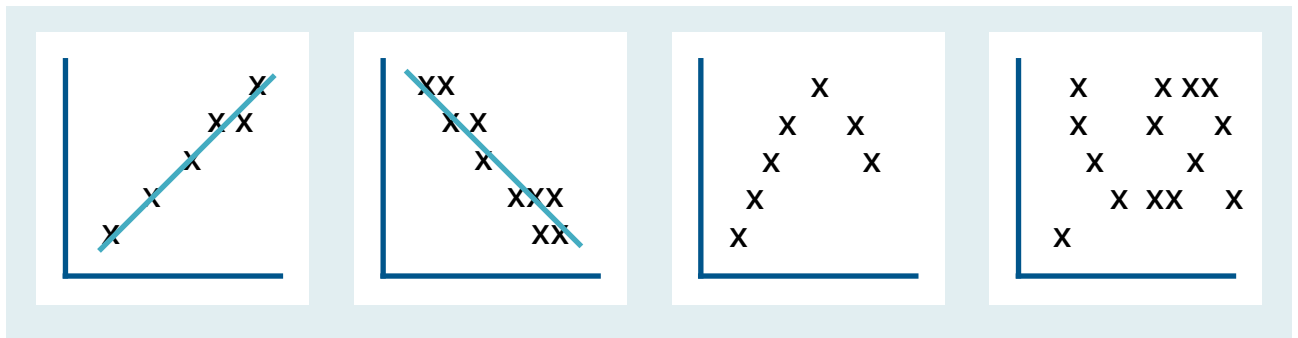

They show whether 2 variables are related, or prove that they are not, the type of relationship, if any, between the variables and how one variable might be controlled, by suitably controlling the other. They also make predictions of values lying outside the measured range.

In its simplest form, **Matrix Analysis** is a way of presenting data in a rectangular grid, with data displayed along the top and down the side.

Symbols placed at the intersections of the grid enable relationships to be established between the two sets of data. It summarises all the known data in one table and highlights gaps in knowledge and relationships between items. It is a valuable attention focusing tool for teams, and simplifies the task of priority ranking a set of items.

	A	B	C	D
1	✓	✓		✓
2			✓	
3	✓	✓	✓	✓
4		✓		

The **Dot Plot** or **Tally Chart** is a frequency distribution. It shows how often (the frequency) a particular value has occurred. The shape of the plot can reveal a great deal about a process, giving a picture of the variation, highlighting unusual values and indicating the probability of particular values occurring.

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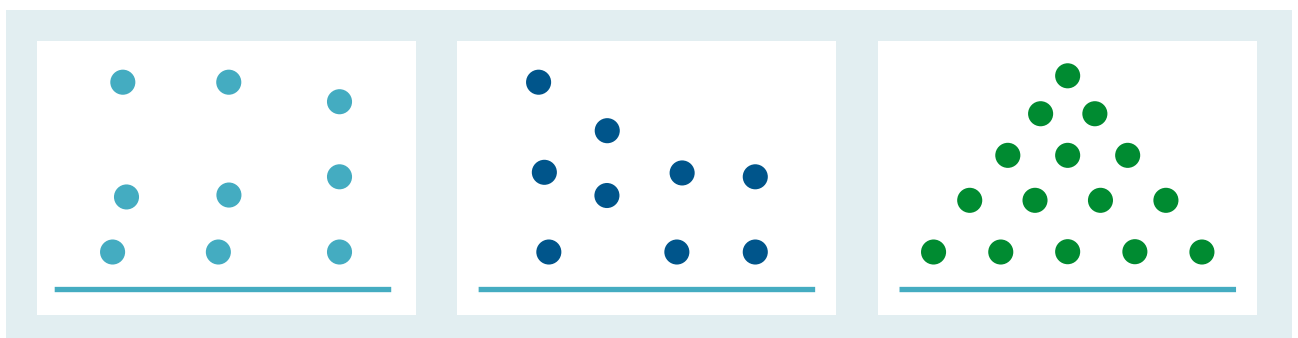
A **Histogram** is a picture of variation or distribution, where data has been grouped into cells and their frequency represented as bars. It is convenient for large amounts of data, particularly when the range is wide. It gives a picture of the extent of variation, highlights unusual areas and indicates the probability of particular values occurring.
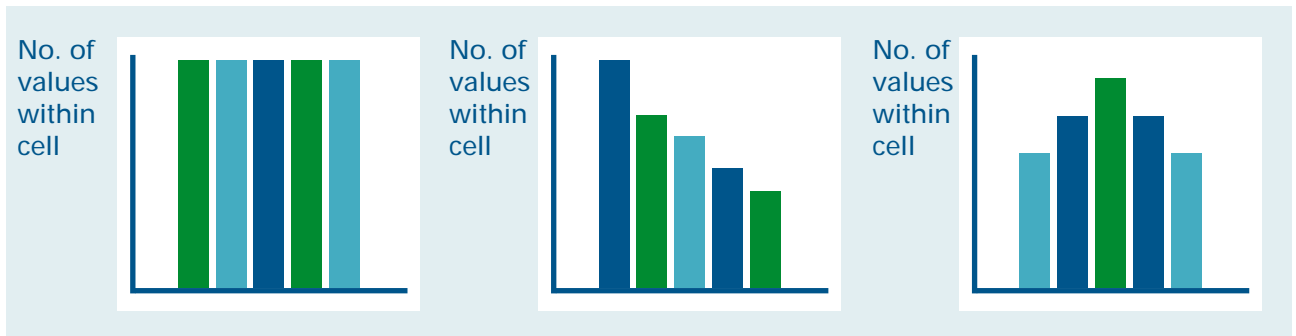
With such a shopping list of tools and techniques, it may not be easy to know which one to use when. To overcome this problem, the following matrix refers to the six step methodology for process improvement and indicates the key tools and techniques that could be used in each step. However, this list is not exhaustive and the tools should be used in conjunction with measurement techniques.

Tool/Technique	Process Improvement Methodology Step (refer to section on Processes)					
	Select	Understand	Performance	Review	Change	Capture
DRIVE		X	X	X	X	X
Mapping		X	X	X		
Flowcharting		X	X	X		
Force Field	X			X	X	
Cause & Effect /CEDAC				X		
Brainstorming	X	X		X		
Pareto Analysis				X		
SPC			X			X
Run/Control Charts			X			X
Check Sheets			X			X
Bar Charts			X			
Scatter Diagram			X			X
Matrix Analysis			X	X		
Dot Plot			X	X	X	X
Histogram			X			X