

## SPC Tools & Application

	Key word	What	When to use	Decision Making	Deciding Factor	Outcome	Prerequisite	Point of caution
Histogram	Data Distribution	A tool that describes data in terms of frequency and its distribution	When you want to visualise data in the form of a curve	Information		Central Location and Min & Max Value of data, distribution across the data range and shape of the curve	Continuous Data	Only one data set can be studied using one histogram
Pareto Chart	Prioritise	A tool to compare different attributes based on their frequency of appearance	When you want to prioritise on major category / major failures	Decide	% Cumulative contribution > 80%	Vital 20% categories among the analysed categories	Frequency or count (repetition in raw data)	Require process expertise to categorise
Box Plot	Compare	A tool to compare the location and spread of multiple data sets	When you want to visualise histogram data with mean, median and outliers and when you want to compare the distribution of more than one data set	Information / Decide	Median Line, Height of box and length of Whisker	Central location (concentration), spread of data (height of the box), skewness (position of median line), Outliers. We can compare multiple data sets in a single graph with multiple box plots	One parameter of multiple data sets	Indicative or comparative decisions can be taken. Not an absolute decision making tool like Pareto or Regression
Time Series	Trends and Patterns	A tool to see process behaviour over a time period	When you want to understand the change in the data against a specific interval of time or sequence	Suspect		Can Identify typo errors, visual validation of data correctness, trends and patterns of data	The interval has to be constant (time interval / sequence interval). We need to follow Simple Systematic sampling to derive a Time Series	Need process expertise to interpret the graph
Control Chart	Statistical Stability	A tool to check whether the process needs adjustments or improvements	When you want to see whether our process is under statistical control / stability	Decide / Suspect	Any point of control limit	Statistical stability of process & presence of any special cause variation. A process with one or more special causes is considered not ready for improvement. Control Limits also indicate where we can expect the next data point	We need to follow Systematic sampling to derive a control chart. The interval has to be constant (time interval / sequence interval). Systematic Sub-group sampling will be required to construct a X-bar R Chart or X-bar S Chart	Higher stability does not mean higher capability
Normality Test	Normality	A tool to check whether our data is following a normal distribution (bell-shaped curve) or not	When you want to measure how much close our data is to ideal normal curve	Decide	p-value (more than 0.05 is said to be close enough to Normal data)	Same as purpose		
Process Capability Cp	Capability	A tool to measure the ability of our process to meet customer requirement with respect to the studied parameter in short term	When you want to measure our capability of process to meet customer specifications	Decide	Cp Value	How less is our process variation in comparison with the allowed variation	The interval has to be constant (time interval / sequence interval).	To be used for only established process (not for a new process). Use of short term Standard Deviation.
Process Capability Cpk	Capability	A tool to measure the ability of our process to meet customer requirement with respect to the studied parameter in short term	When you want to measure the capability of process to meet customer specifications	Decide	Cpk Value (Least of Cpk-Upper and Cpk-Lower is considered as Process Cpk)	How much close is my mean to the target and how much less my process variations compared to allowed variations	The interval has to be constant (time interval / sequence interval).	Use of short term Standard Deviation
DPMO	Capability	A tool to measure the number of defects the process will produce	When you want to assess our process capability in terms of number of defects produced by the process	Decide	DPMO Value	How many defects will my process produce in future	We need to count the number of defects produced in a process and not the number of defective pieces. i.e., % rejection data cannot be converted into DPMO	It is different from PPM. Optimum number of Defect Opportunities
Brainstorming	Cause Analysis	A tool to collect expert ideas, opinions from a small team	When you want to gather all possible causes of a rejection / all possible ideas for a solution	Suspect	-	List of all possible cause of failure or solutions that are mutually exclusive and collectively exhaustive	People participating in brainstorming has to have some basic knowledge about the process and the problem	Every point counts. To be exhaustive
Fish-bone Analysis	Cause Analysis	A framework to collect ideas from people related to 6 Categories of failures	When you want to gather all possible causes of a rejection / all possible ideas for a solution	Suspect	-	If we covered all the 6 categories then there is a high probability that we have covered all possible causes	People participating in brainstorming has to have some basic knowledge about the process and the problem	Everything can not be done using spreadsheets
Why-Why Analysis	Cause Analysis	A tool to dig into the root cause	When you want explore all root causes	Suspect	-	List of all possible root causes	People participating in brainstorming has to have some basic knowledge about the process and the problem	Knowing where to stop
Regression	Relationship	A tool to check the relationship between two factors	When you want mathematically determine the relationship between two process variables	Decide	R-Square Value	Mathematical equation stating the relationship between the analysed variable. Whether one variable is impacting the other variable, if so how strongly it impacts.	Data of two variables (more than 2 is also possible) preferably collected at same time (simultaneously)	Correlation is not causation