



8.3 Control Quality (298)



'Test the Process Output'

~ 10Q

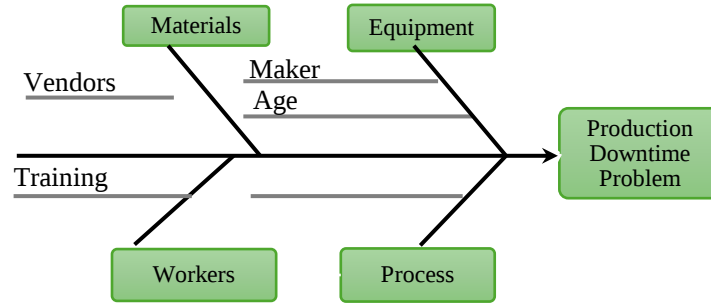
Definition: The process of...

monitoring and recording results of executing the quality management activities in order to assess performance and ensure the project outputs are complete, correct, and meet customer expectations

INPUT	TOOLS & TECHNIQUES	OUTPUT
- Project Management Plan (PMP) - Quality Management Plan - Project Documents - Lessons Learned register - Quality Metrics - Test & Evaluation docs - Approved Change Requests - Deliverables - Work Performance Data (WPD) - EEFs & OPAs	- Data Gathering - Checklists - Check Sheets - Statistical Sampling - Questionnaires & Surveys - Data Analysis - Performance Reviews - Root Cause Analysis - Inspection - Testing / Product Evaluations - Population Testing (test every item) - Sample Testing (test a predetermined percentage of every item created) - Data Representation - Cause-and-Effect Diagrams - Control Charts - Histogram - Scatter Diagrams - Meetings	- Quality Control Measurements - Verified Deliverables - Work Performance Info (WPI) - Change Requests - Project Management Plan updates - Quality Management Plan - Project Doc updates - Issue Logs - Lessons Learned Register - Risk Register - Test & Evaluation docs

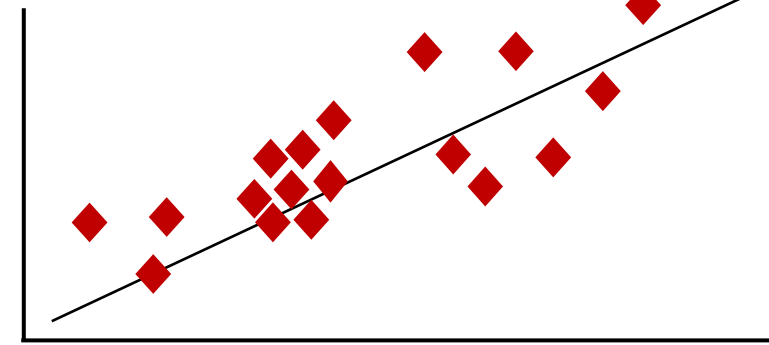
Tools & Techniques - Quality Model Tools

Cause & Effect Diagram aka Isakawa / Wishbone

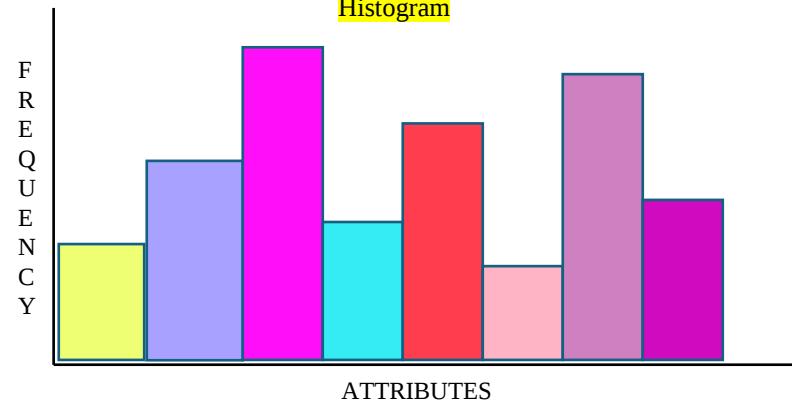


*Diagram relationships to reveal potential causes of a problem; e.g., what is causing production downtime?

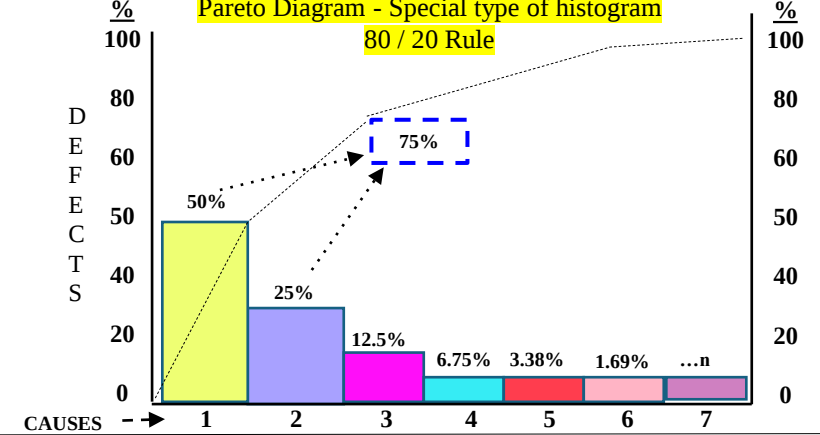
Scatter Diagram



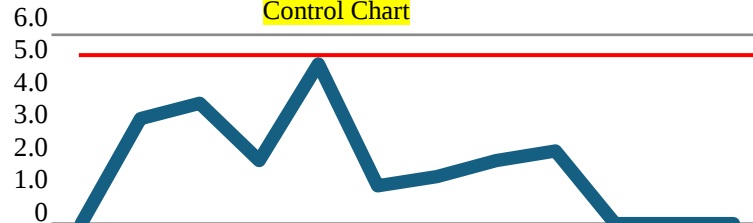
Histogram



Pareto Diagram - Special type of histogram



Control Chart



- Mean (AVG of all data)
- Upper / Lower Spec Limits
- Upper / Lower Control limits

Flowcharts

- Process Maps
- Display sequence of steps

Checklists

- Also known as tally sheets (i.e. Excel spreadsheet)
- Used to inform inspections to identify

Tools & Techniques - Quality Control

1.

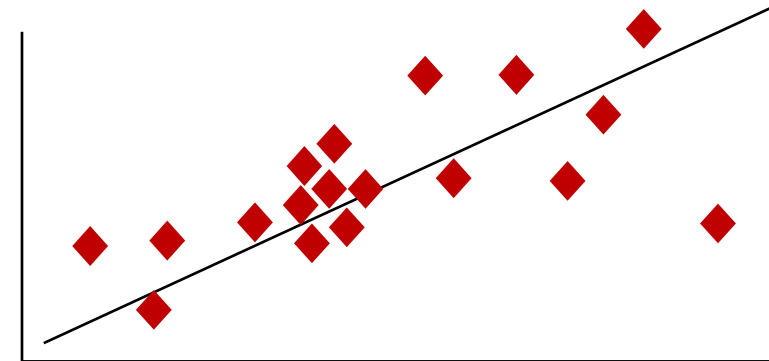
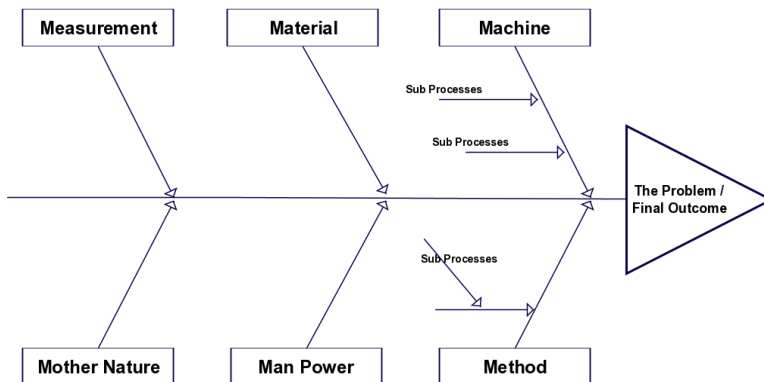
Ishikawa diagram (cause & effect diagram)

- Referred to as 'fish bone' diagrams because they resemble a fish skeleton
- Allow management to determine which issues have to be addressed in order to gain or avoid a particular event.
- Often used in manufacturing and product development to outline the different steps in a process, demonstrate where quality control issues might arise and determine which resources are required at specific.

2.

Scatter Diagram

- Tool for analyzing relationships between two variables, one independent, the other dependent.
- The closer the points are to the diagonal line, the more closely they are related.
- One variable is plotted on the horizontal axis and the other is plotted on the vertical axis. The pattern of their intersecting points can graphically show relationship patterns. Most often a scatter diagram is used to prove or disprove cause-and-effect relationships.
- Use a scatter diagram to design a control system to ensure that gains from quality improvement efforts are maintained.



Tools & Techniques - Quality Control

3.

Histogram

- Histogram is a vertical bar chart
- Each column = attribute
- Height = frequency
- Used to present 'continuous data', that is data that represents measured quantity where, at least in theory, the numbers can take on any value in a certain range.
- Sometimes you see bar graphs with no spaces between the bars but **histograms are never drawn with spaces between the bars.**

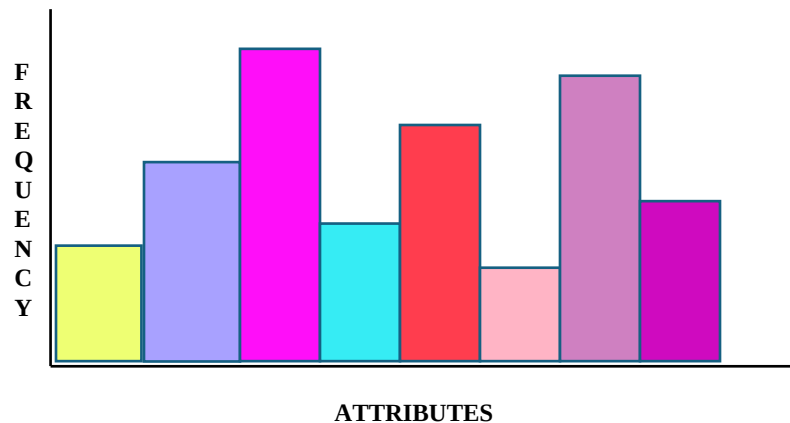
4.

Pareto Chart (80 / 20 Rule)

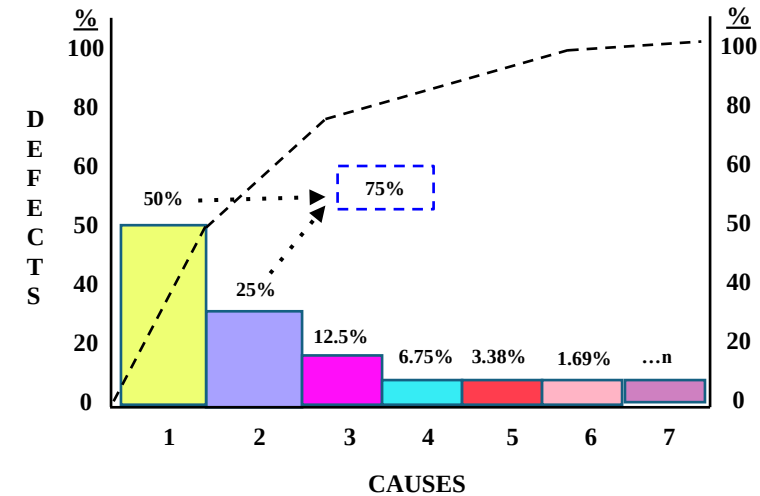
3Q

- 20 percent of the problems cause 80 percent of the impact
- Special type of histogram
- A bar chart used to separate the 'vital few' from the 'trivial many.'
- Separate the few major problems from the many possible problems so you can focus your improvement efforts
- Arrange data according to priority or importance
- Determine which problems are most important, using data, not perception

Histogram



Pareto Diagram
(80 / 20 Rule)





Manage Quality	Control Quality
Focused on Process	Focused on Product
Pro -active	Re active
Staff function	Line function
Prevents defects	Finds defects
Quality Audits	Testing
Do things right!	Do the right things!

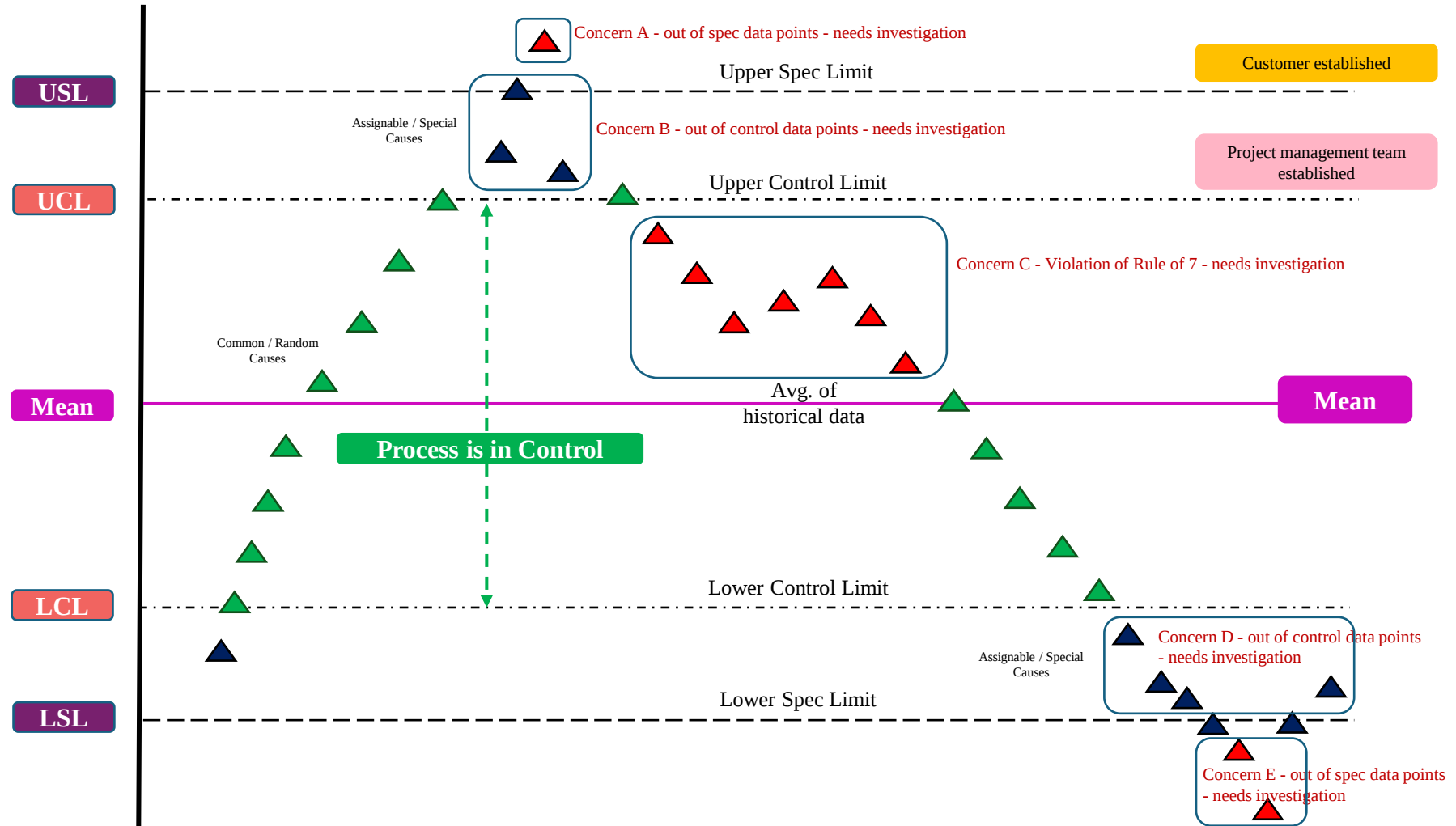


Example: Control Chart (a picture of the process output over time)

Outcome might be acceptable if the data falls between the USL & LSL

Think of a road!

- Mean = middle of road
- CL's are the white stripes near edge.
- The edges are the tolerance, SL's



1. Control Chart is a graph used to study **how a process changes over time**.
2. Data are plotted in time order.
3. A control chart always has a central line for the **average (MEAN)** determined from historical data.
4. An upper line for the upper **spec limit** and a lower line for the lower spec limit is **set by the customer**
5. An upper line for the upper **control limit** and a lower line for the lower control limit is **set at +/- 3 sigma**
6. By comparing current data to these lines, you can draw conclusions about whether **the process variation is consistent (in control / stable) or is unpredictable (out of control)**, affected by special causes of variation).
7. Data points within control limits are called **common-random-normal causes**
8. Data points falling outside the control limits are called **assignable or special causes** (unstable causes that must be investigated)
9. **Rule of 7...** 7 data points, consecutive, and on same side of mean within the control limits, must be investigated

When to Use a Control Chart

- When controlling ongoing processes by finding and correcting problems as they occur.
- When predicting the expected range of outcomes from a process.
- **When determining whether a process is stable (in statistical control).**
- When analyzing patterns of process variation from special causes (non-routine events) or common causes (built into the process).
- When determining whether your quality improvement project should aim to prevent specific problems or to make fundamental changes to the process.

Tools & Techniques - Quality Control

6.

Flowcharts

- Process Maps
- Display sequence of steps

7.

Checklists

- Also known as tally sheets (i.e. Xcel spreadsheet) to gather data
- Used to inform inspections

8.

Run Chart

- A **run chart**, also known as a **run-sequence plot** is a graph that displays observed data in **time sequence**. Often the data displayed represent some aspect of the output or performance of a business process.

9.

Trend Chart

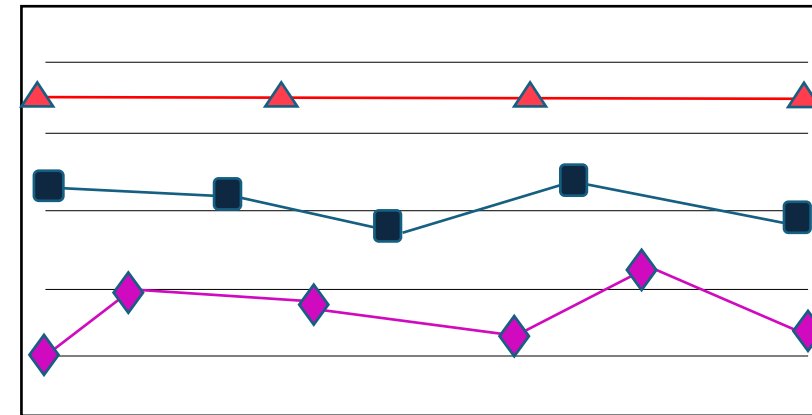
- Graphical representation of **time series data** (information in **sequence over time**) showing the trend line or curve that reveals a general pattern of change

Run Chart



Time

Mortgage Rate Trend Chart



Time

- **Prevention (keeping errors out of the process)**
- **Inspection (keeping errors out of the hands of the customer)**
 - Examination of a work product to determine if it conforms to documented standards
- **Attribute Sampling**
 - **The result either conforms or does not conform** - degree of conformity
 - Presence or absence of a characteristic in the inspected item is only taken note of
 - **'Think Binary' - Examples: Go / No Go; Yes / No; Good / Bad; Acceptable / Unacceptable**
- **Variable Sampling**
 - **The result is rated on a continuous scale**
 - The presence or absence of a characteristic in the inspected item is measured on a predetermined scale
 - **Examples: (Note: Good / Better / Best)**
- Tolerances - Specified range of acceptable results
- Control Limits - Identification of the boundaries in a process
- Quality Metric - Describes a project/product attribute and HOW it will be measured
- Quality Checklists - Structured list that helps to verify that the work of the project and its deliverables fulfill a set of requirements
- Statistical Sampling - Choosing part of a population of interest for inspection, testing, etc., rather than measuring the entire group. More practical and less costly than attempting to analyze entire population.

Attribute Sampling Example

Part of the table used to determine sample size when the auditor specifies a 95% desired confidence level.

Expected Population Deviation	Sample Size at 95% Desired Confidence Level				
	1%	2%	3%	4%	5%
0.00%	149	99	74	59	42
0.25%	236	157	117	93	66
0.50%	338	226	167	131	93
0.75%	456	308	226	177	125
1.00%	591	398	294	234	166
1.25%	744	506	375	297	211
1.50%	916	625	456	361	258
1.75%	1106	756	548	437	311
2.00%	1314	900	651	516	370

Project Quality Management Summary - What we reviewed and discussed				
Process Group	Planning	Executing	Monitoring & Controlling	Monitoring & Controlling
Process	Plan Quality Management	Manage Quality	Control Quality	Validate Scope
Primary Activity	PLAN	Implement / Manage	Measure / Monitor	Formalize Acceptance by Customer
Concept	HOW	Prevention (Audit Process)	Inspection (Concerned w/Correctness & Meeting Quality)	Deliverables are completed satisfactorily
Input	PMP (Scope Baseline)	QMP / Quality Metrics	QMP / Deliverables	Verified Deliverables
Output	QMP Quality Metrics Lessons Learned Register	Quality Reports Change Requests Lessons Learned Register	QC Measurements Verified Deliverables (correctness) Lessons Learned Register	Accepted Deliverables
T / T	-Flowcharts, Matrix Diagrams, Mind Mapping	<u>Quality Audits</u> -Diagrams: Affinity, Cause & Effect, Matrix, Scatter -Charts: Flowcharts, Histograms - DfX	Diagrams: Cause & Effect, Scatter Charts: Pareto, Control, Trend, Run	Inspection
Explanation	Determine what the quality standards for the project will be and document HOW the project will measure compliance	Use the Measurements to see if the quality standards will be met; validation of quality standards	Perform the measurements and compare them to specific quality standards; identify ways of eliminating problems in future	Customer Sign-Off Doc's forwarded to Close Project or Phase
Pareto Chart... ▪ 80 / 20 Rule; special type of histogram ▪ rank / hierarchical ordering by frequency of occurrence ▪ shows defects by type of identified cause			Control Chart... ▪ Voice of Process (VOP) ▪ used to determine if process is stable & predictable	