SPM

Project Quality Management

Day 8: Project Quality Management

Er. Pratik Shrestha, IIMS College | Lincoln University

Last Class We Discussed

- What is Project Cost Management ?
- Project Cost Management Processes
- Types of Costs/Benefits
- Learning Curve Theory
- Types of Cost Estimates
- Cost Estimation Tools and Techniques
- EVM (Earned Value Management)
- EVM Terminologies
- Project Portfolio Management

Today’s Learning Objectives

- What is Project Quality Management ?
- Project Quality Management Processes
- Quality Assurance using Kaizen and Kanban
- Quality Control and 7 Tools of Quality Control
- Histogram, Pareto Chart, Scatter Chart, Ishikawa Diagram, Control Chart, Checksheet and Stratification
- SIX SIGMA
- Six 9s of Quality
- Levels & Types of testing
- Cost of Quality and Maturity Models

Importance of Quality Management

- **IT Projects** generally have lower threshold for quality. People are open to accepting occasional shutdown/reboots.
- At the COMDEX computer exposition, Bill Gates, the founder and CEO of Microsoft Corporation, stated: “If General Motors had kept up with technology like the computer industry has, we would all be driving $25 cars that got 1,000 miles to the gallon.” In response to Gates’ comments, General Motors issued a press release stating: “If GM had developed technology like Microsoft, we would all be driving cars with the following characteristics:

For no reason whatsoever your car would crash twice a day.

Every time they repainted the lines on the road, you would have to buy a new car.

Macintosh would make a car that was powered by the sun, reliable, five times as fast, and twice as easy to drive, but would run on only five percent of the roads. New seats would force everyone to have the same size hips.

The airbag system would say “Are you sure?” before going off.

Occasionally, for no reason whatsoever, your car would lock you out and refuse to let you in until you simultaneously lifted the door handle, turned the key, and grabbed hold of the radio antenna.”

Case Study - What Went Wrong ?

In 1986, two hospital patients died after receiving fatal doses of radiation from a Therac 25 machine after a software problem caused the machine to ignore calibration data

In one of the biggest software errors in banking history, Chemical Bank mistakenly deducted about $15 million from more than 100,000 customer accounts

In 2015, the United States Department of Justice unsealed indictments in what was described as “the largest data break of names and e-mail addresses in the history of the internet”

What is Project Quality ?

The International Organization for Standardization (ISO) defines quality as “the degree to which a set of inherent characteristics fulfils requirements” (ISO9000:2000)

General definition from experts are based on two key characteristics:

Conformance to requirements and Fitness for use.

Example Case Scenario: Handling a computer stock delivery project where 100 computers are to be delivered with Ryzen 6 CPU and 16GB DDR4 RAM. Could you guess the two quality requirements basis ?

Project Quality Management Plan with Controlling

Project Quality Management Plan

Plan Quality Management

1. Inputs
- Create project charter
- Project management plan
- Add text here

2. Tools & Techniques
- Data collection
- Analyzing data
- Data presentation
- Testing
- Inspection

3. Outputs
- Quality management metrics
- Updated documents

Managing

1. Inputs
- Project related documents
- Organizational process assets

2. Tools & Techniques
- Quality auditing
- Designing
- Problem solving tools

3. Outputs
- Quality reports
- Test and evaluation documents
- Change requests

Controlling

1. Inputs
- Approving change requests
- Project deliverables
- Environmental factors
- Add text here

2. Tools & Techniques
- Evaluating products
- Testing and inspection
- Team meetings

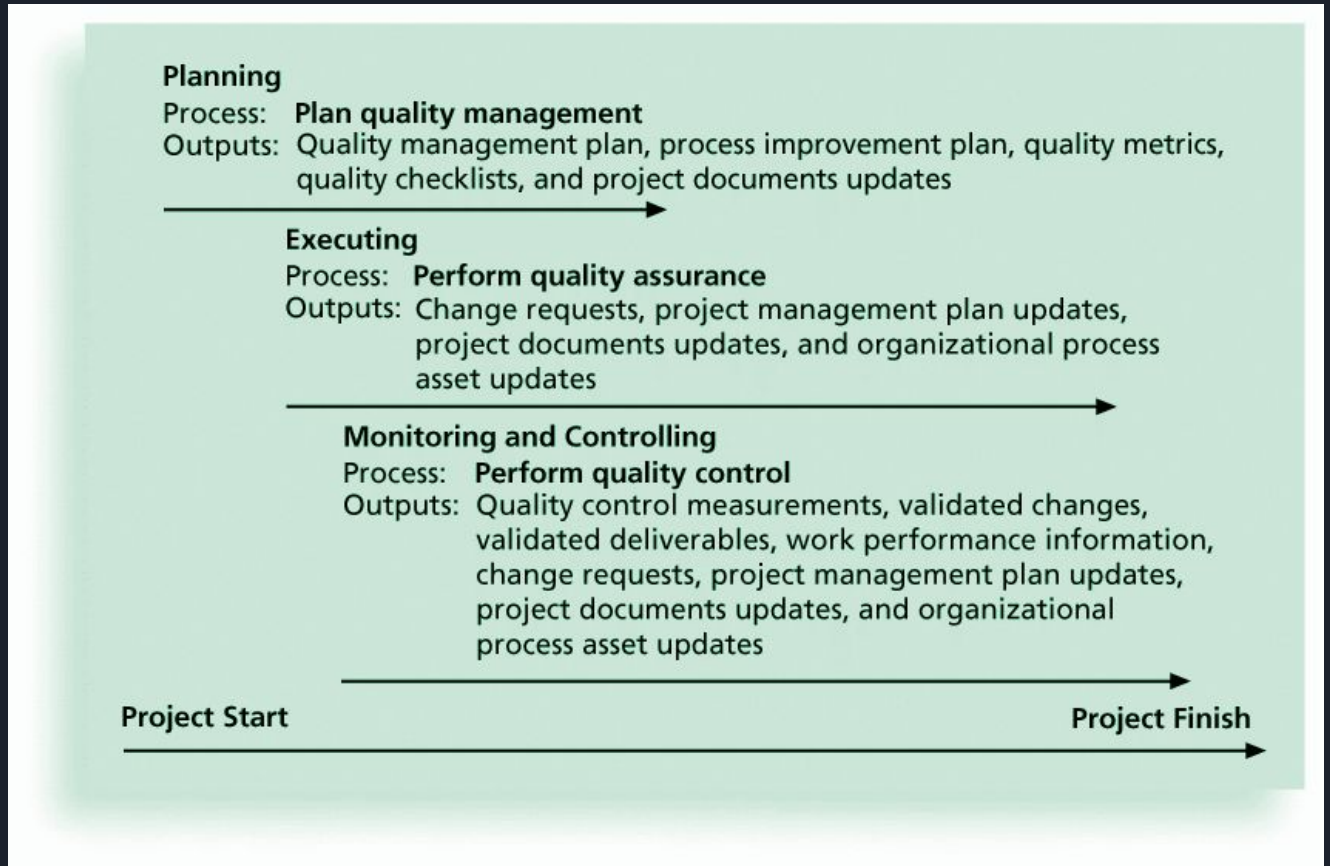
3. Outputs
- Quality Control Measurements
- Validated Changes

Project Quality Management Processes

PQM ensures that the project will satisfy the needs for which it was undertaken. The processes include:

1. Planning Quality Management : Identifying which quality standards are relevant to the project and how to satisfy them using a metric
2. Perform Quality Assurance: Periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards
3. Perform Quality Control: Monitoring specific project results to ensure that they comply with the relevant quality standards

Project Quality Management Process Flow



1) Plan Quality Management

Planning for quality implies the ability to anticipate situations and prepare actions to bring about the desired outcome

Quality Defects can be prevented by:

- Selecting proper materials
- Training and Indoctrinating people in quality
- Planning a process that ensures the appropriate outcome

Quality Aspects of IT Projects

- **Functionality** is the degree to which a system performs its intended function
- **Features** are the system's special characteristics that appeal to users
- **System outputs** are the screens and reports the system generates
- **Performance** addresses how well a product or service performs the customer's intended use
- **Reliability** is the ability of a product or service to perform as expected under normal conditions
- **Maintainability** addresses the ease of performing maintenance on a product

2) Performing Quality Assurance

Quality assurance includes all the activities related to satisfying the relevant quality standards for a project

Continuous quality improvement. *Kaizen* - *Kaizen is an approach to creating continuous improvement based on the idea that small, ongoing positive changes can reap significant improvements.*

Lean involves evaluating processes to maximize customer value while minimizing waste

Benchmarking generates ideas for quality improvements by comparing specific project practices or product characteristics to those of other projects or products within or outside the performing organization

A **quality audit** is a structured review of specific quality management activities that help identify lessons learned that could improve performance on current or future projects

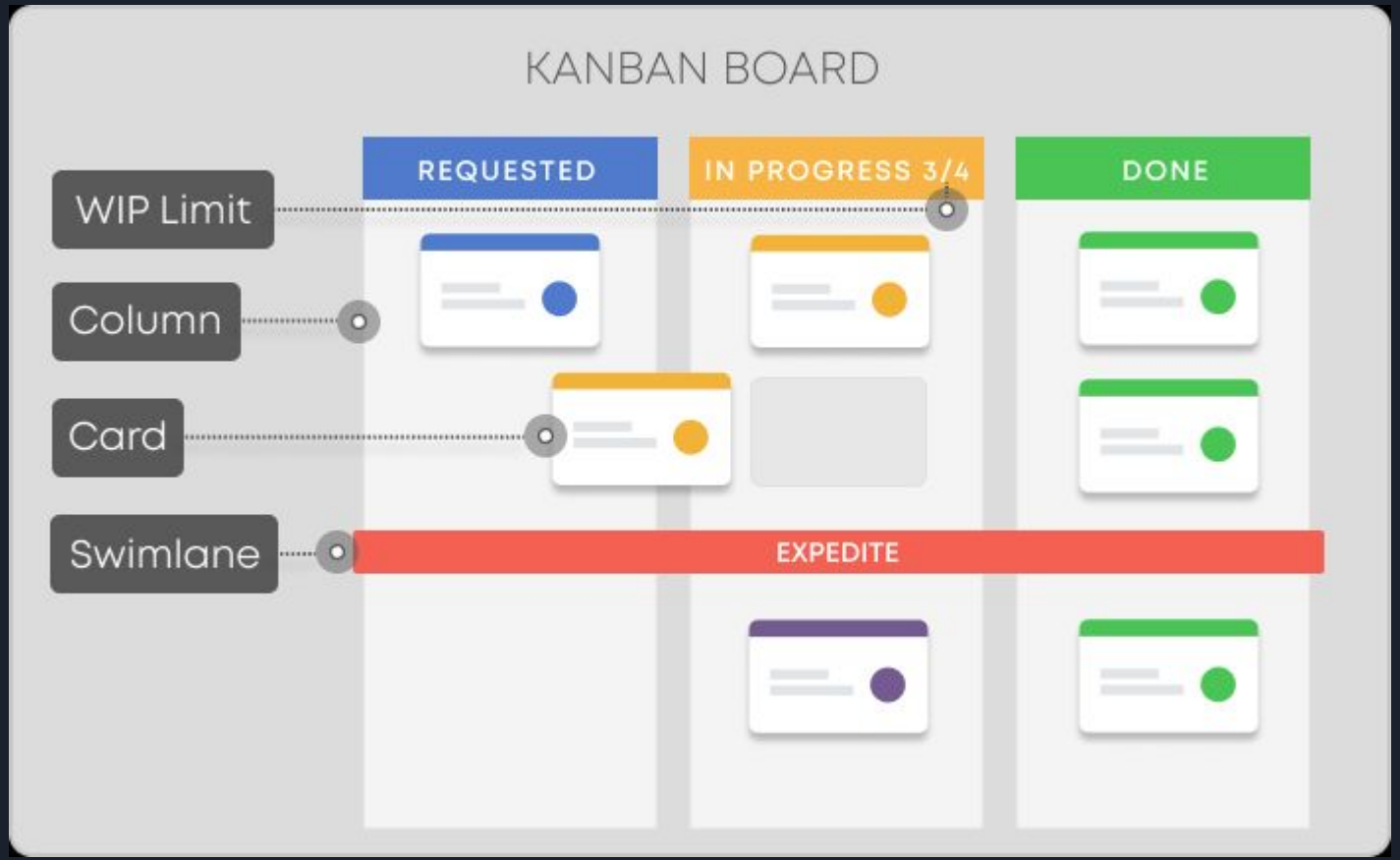
Continuous improvement using the Plan, Do, Check, Act (PDCA) cycle

QA using Kanban

Kanban uses five core properties:

- Visual workflow
- Limit work-in-process
- Measure and manage flow
- Make process policies explicit
- Use models to recognize improvement opportunities

The application of Kanban is different for every team

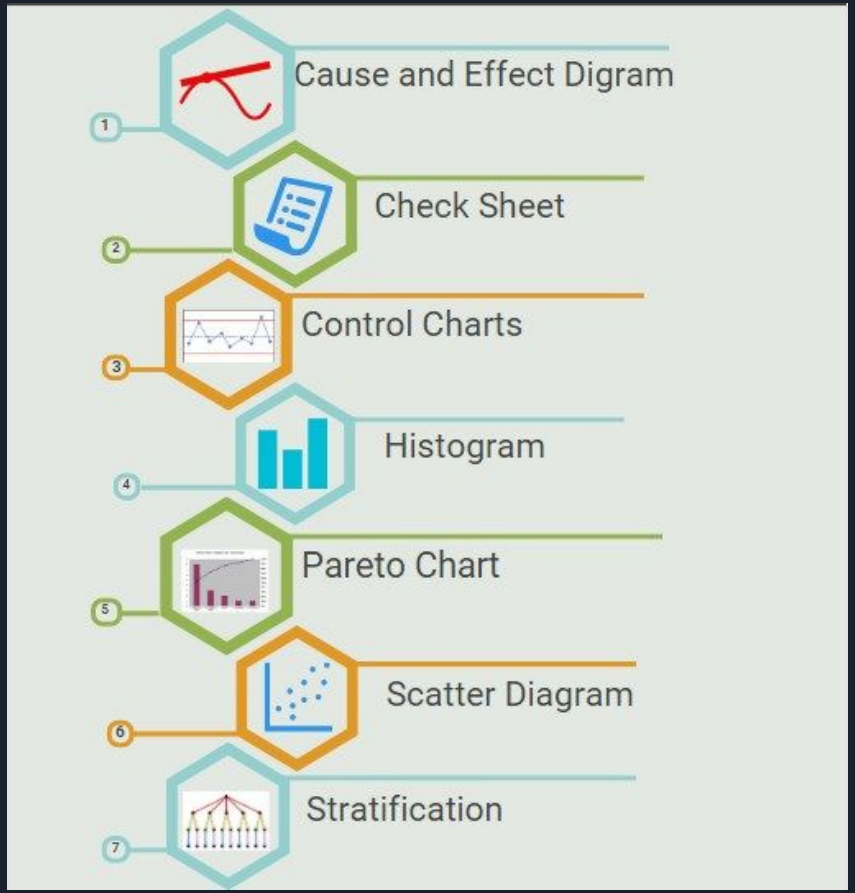

KANBAN BOARD
REQUESTED
IN PROGRESS 3/4
DONE
WIP Limit
Column
Card
Swimlane
EXPEDITE

3) Quality Control

QC depends directly on acceptance criterias/decisions. If project stakeholders reject some of the project's products or services, there must be rework. PM should strive to avoid reworks.

Process Adjustments will help correct/prevent further quality problems based on quality control measurements.

There are 7 basic tools of Quality that help in performing quality control—---------->



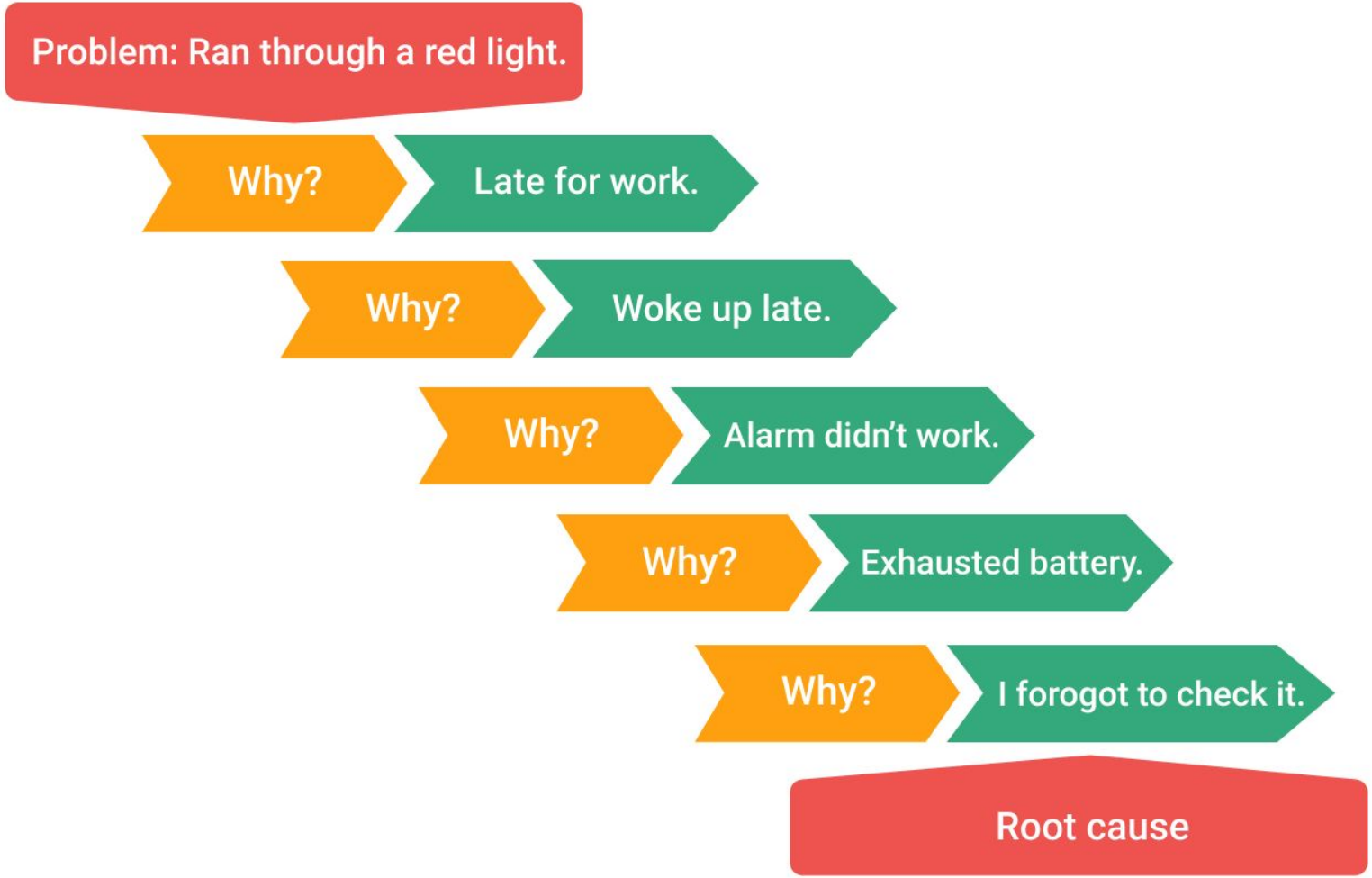
3.1) Cause and Effect Diagrams

Cause-and-effect diagrams trace complaints about quality problems back to the responsible production operations

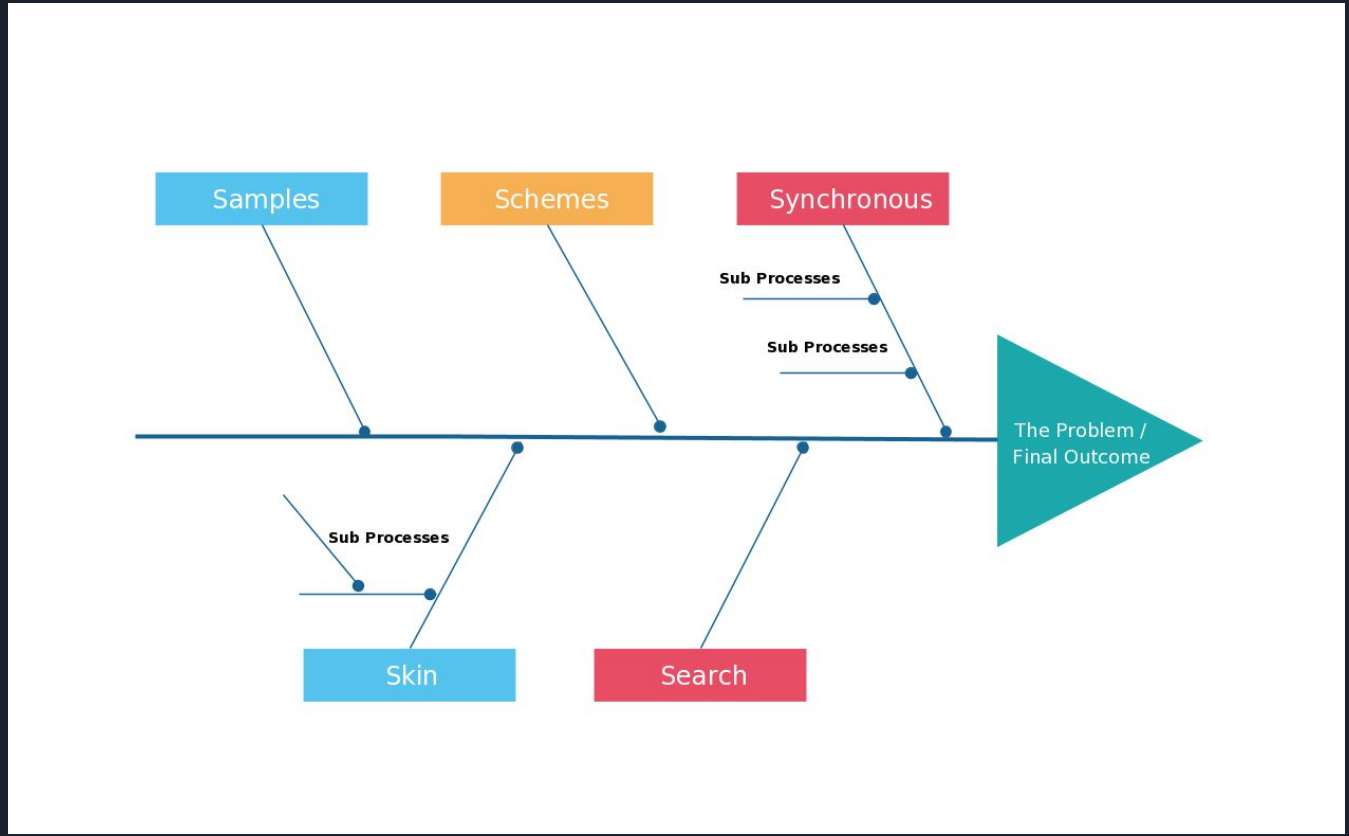
They help you find the root cause of a problem

Also known as Fishbone or Ishikawa diagrams

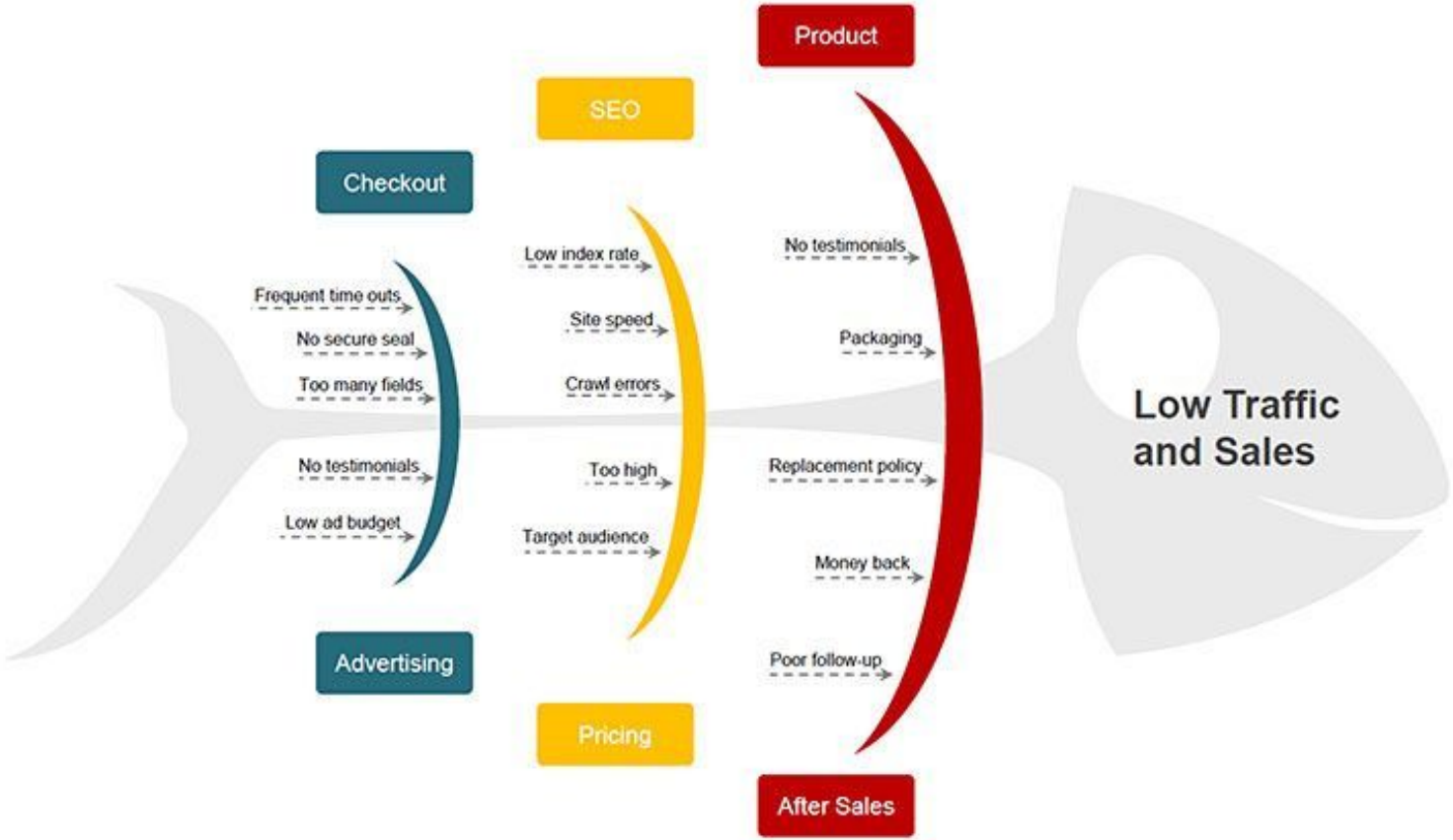
Can also use the 5 whys technique where you repeated ask the question “Why” (five is a good rule of thumb) to peel away the layers of symptoms that can lead to the root cause


Problem: Ran through a red light.
Why?
Late for work.
Why?
Woke up late.
Why?
Alarm didn't work.
Why?
Exhausted battery.
Why?
I forogot to check it.
Root cause

How to make ishikawa diagram



Cause & Effect Analysis Using Ishikawa Fishbone Diagram



3.2) Control Charts

- A control chart is a graphic display of data that illustrates the results of a process over time
- The main use of control charts is to prevent defects, rather than to detect or reject them
- When a process is in control, any variations in the results of the process are created by random events; processes that are in control do not need to be adjusted
- When a process is out of control, variations in the results of the process are caused by non-random events; you need to identify the causes of those non-random events and adjust the process to correct or eliminate them

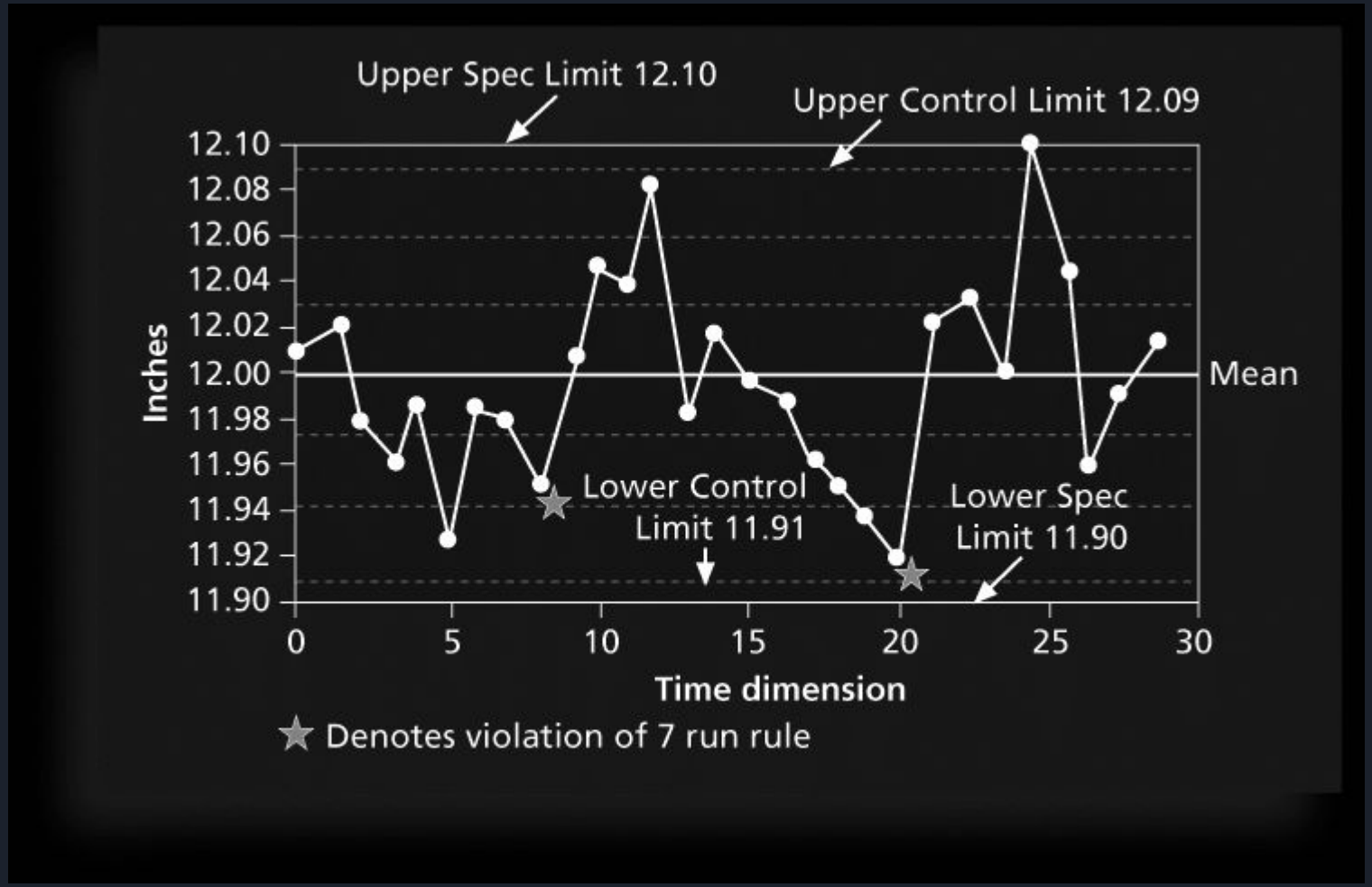
7 Run Rule in Control Charts

You can use quality control charts and the seven run rule to look for patterns in data

The seven run rule states that if seven data points in a row are

- all below the mean,
- above the mean,
- or are all increasing or decreasing,

then the process needs to be examined for non-random problems


Upper Spec Limit 12.10
Upper Control Limit 12.09
12.10
12.08
12.06
12.04
12.02
12.00
11.98
11.96
11.94
11.92
11.90
Inches
Mean
Lower Control Limit 11.91
Lower Spec Limit 11.90
0
5
10
15
20
25
30
Time dimension
Denotes violation of 7 run rule

3.3) Checksheet

A checksheet is used to collect and analyze data

It is sometimes called a tally sheet or checklist, depending on its format

For instance, In the example in next slide, most complaints arrive via text message, and there are more complaints on Monday and Tuesday than on other days of the week

This information might be useful in improving the process for handling complaints

Sample checksheet

System Complaints

Source	Day							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
Email	𝍸	𝍸𝍸	𝍸	𝍸	𝍸		𝍸	12
Text	𝍸𝍸	𝍸𝍸	𝍸𝍸	𝍸	𝍸𝍸	𝍸	𝍸	29
Phone call	𝍸	𝍸	𝍸	𝍸	𝍸	𝍸		8
Total	11	10	8	6	7	3	4	49

Quality Control Check Sheet

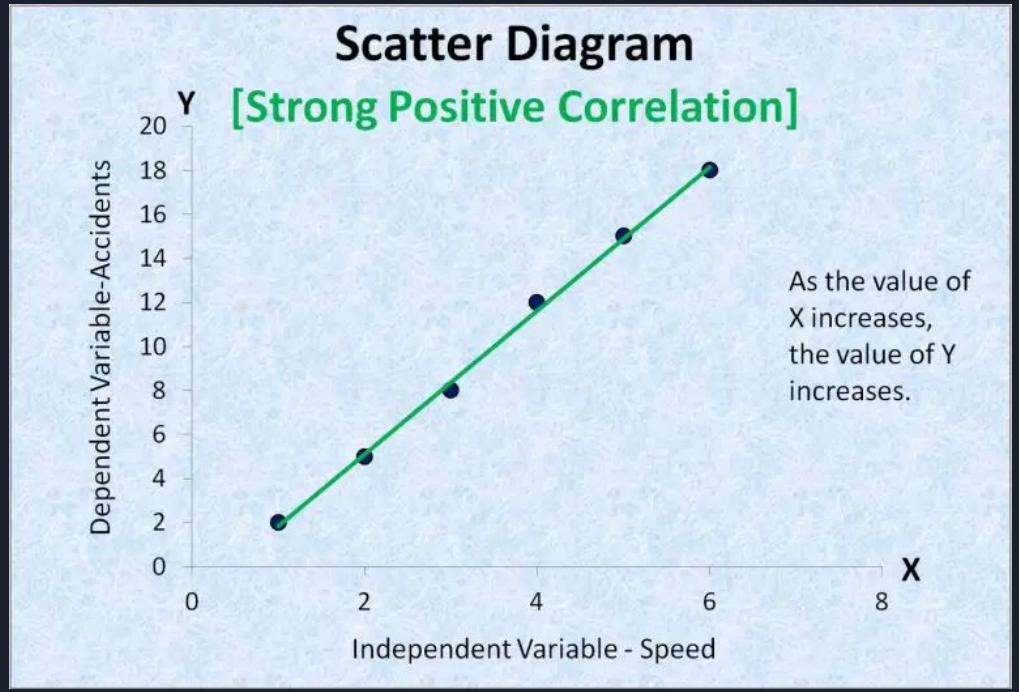
Product	< Product name>	**ID**	R123	**Number Inspected**	265
Stage	Final Inspection	**Date**	12th Jan	**Checked By**	John Doe

Error Type / Reason	Count / Check					Subtotal
	Monday	Tuesday	Wednesday	Thursday	Friday	
Description 1	3	4	1	1	1	10
Description 2						
Description 3						
Description 4						
Grand Total	3	4	1	1	1	

3.4) Scatter Diagrams

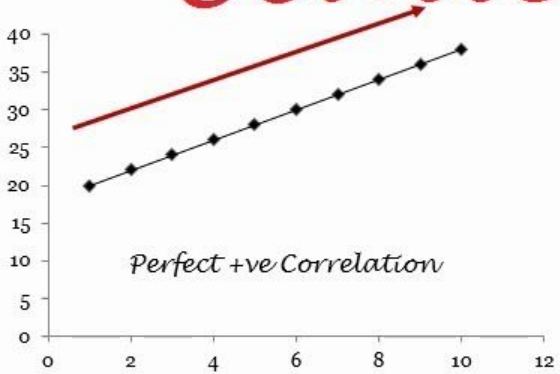
A scatter diagram helps to show if there is a relationship between two variables.

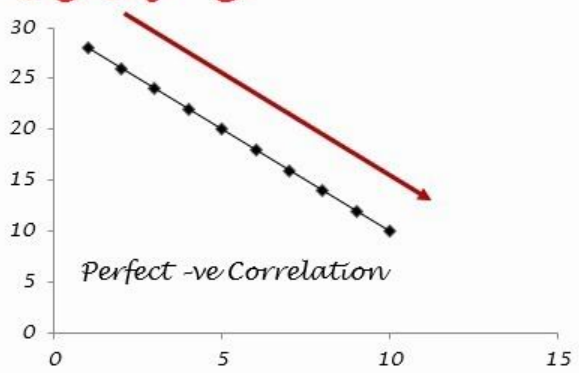
The closer data points are to a diagonal line, the more closely the two variables are related.

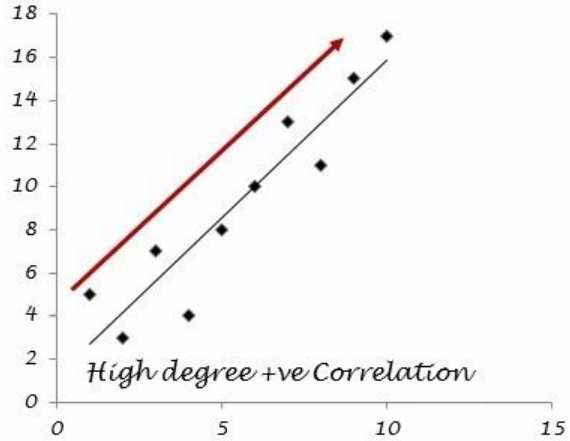


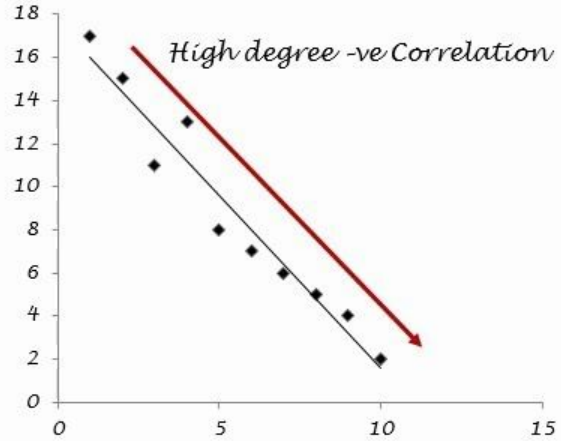
https://cqeacademy.com/cqe-body-of-knowledge/continuous-improvement/quality-control-tools/the-scatter-plot-linear-regression/

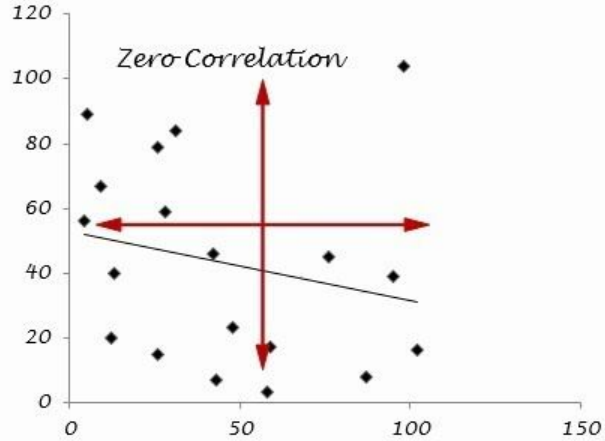
Scatter Chart











3.5) Histograms

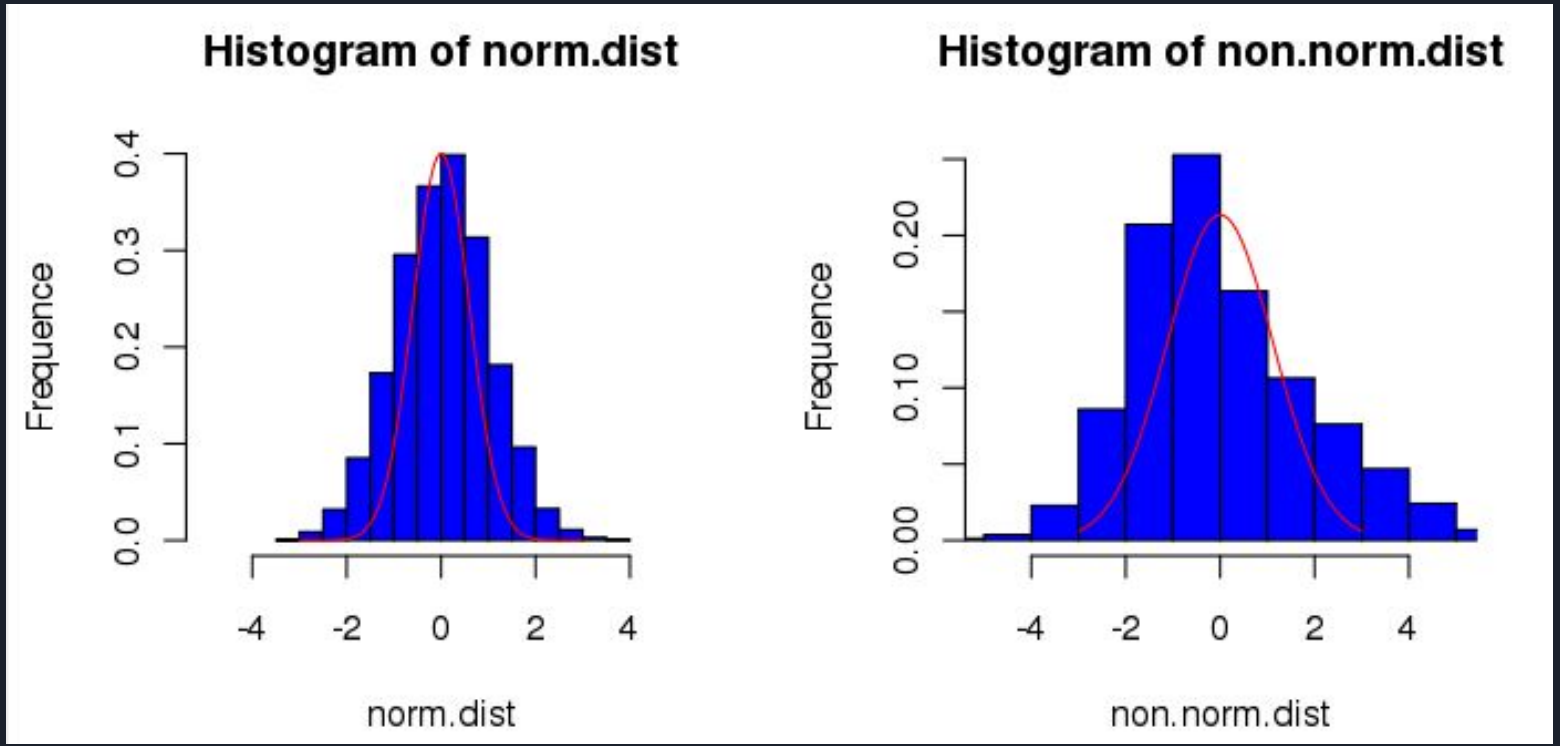
A histogram is a bar graph of a distribution of variables

Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency

A histogram will show you the central value of a characteristic produced by your process, as well as the shape and size of the dispersion on either side of this central value.

The shape and size of the dispersion will help identify hidden sources of variation.

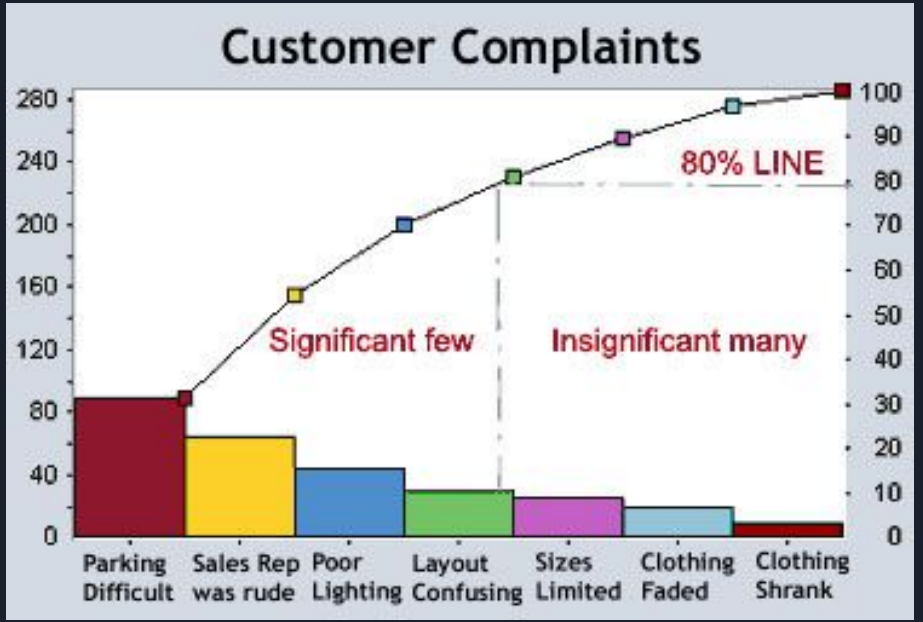
Ultimately, the data used to produce a histogram can determine the capability of a process to produce output (output that consistently falls within specification limits.)

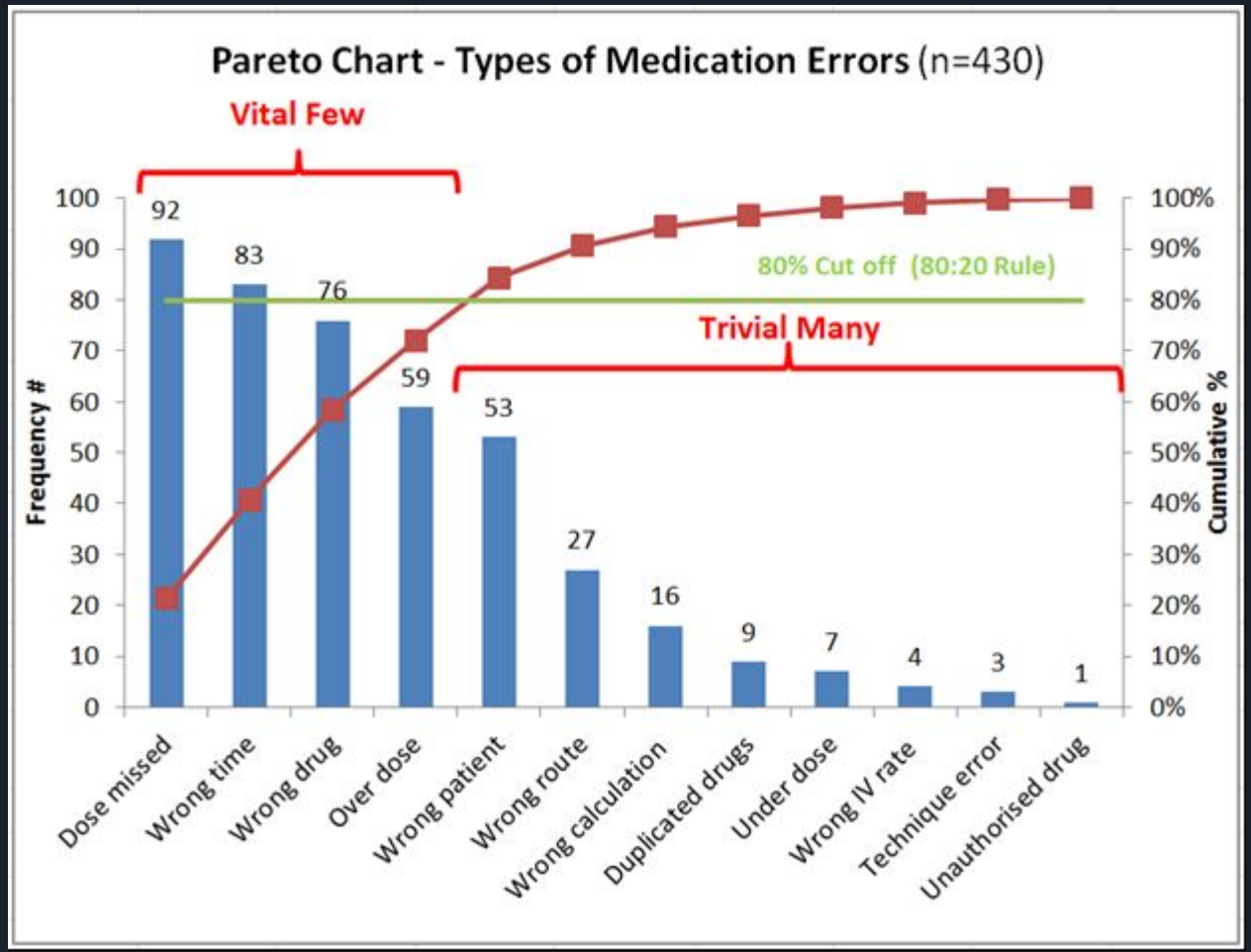

Histogram of norm.dist
Frequence
0.0
0.1
0.2
0.3
0.4
-4
-2
0
2
4
norm.dist
Histogram of non.norm.dist
Frequence
0.00
0.10
0.20
-4
-2
0
2
4
non.norm.dist

3.6) Pareto Charts/ Pareto Analysis

A Pareto chart is a histogram that can help you identify and prioritize problem areas

Pareto analysis is also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes




Pareto Chart - Types of Medication Errors (n=430)
Vital Few
Trivial Many
80% Cut off (80:20 Rule)
Frequency #
Cumulative %
100
90
80
70
60
50
40
30
20
10
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
92
83
76
59
53
27
16
9
7
4
3
1
Dose missed
Wrong time
Wrong drug
Over dose
Wrong patient
Wrong route
Wrong calculation
Duplicated drugs
Under dose
Wrong IV rate
Technique error
Unauthorised drug

Why is Pareto Chart Useful ?

The Pareto Principle helps you realize that the majority of results come from a minority of inputs. Knowing this, if…

- 20% of workers contribute 80% of results: Focus on rewarding these employees.
- 20% of bugs contribute 80% of crashes: Focus on fixing these bugs first.
- 20% of customers contribute 80% of revenue: Focus on satisfying these customers.

The examples go on. The point is to realize that you can often focus your effort on the 20% that makes a difference, instead of the 80% that doesn't add much.

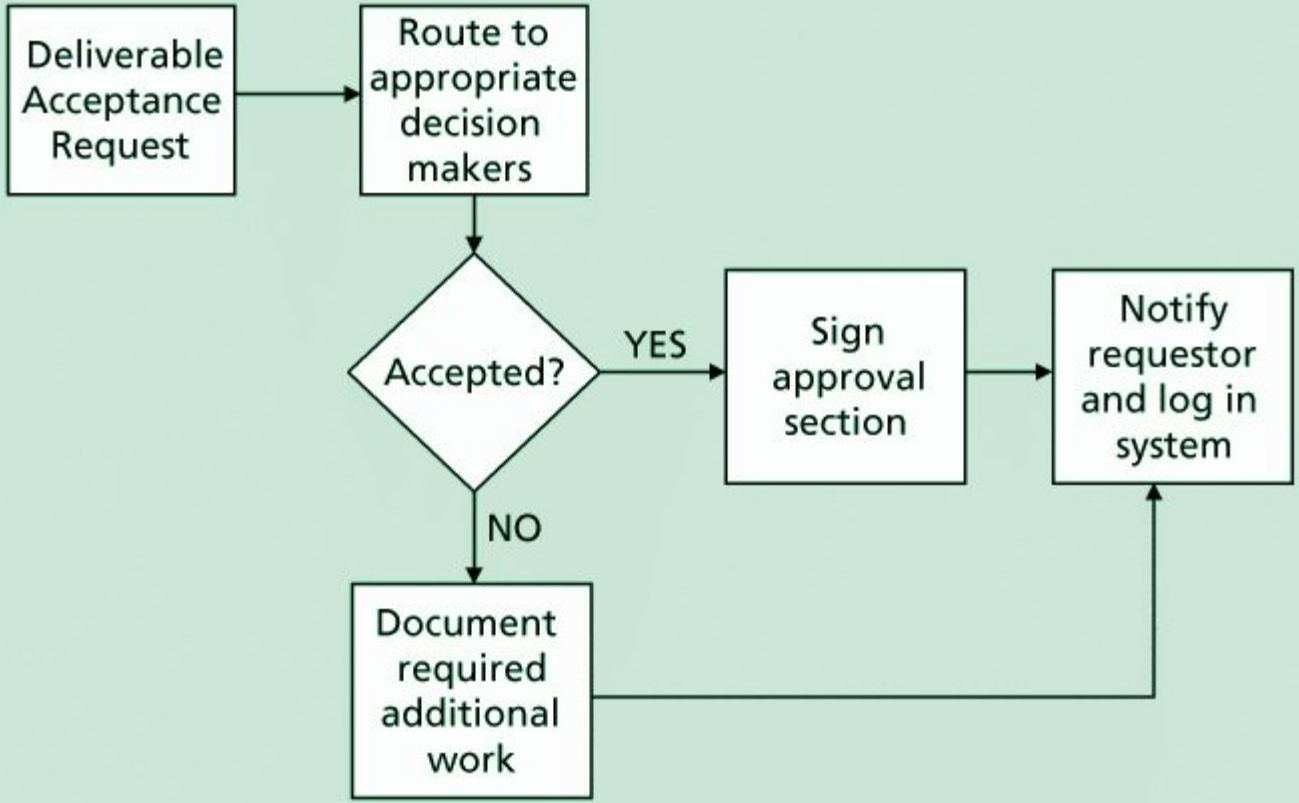
https://betterexplained.com/articles/understanding-the-pareto-principle-the-8020-rule/

3.7) Stratification

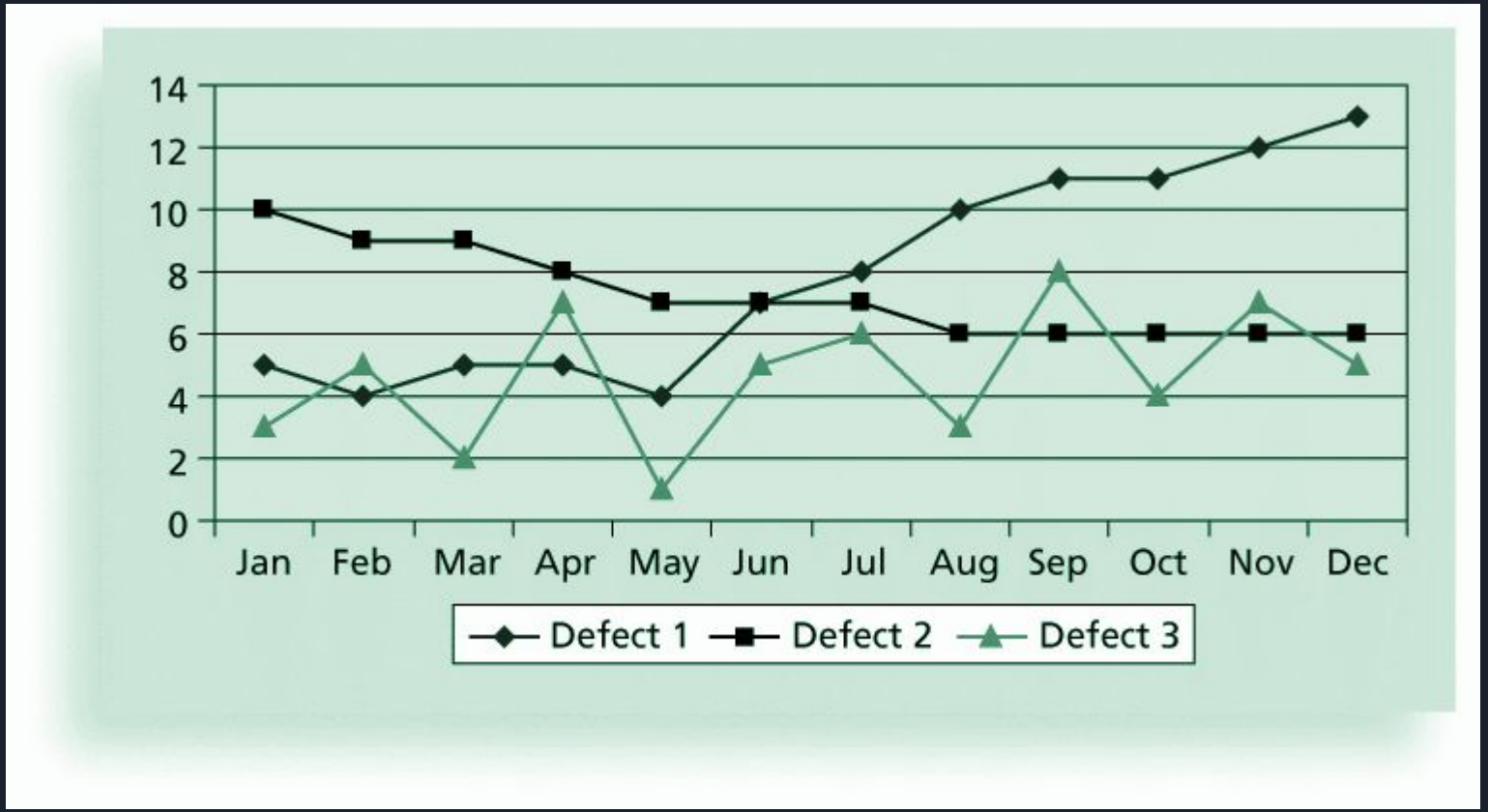
Several chart systems like - flowcharts, run charts, six sigma are used for stratification, a technique that shows data from a variety of sources to see if a pattern emerges

Flowcharts are graphic displays of the logic and flow of processes that help you analyze how problems occur and how processes can be improved. They show activities, decision points, and the order of how information is processed

A run chart displays the history and pattern of variation of a process over time. You can use run charts to perform trend analysis and forecast future outcomes based on historical results


Deliverable Acceptance Request
Route to appropriate decision makers
Accepted?
YES
Sign approval section
Notify requestor and log in system
NO
Document required additional work

Sample Run Chart



More on Statistical Sampling / Stratification

Statistical sampling involves choosing part of a population of interest for inspection

The size of a sample depends on how representative you want the sample to be

Sample size formula:

Sample size = .25 X (certainty factor/acceptable error)2

Be sure to consult with an expert when using statistical analysis

SIX SIGMA

Six Sigma is “a comprehensive and flexible system for achieving, sustaining, and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes”

- *Pande, Peter S., Robert P. Neuman, and Roland R. Cavanagh, The Six Sigma Way, New York: McGraw-Hill, 2000, p. xi.

SIX SIGMA DMAIC

Six Sigma projects normally follow DMAIC. It is a 5 phase improvement process that is systematic, closed-loop process for continued improvement. It is scientific and fact based.

Define: Define the problem/opportunity, process, and customer requirements

Measure: Define measures, then collect, compile, and display data

Analyze: Scrutinize process details to find improvement opportunities

Improve: Generate solutions and ideas for improving the problem

Control: Track and verify the stability of the improvements and the predictability of the solution


DEFINE
MEASURE
ANALYZE
IMPROVE
CONTROL
SIX
SIGMA
6σ

How is Six Sigma QC Unique ?

- The target for perfection is the achievement of no more than 3.4 defects per million opportunities
- Requires Organisation wide commitment
- Six Sigma organizations have the ability and willingness to adopt contrary objectives, such as reducing errors and getting things done faster
- It is an operating philosophy that is customer focused and strives to drive out waste, raise levels of quality, and improve financial performance at breakthrough levels

Six Sigma and Project Management

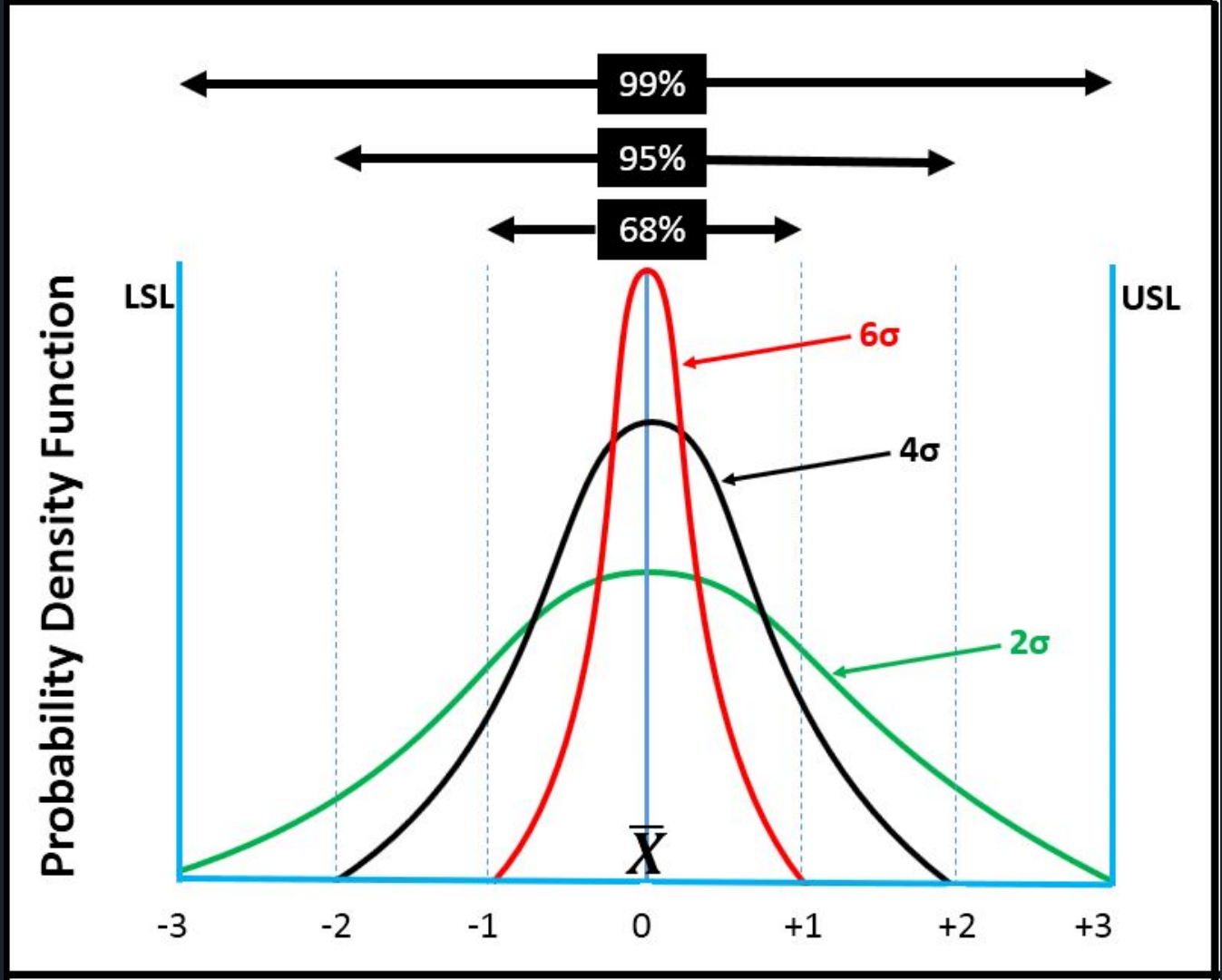
Joseph M. Juran stated, “All improvement takes place project by project, and in no other way”*

It’s important to select projects carefully and apply higher quality where it makes sense; companies that use Six Sigma do not always boost their stock values. Because minimizing defects does not matter if an organization makes a product that people do not want. As Mikel Harry puts it, “I could genetically engineer a Six Sigma goat, but if a rodeo is the marketplace, people are still going to buy a Four Sigma horse.”**

Six Sigma projects must focus on a quality problem or gap between the current and desired performance and not have a clearly understood problem or a predetermined solution

**“What You Need to Know About Six Sigma,” Productivity Digest (December 2001), p. 38.*

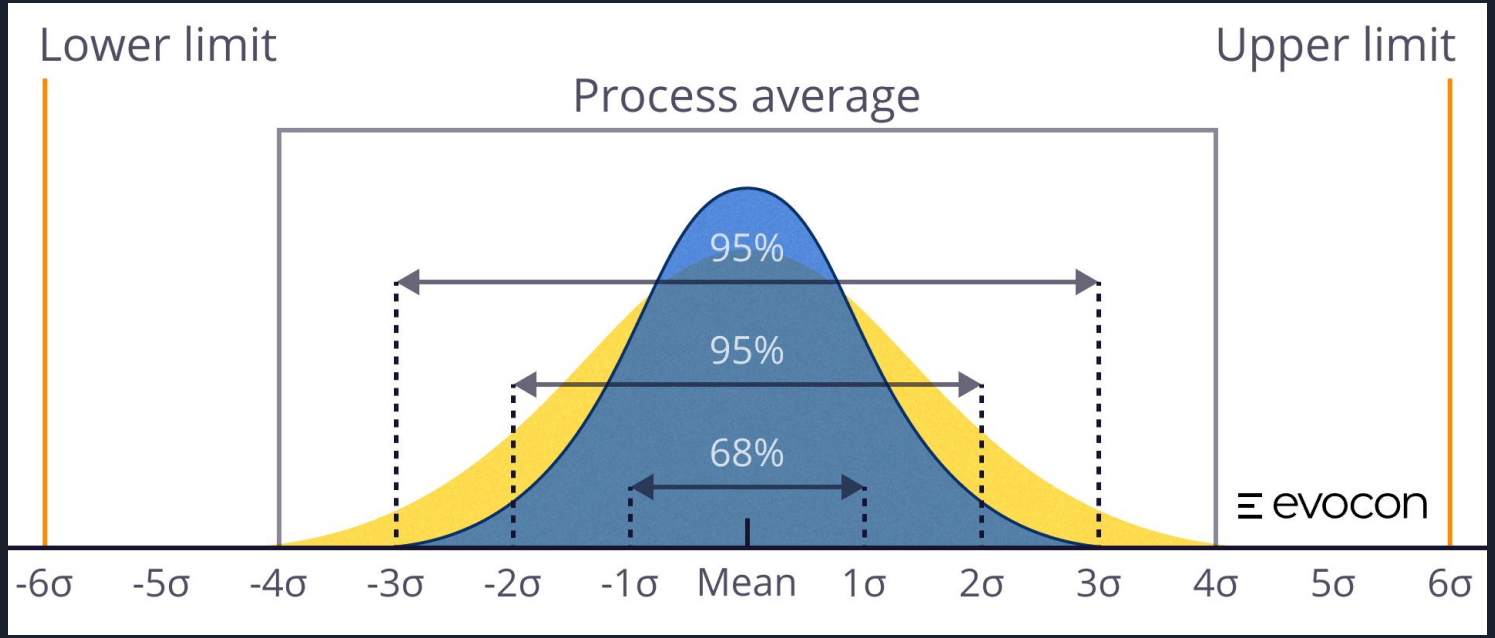
***Clifford, Lee, “Why You Can Safely Ignore Six Sigma,” Fortune (January 22, 2001), p. 140.*


99%
95%
68%
LSL
USL
6σ
4σ
2σ
Probability Density Function
X
-3
-2
-1
0
+1
+2
+3

SIX SIGMA & STATISTICS

The term sigma means standard deviation. Standard deviation measures how much variation exists in a distribution of data. Specifically, sigma is one standard deviation from the mean.

Stated another way, if the desired result of a production process is the creation of a part that measures within a design's dimensional tolerances (aka a 'good' part), then when you run the process 1,000,000 times, less than 4 of the parts that you manufactured will have any defect.

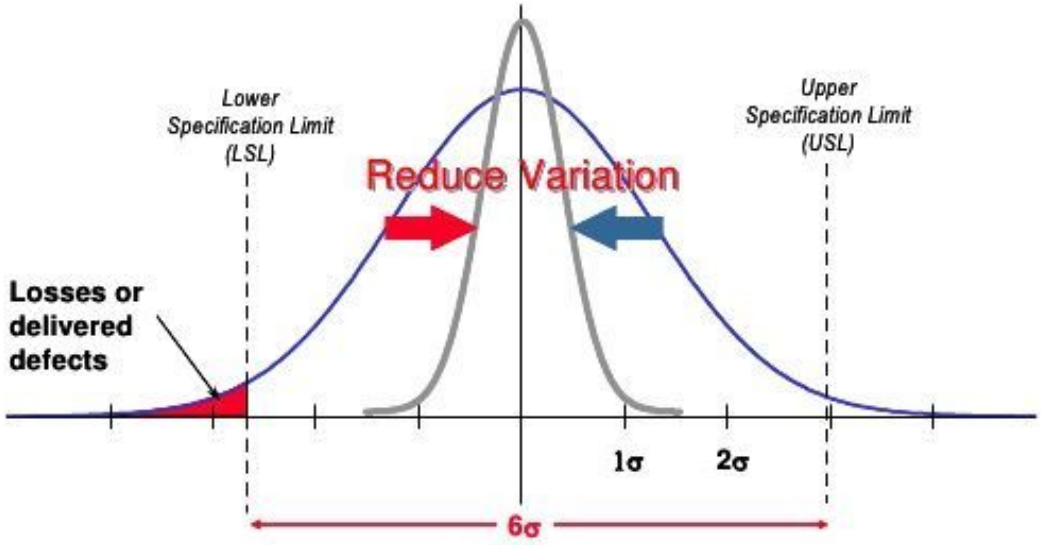


https://evocon.com/articles/introduction-to-six-sigma-and-lean-six-sigma/

https://www.whatissixsigma.net/three-sigma-vs-six-sigma/

Six Sigma aids in eliminating defects by reducing variability

The objective of a Six Sigma program is to reduce process variation to such a degree that six sigmas of variation (99.9997% yield) will fit within the specification limits defined by customers.



Sigma and Defective Units

Specification Range (in ± Sigmas)	Percent of Population within Range	Defective Units per Billion
1	68.27	317,300,000
2	95.45	45,400,000
3	99.73	2,700,000
4	99.9937	63,000
5	99.999943	57
6	99.9999998	2

Sigma Conversion Table

Yield represents the number of units handled correctly through the process steps

Sigma	Yield	Defects per Million Opportunities (DPMO)
1	31.0%	690,000
2	69.2%	308,000
3	93.3%	66,800
4	99.4%	6,210
5	99.97%	230
6	99.99966%	3.4

Six 9s of Quality

Six 9s of quality is a measure of quality control equal to 1 fault in 1 million opportunities

In the telecommunications industry, it means 99.9999 percent service availability or 30 seconds of down time a year

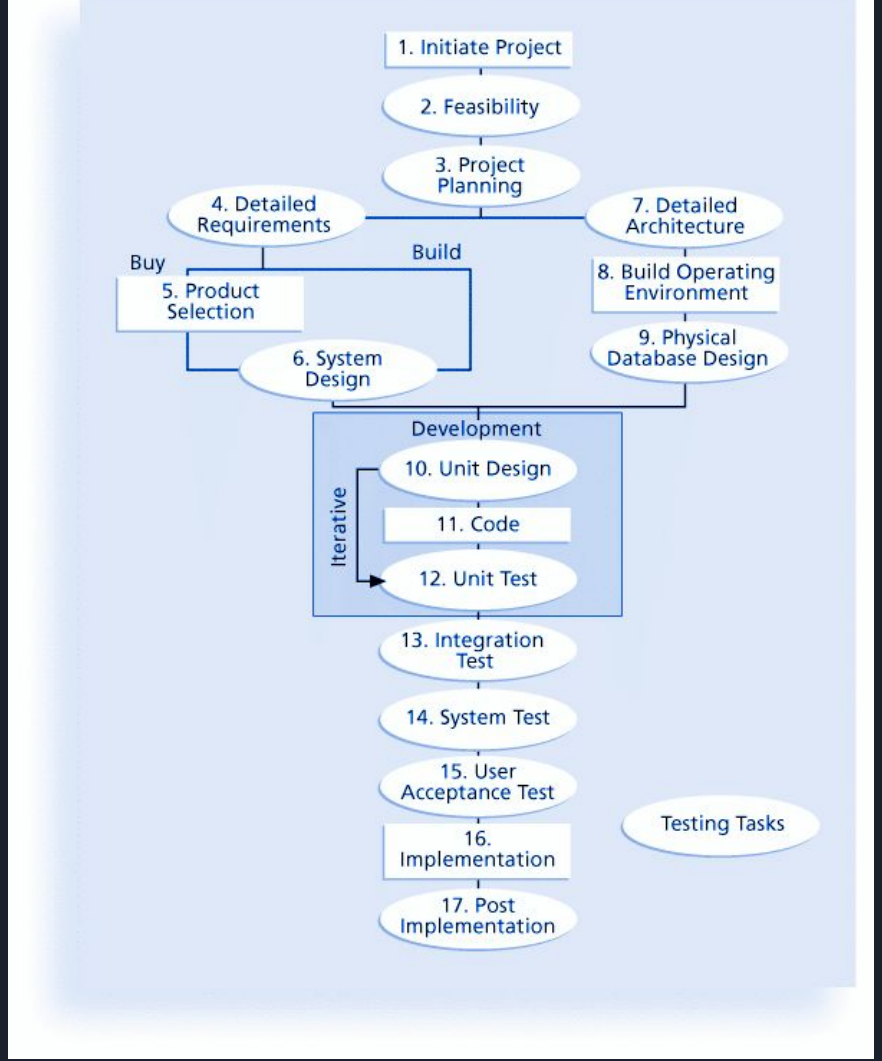
This level of quality has also been stated as the target goal for the number of errors in a communications circuit, system failures, or errors in lines of code

Testing in

Software Development

OR

IT project Testing



Levels of Testing

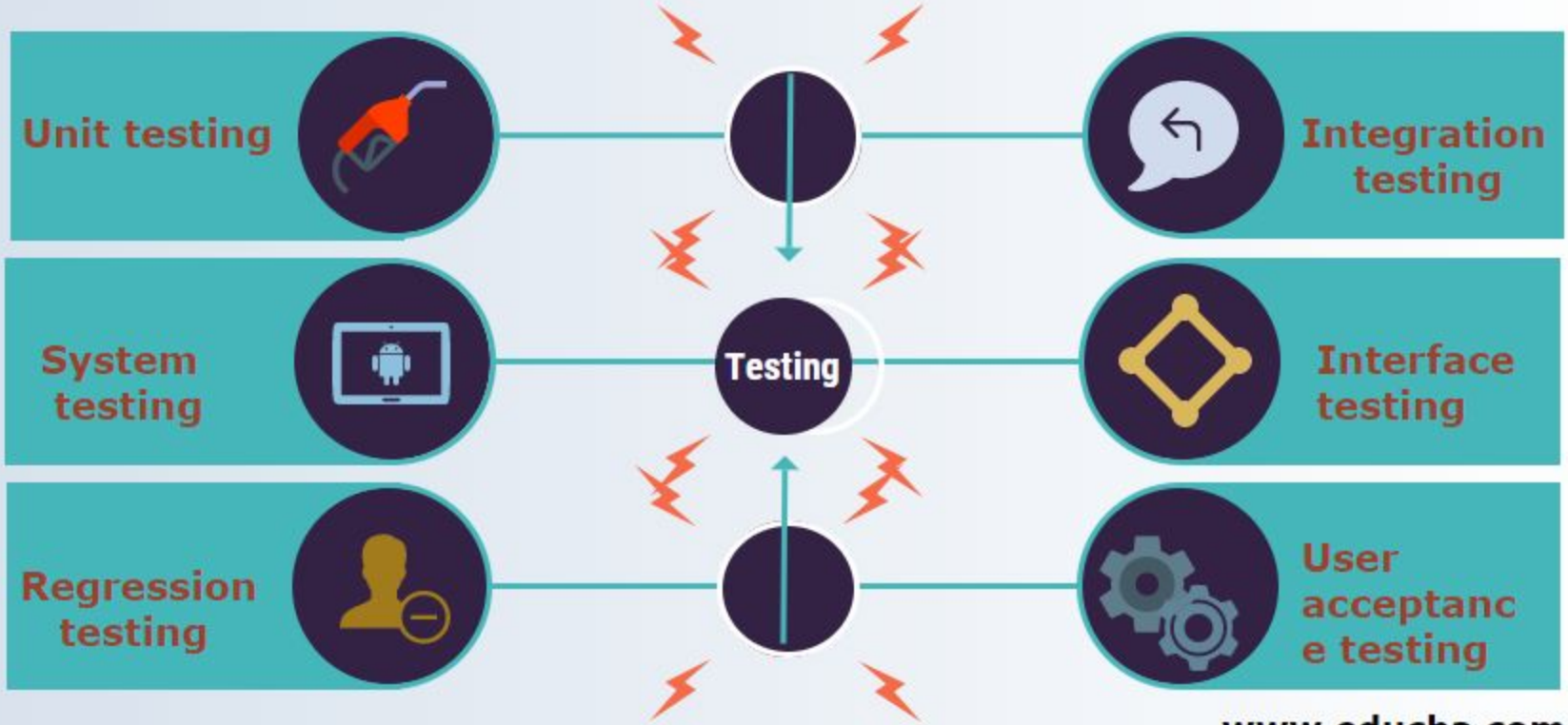
UNIT TESTING
Test Individual Component

INTEGRATION TESTING
Test Integrated Component

SYSTEM TESTING
Test the entire System

ACCEPTANCE TESTING
Test the final System

Types of Software Testing



Popular Quality Experts

Deming was famous for his work in rebuilding Japan and his 14 Points for Management

Juran wrote the Quality Control Handbook and ten steps to quality improvement

Crosby wrote Quality is Free and suggested that organizations strive for zero defects

Ishikawa developed the concepts of quality circles and fishbone diagrams

Taguchi developed methods for optimizing the process of engineering experimentation

Feigenbaum developed the concept of total quality control

Malcolm Baldrige Award

The Malcolm Baldrige National Quality Award originated in 1987 to recognize companies that have achieved a level of world-class competition through quality management

Given by the President of the United States to U.S. businesses

Three awards each year in different categories:

- Manufacturing
- Service
- Small business
- Education and health care

The ISO Standards

ISO 9000 is a quality system standard that:

Is a three-part, continuous cycle of planning, controlling, and documenting quality in an organization

Provides minimum requirements needed for an organization to meet its quality certification standards

Helps organizations around the world reduce costs and improve customer satisfaction

See www.iso.org for more information

How to improve IT Projects Quality

1. Establish leadership that promotes quality
2. Understand the cost of quality
3. Focus on organizational influences and workplace factors that affect quality
4. Follow maturity models

Cost of Quality

The cost of quality is the cost of conformance plus the cost of nonconformance

Conformance means delivering products that meet requirements and fitness for use

Cost of nonconformance means taking responsibility for failures or not meeting quality expectations

A study reported that software bugs cost the U.S. economy $59.6 billion each year and that one third of the bugs could be eliminated by an improved testing infrastructure

5 Cost categories related to Quality

Prevention cost: Cost of planning and executing a project so it is error-free or within an acceptable error range

Appraisal cost: Cost of evaluating processes and their outputs to ensure quality

Internal failure cost: Cost incurred to correct an identified defect before the customer receives the product

External failure cost: Cost that relates to all errors not detected and corrected before delivery to the customer

Measurement and test equipment costs: Capital cost of equipment used to perform prevention and appraisal activities

https://cqeacademy.com/cqe-body-of-knowledge/quality-system/cost-of-quality/

Maturity Models

Maturity models are frameworks for helping organizations improve their processes and systems

Software Quality Function Deployment Model focuses on defining user requirements and planning software projects.

The result of SQFD is a set of measurable technical product specifications and their priorities.

Having clearer requirements can lead to fewer design changes, increased productivity, and ultimately, software products that are more likely to satisfy stakeholder requirements.

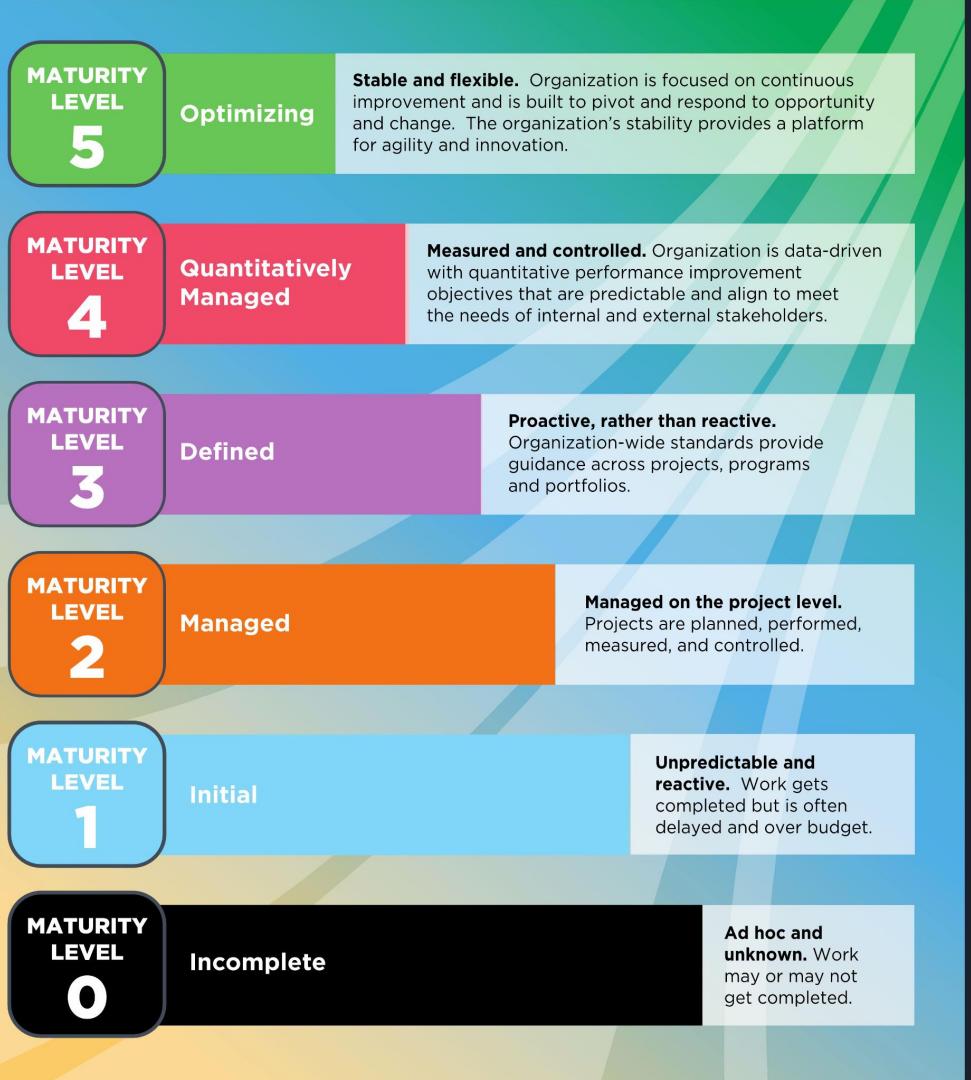
The idea of introducing quality early in the design stage was based on Taguchi's emphasis on Robust Design methods.

CMMI Model

The Software Engineering Institute's **Capability Maturity Model Integration** is a process improvement approach that provides organizations with the essential elements of effective processes.

CMMI Model has following 5 Levels:

Companies may not get to bid on government projects unless they have a CMMI Level 3



PMI's Maturity Model / OPM3

PMI released the Organizational Project Management Maturity Model (OPM3) in December 2003

Model is based on market research surveys sent to more than 30,000 project management professionals and incorporates 180 best practices and more than 2,400 capabilities, outcomes, and key performance indicators

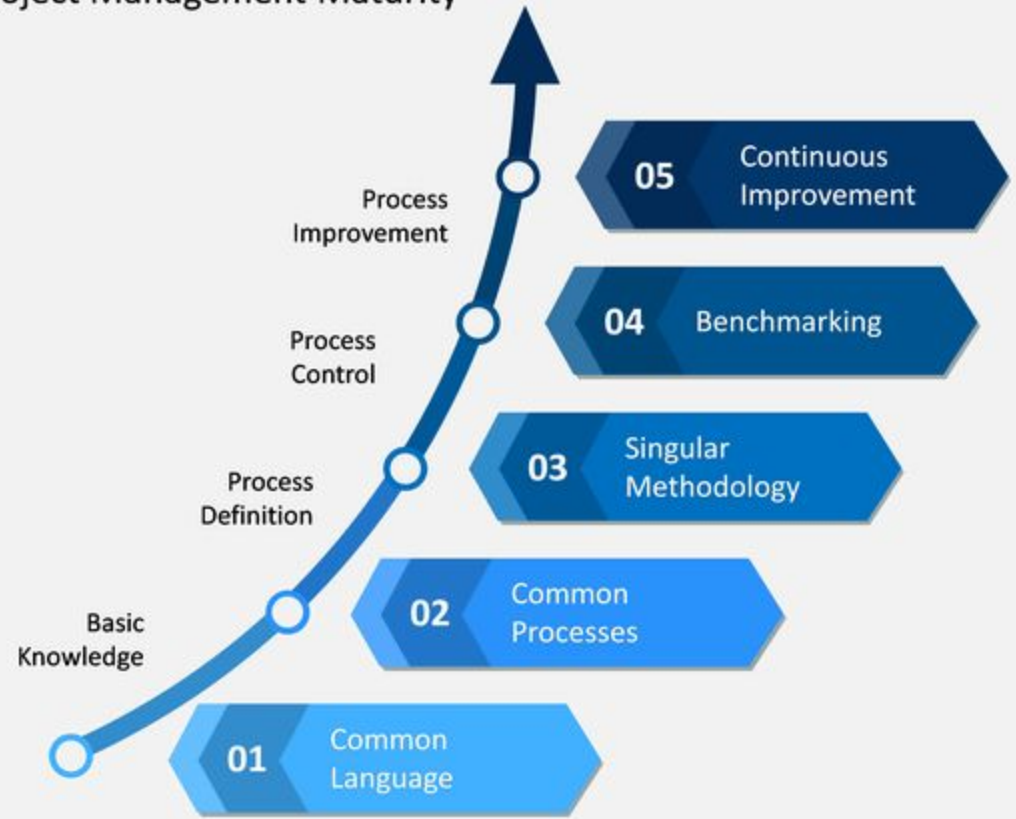
Finding 1: Companies with more mature PM practices have better project performance

Finding 2: Model Maturity is strongly correlated with predictable cost and schedule performance

Finding 3: Well managed companies have lower direct cost than poorly managed ones

PROJECT MANAGEMENT MATURITY MODEL

Levels of Project Management Maturity



OPM3

OPM3 provides the following example to illustrate a best practice, capability, outcome, and key performance indicator:

Best practice: Establish internal project management communities

Capability: Facilitate project management activities

Outcome: Local initiatives, meaning the organization develops pockets of consensus around areas of special interest

Key performance indicator: Community addresses local issues

https://studylib.net/doc/8378496/organizational-project-management-maturity-model

PS: Pre-Test/Exam has been scheduled for last week of July, approx only 2.5 weeks remaining !!!

THANK YOU

happy weekends