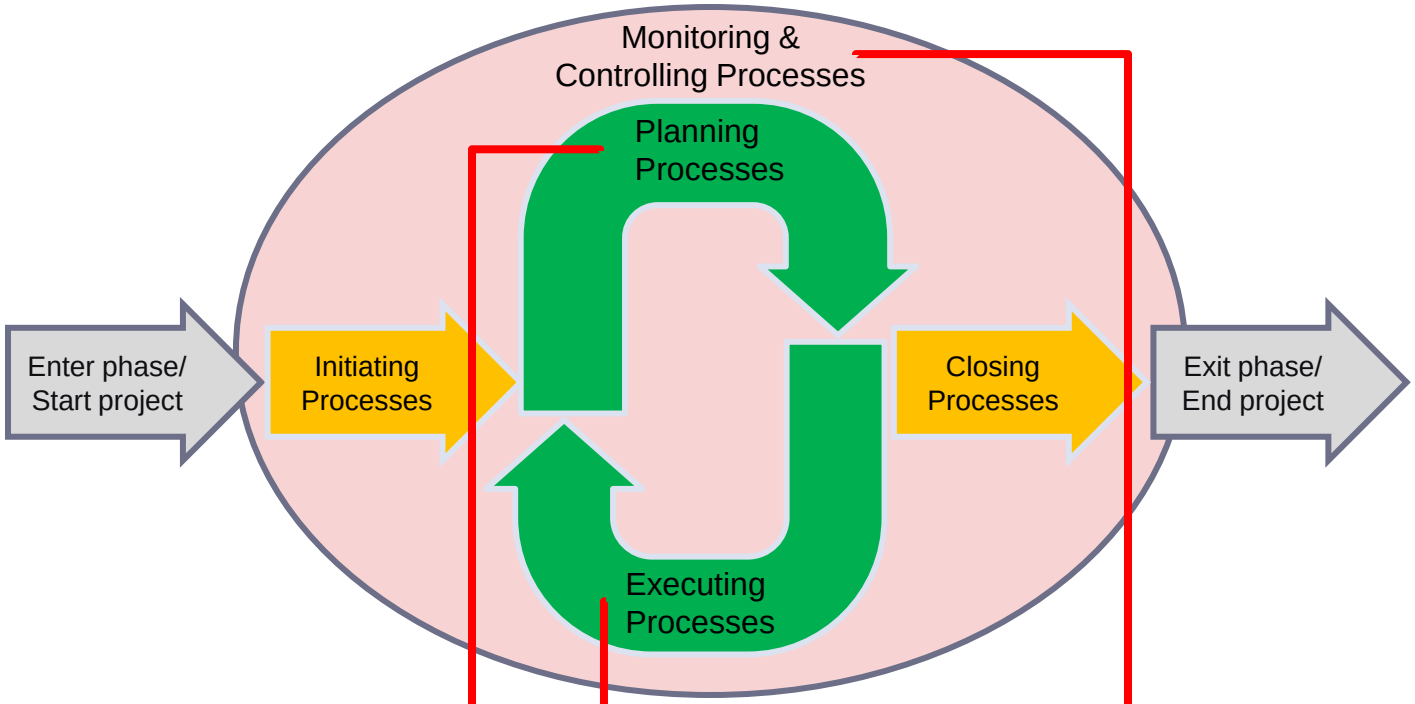
BY: AHMED ABBAS

PROJECT MANAGEMENT

QUALITY MANAGEMENT

8. PROJECT QUALITY MANAGEMENT



Knowledge Area	Process				
	Initiating	Planning	Executing	Monitoring & Control	Closing
Cost		• Quality Planning	• Perform Quality Assurance	• Perform Quality Control	

8. Project Quality Management Knowledge Area

8.1 Plan Quality Management:

- It is the process of identifying quality requirements and/or standards for the project and its deliverables
- Document how the project will demonstrate compliance with relevant quality requirements.

8.2 Perform Quality Assurance:

- It is the process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used.

8.3: Control Quality:

- It is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes.

PROJECT QUALITY MANAGEMENT

- **Quality is degree to which the project fulfills requirements**
- **Quality Management includes creating and following policies and procedures to ensure that a project meet the defined needs (from the customer's perspective)**
- **Completing project with no deviations from the project requirements**

QUALITY CONCEPTS

Introduction – Quality vs. Grade

If you opted for Saloon CAR, you probably choose it over the regular looking CAR because it looks **superior**.

However, this Saloon CAR will looks **low grade** compared to Sports CAR.

QUALITY CONCEPTS

Introduction– Quality vs. Grade

Quality of a product is a measure of how **closely it matches its intended purpose**.

Grade is a measure of the **value people put on a product**.

Different technical characteristics.

High grade product might be low quality product.

Regardless of the grade, the quality should be high. In any case, quality cannot be compromised.

QUALITY CONCEPTS

Introduction – Precision vs. Accuracy

Accuracy: Refers to how far you are from the true value. (True value is yellow circle)

This is accurate but not Precise.

Precision: Refers to how close do you get to the same value if you repeated the exercise several times.

This is **precise but not accurate.**

Precise and accurate: Quality of product will be considered high if results are **Precise and accurate.**

KEY CONCEPTS

Introduction -> Key concepts

Customer satisfaction :

- Understanding, evaluating, defining and managing requirements, so that customer expectations are met.

Prevention over inspection:

- Quality should be planned, designed, and built into into the project's deliverables.
- It should not be inspection driven (reactive).

Continuous improvement:

- The PDCA (plan-do-check-act) cycle is the basis for quality improvement.
- Well known quality improvement theories include: Total Quality Management & Six Sigma.

QUALITY THEORIES

Introduction – Quality Theories

Six Sigma (Introduced by Bill Smith at Motorola)

Just In Time (Toyota)

Total Quality Management - W. Edwards Deming:

ISO – International Standard Organization

80/20 principle - Joseph Juran

Zero Defects: Philip Crosby:

6 SIGMA

Quality Theories -> Six Sigma

Six Sigma

Set of techniques and tools for process improvement.

Quality levels:

Sigma value	Compliance percentage	Defects percentage	DPMO
1	31%	69%	691,462
2	69%	31%	308,538
3	93.3%	6.7%	66,807
4	99.38%	0.62%	6,210
5	99.977%	0.023%	233
6	99.99966%	0.00034%	3.4

Sigma values will be used in calculation

DPMO : • Defects Per Million Opportunities

QUALITY CONCEPTS

Gold Plating: The Project Manager wanting to shine in front of the customer (there might ... For example giving extra functionality, higher-quality components etc..)

- This practice is not recommended

Marginal Analysis: **looking for the point where..**
benefits/revenue to be received from improving quality EQUALS the incremental cost to achieve that quality

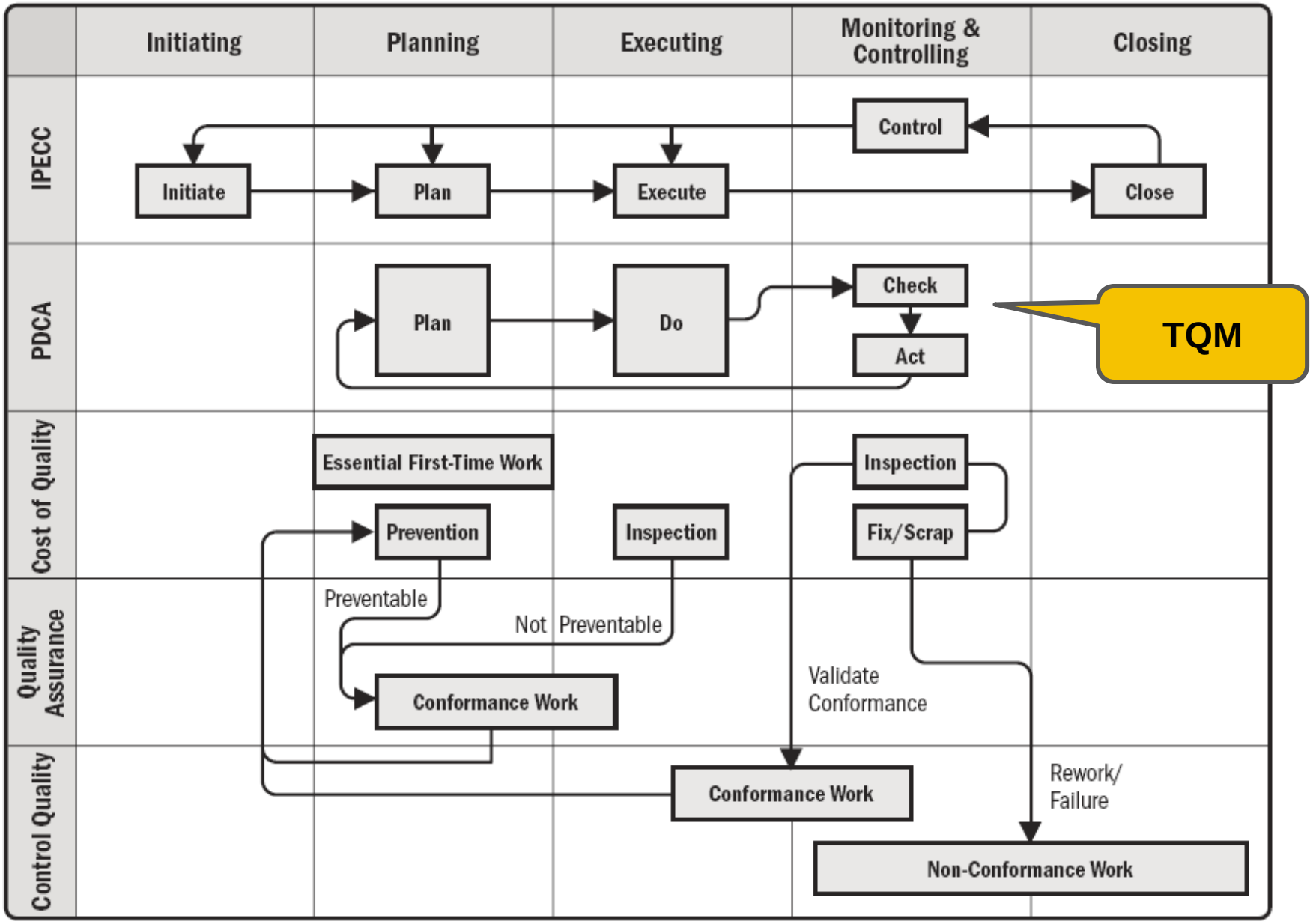
Just in Time (JIT): **just when they are needed or just before they are needed.**

- It forces attention on quality practices.

Total Quality Management (TQM)

- Company & their employees focus on finding ways to continuous improve the quality of their business practices & products.

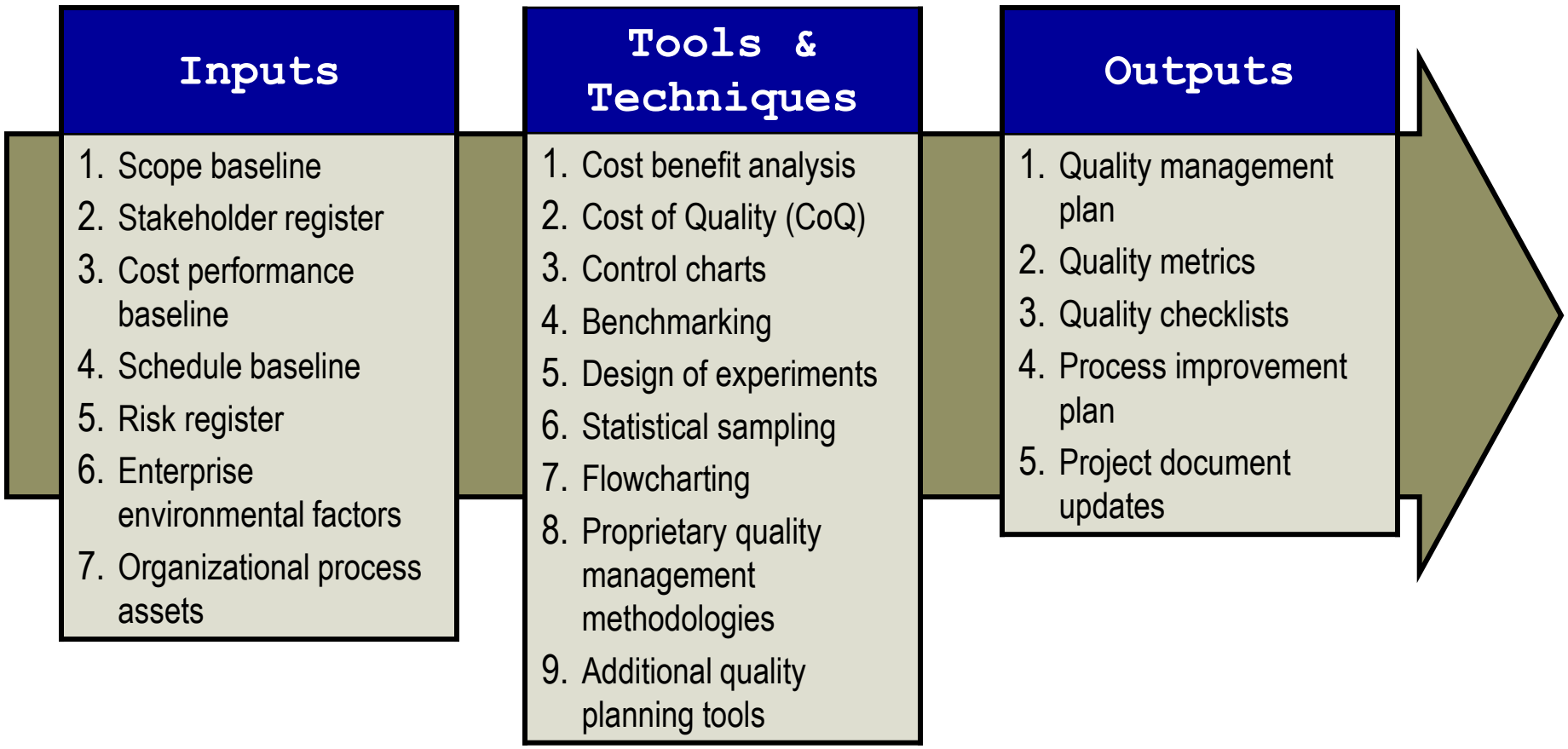
FUNDAMENTAL RELATIONSHIPS OF QUALITY ASSURANCE AND CONTROL QUALITY



8.1 PLAN QUALITY

The process of identifying requirement and/or standards for the project and product and documenting how the project will demonstrate compliance.

- *What is quality? How will we ensure it?*



QUALITY PLANNING TECHNIQUES

Cost benefit analysis

- Weight the benefits versus the cost of meeting quality requirements

Design of Experiments (DOE)

- Use experimentation to statistically determine what variable will improve quality
- Systematically changing all of the important factors, rather than changing the factors one at a time

Statistical sampling

- We need it since studying entire population would take too long, too much cost, be too destructive

Flow charting

- Use to see a process or system flows and find potential quality problem

8.1 Plan Quality Management->T&T->Cost Benefit Analysis

Cost-benefit Analysis

A financial analysis tool used to determine the benefits provided by a project against its costs.

Cost of quality

Vs

Higher productivity

Lower costs

Less rework

Increased stakeholder satisfaction.

Benefit of meeting quality requirements

The primary cost of meeting quality requirements is expenses associated with quality management activities.

COST OF QUALITY

Cost of quality (CoQ)

- Looking at what the cost of conformance and nonconformance to quality and creating an appropriate balance

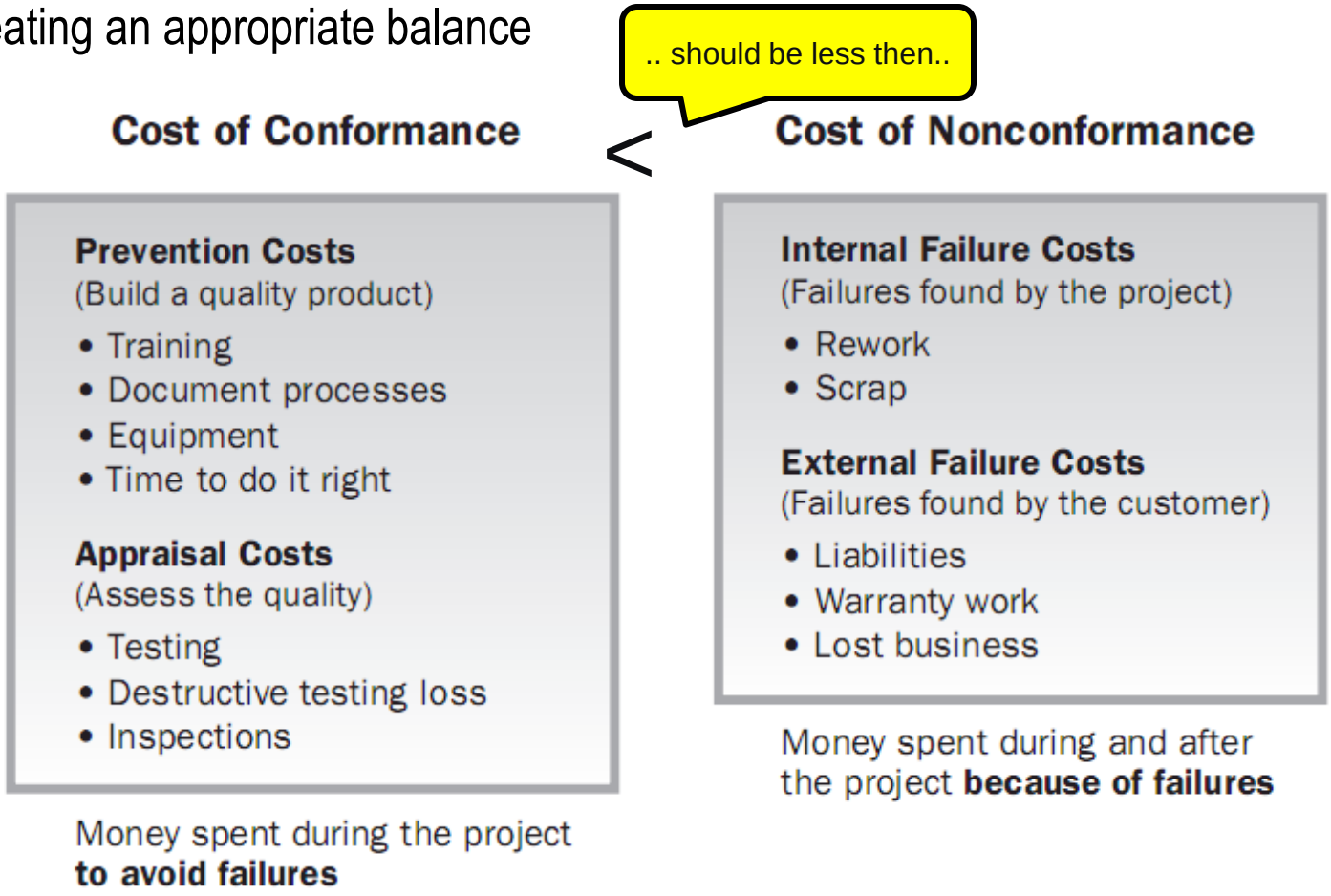
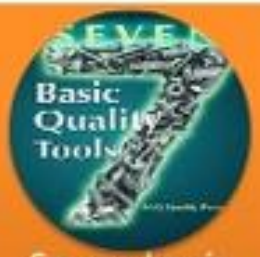
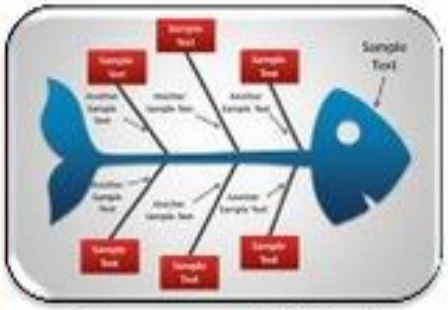


Image Source: PMBOK Guide

8.1 Plan Quality Management->T&T-> 7 Basic quality tools



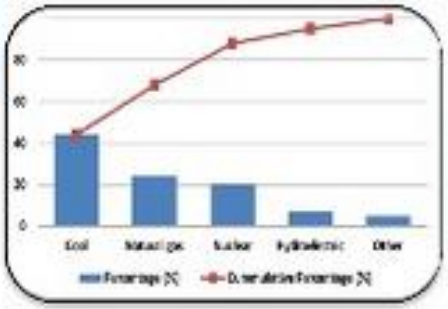
Seven basic quality tools



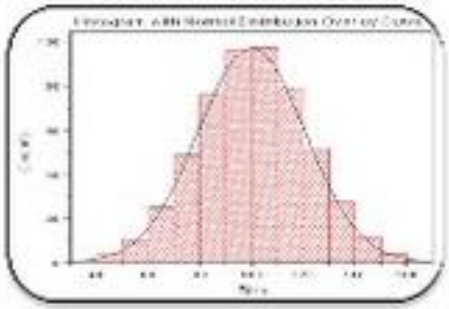
Cause-and-Effect

Flowcharts

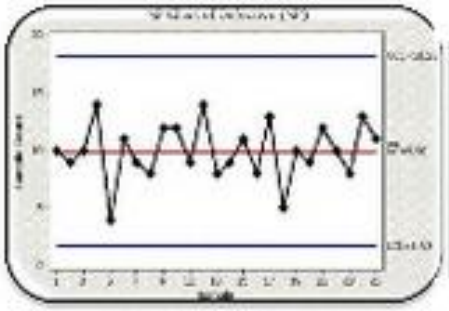
Check-sheet



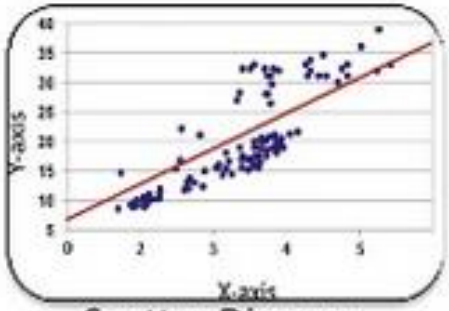
Pareto Diagram



Histograms

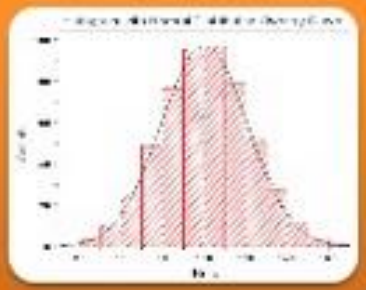


Control Charts



Scatter Diagram

8.1 Plan Quality Management->T&T->7QT->Histograms



Histograms (by Karl Pearson): - Special types of bar charts.

- Summarize the distribution of a data set.
- Graphical representation of distribution of numerical data.
- Each bar represents characteristic of a problem & height represents its frequency.

Roll No	Grade
1001	33
1002	25
1003	26
1004	78
1005	76
1006	73
1007	80
1008	71
1009	72
1010	72
1011	78
1012	70
1013	65
1014	66
1015	68
1016	61
1017	62
1018	63
1019	60
1020	66
1021	60
1022	70
1023	55
1024	50
1025	59
1026	50
1027	53
1028	59
1029	52
1030	53
1031	55

1

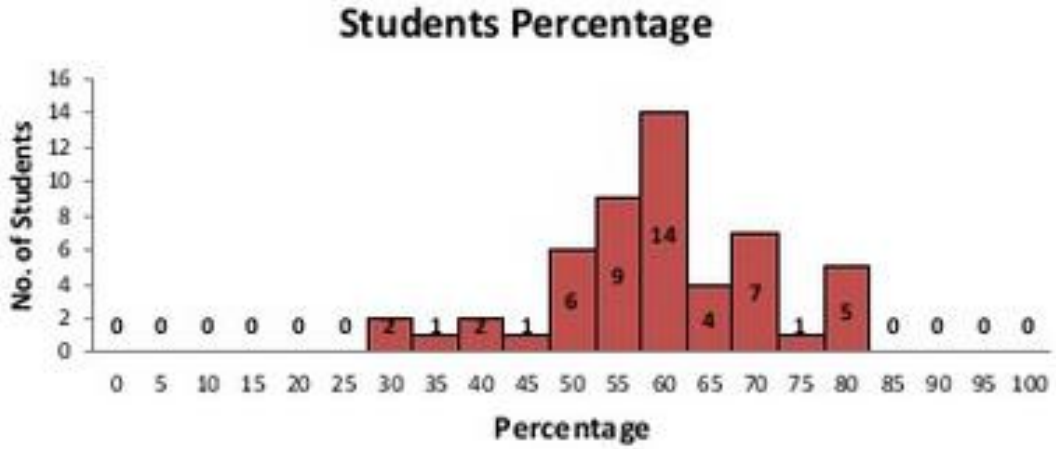
2

Bin Units	Frequency
0	0
5	0
10	0
15	0
20	0
25	0
30	2
35	1
40	2
45	1
50	6
55	9
60	14
65	4
70	7
75	1
80	5
85	0
90	0
95	0
100	0

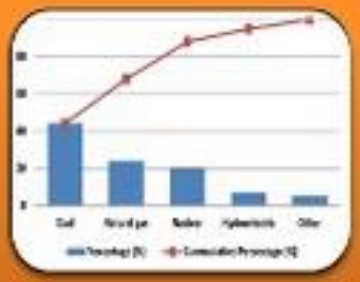
3

Ex: Analyse student performance through Histogram:

1. List all students grades (e.g., 500 students)
2. Create bins (categories like 10 to 15%) & add frequencies.
3. Plot the histogram.



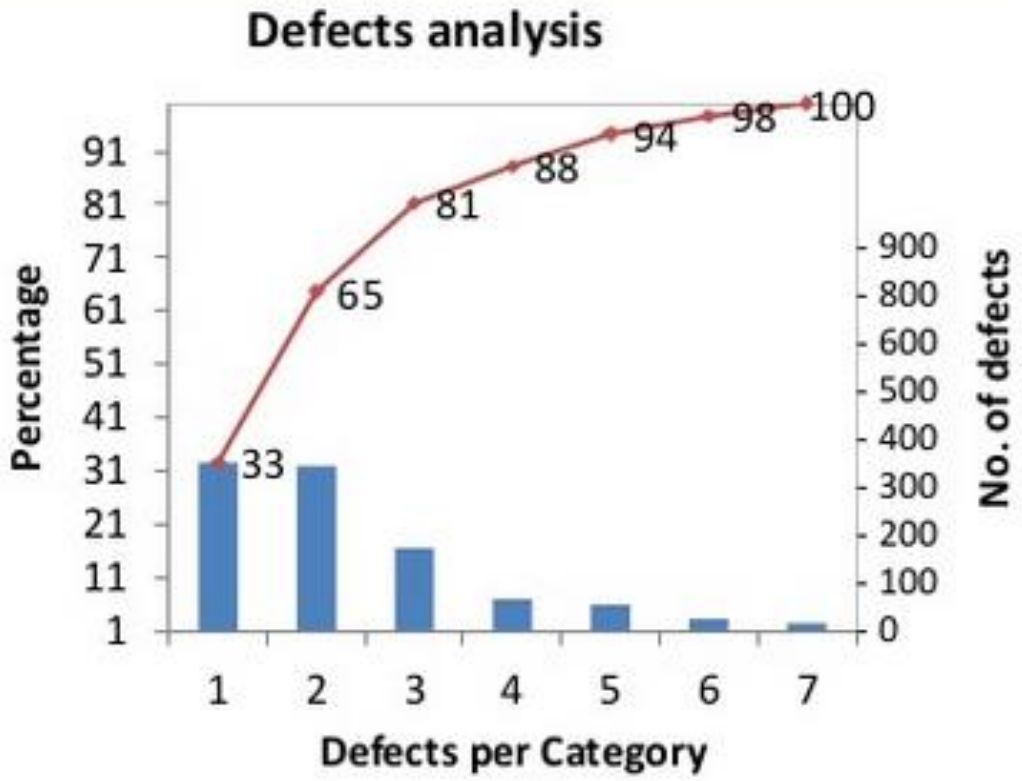
8.1 Plan Quality Management->T&T->7QT->Pareto Diagram



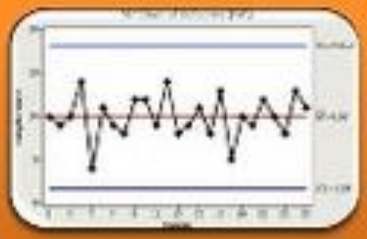
Pareto Diagram:

- It's a histogram that can help you identify & prioritize problem areas.
- Pareto analysis (80-20 rule), means that, 80% of problems are often due to 20% of the causes.

Sr. No	Defect Classification	No of Defects
1	Not according to requirements	326
2	User Interface Defects	320
3	Unexpected exceptions	166
4	Others	70
5	Integration Failures	60
6	Wrong Calculation	33
7	System Crashes	25

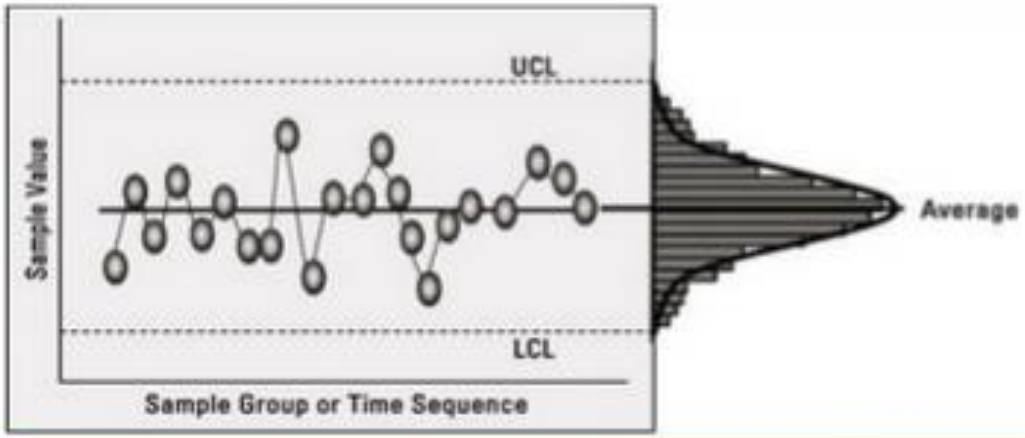


8.1 Plan Quality Management->T&T->7QT->Control Charts



Control Charts (developed by Walter A. Shewhart):

- Graphic display that illustrates results of a process over time.
- Determine whether a process is in control or out of control.
- Prevent defects, rather than to detect or reject them.



1 Sigma	• 68.27%
2 sigma	• 95.44%
3 Sigma (UCL / LCL)	• 99.73%
6 Sigma	• 99.99%

Sigma is another name for standard deviation & indicates how much variance from mean has been established as permissible in the process. Level of quality is indicated by 3 or 6 sigma.

3 Sigma

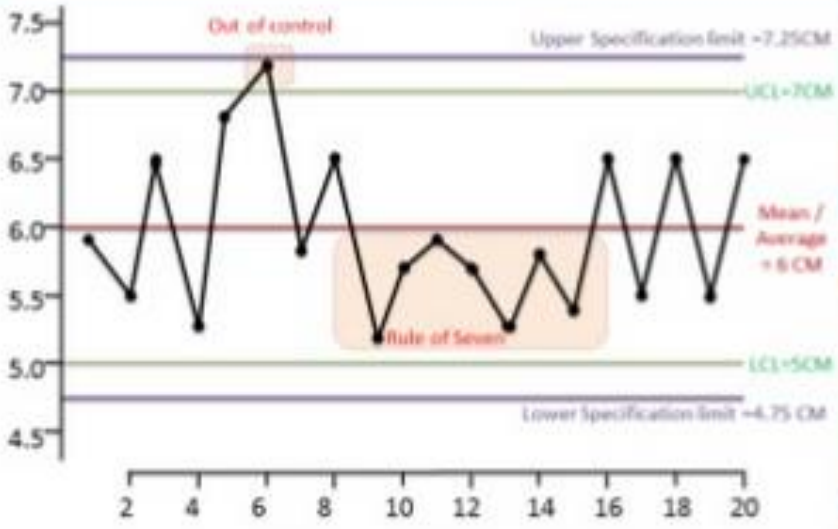
- 66,807 out of 1 million screws produced will have some problems.

6 Sigma

- 3.4 out of 1 million screws produced will have problems

8.1 Plan Quality Management->T&T->7QT->Control Charts

Analyse control chats shown in previous slide:



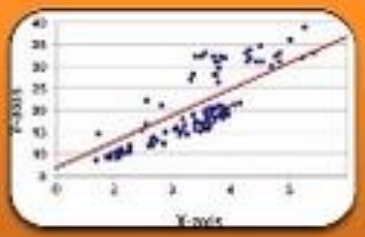
Process is out of control - There is one dot out of UCL, called as special cause.

Rule of seven: Consecutive 7 time, measurements fall on the one side of the mean.

This also, means process is out of control & need investigation.

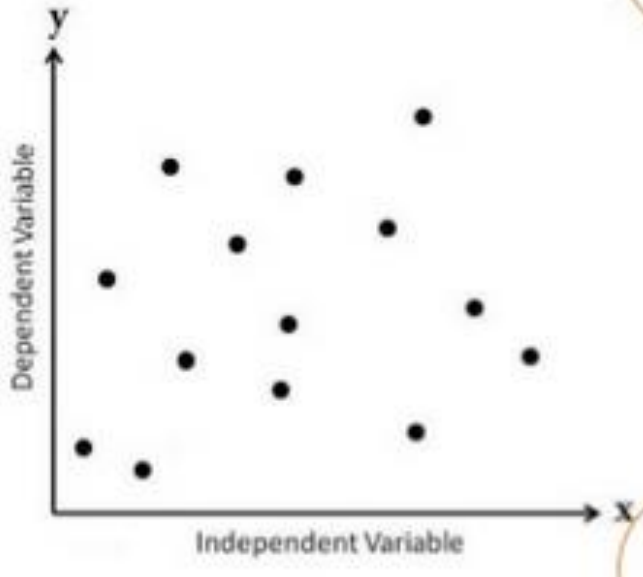
Assignable causes – Variations may be caused by differences in machines, workers overtime, etc. Identify the root cause

8.1 Plan Quality Management->T&T->7QT->Scatter Diagram



Scatter Diagram(scatter plot/ graph, correlation chart):

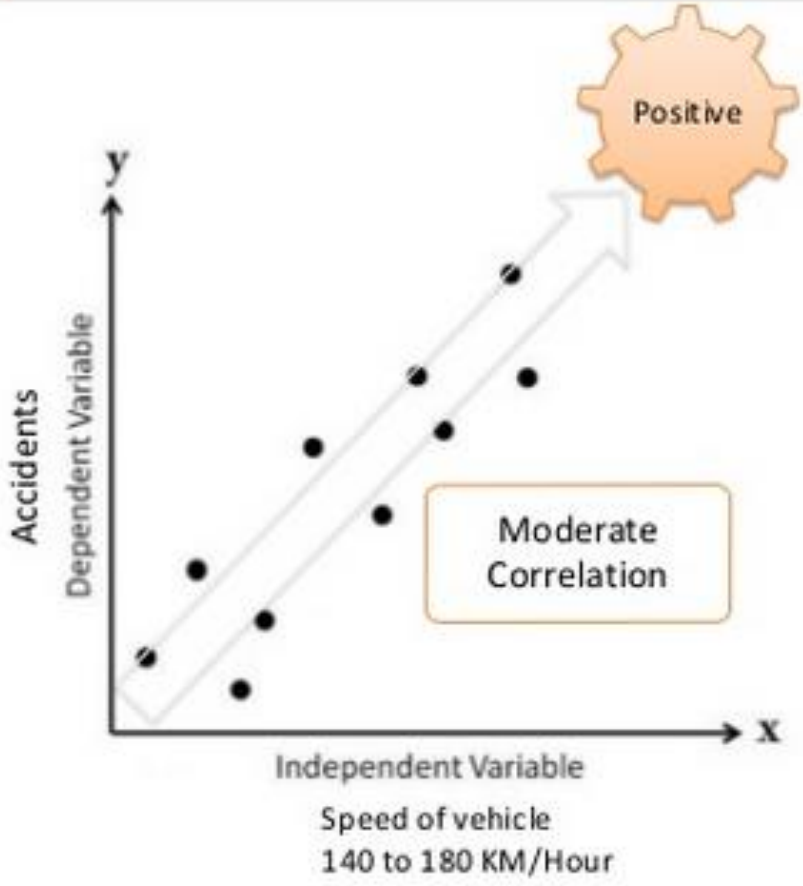
- Predict how change in an independent variable will change a dependent variable.

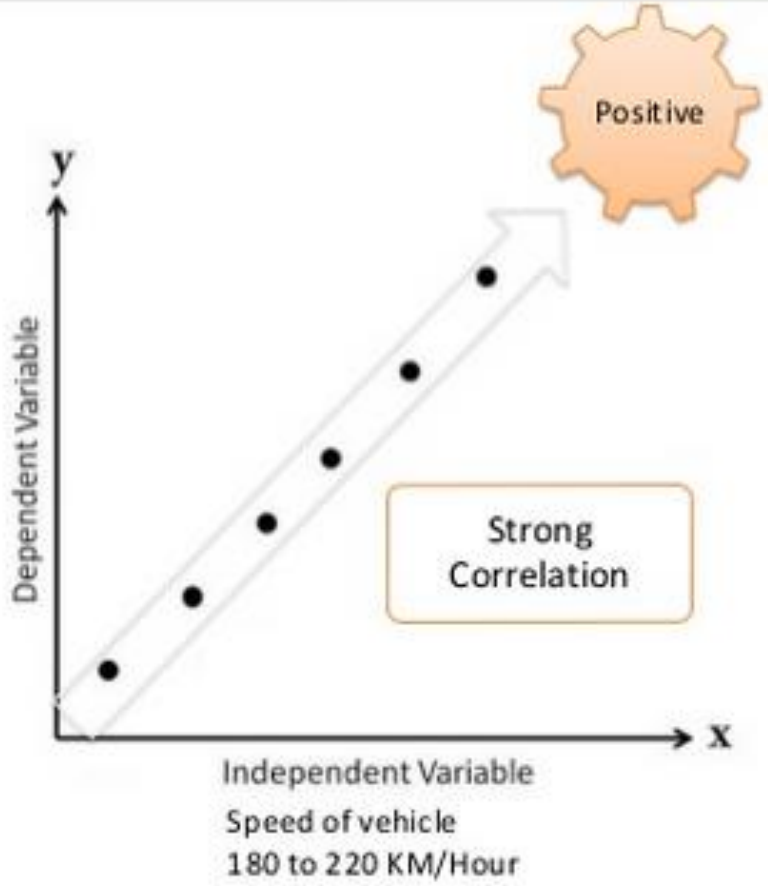


- Show if there is a relationship between two variables.
- Usually first variable is **independent** & second is **dependent** on first.
- Useful when one variable is easy to measure & other is not.
- Closer data points are to a diagonal line, stronger relation.

8.1 Plan Quality Management->T&T->7QT->Scatter Diagram

Example: The Y axis show number of Accidents and X axis show speed of vehicle. As speed increases, accidents increases.

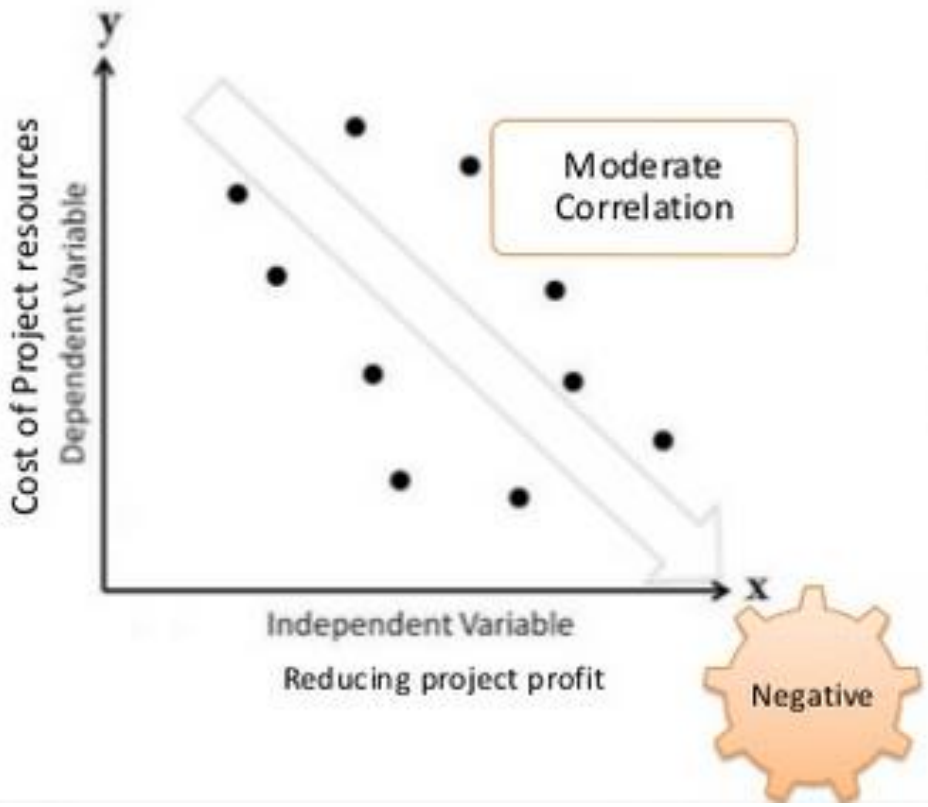


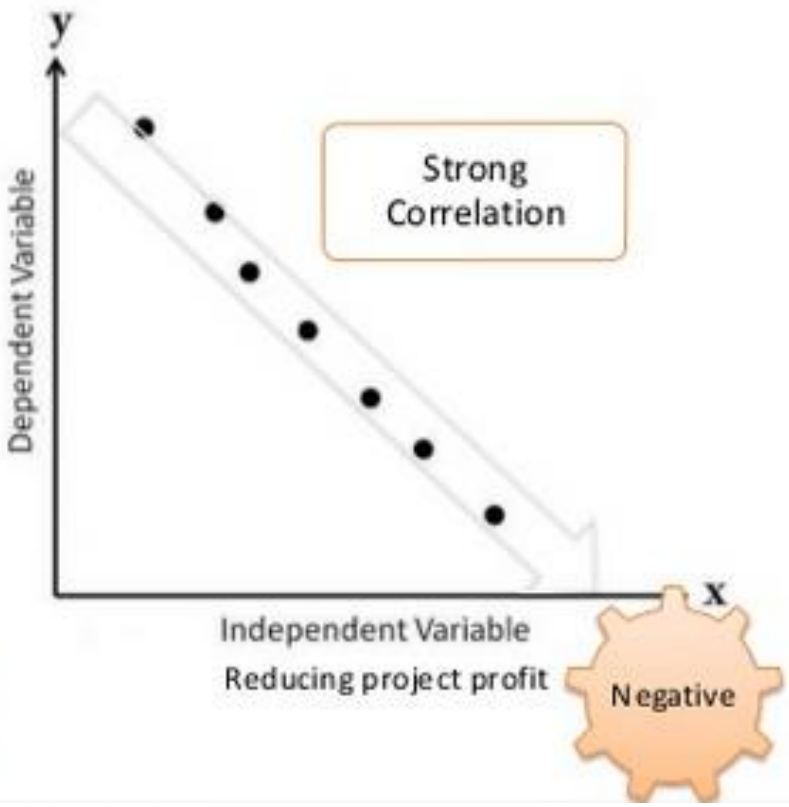


8.1 Plan Quality Management->T&T->7QT->Scatter Diagram

Example: The Y axis show cost of Project resources and X axis show project profile. As cost of project resources increases, profit will decrease.

If resource cost is one of the factor then correlation will be moderate, however if this is only factor then correlation will be strong.





8.1 Plan Quality Management->T&T->Add. QPT

Additional quality planning tools

Brainstorming:

Used for generating ideas.

Force Field Analysis:

Diagrams of forces for and against change.

Nominal Group Technique:

In this technique to vote for ideas to be further discussed by a larger group of people .

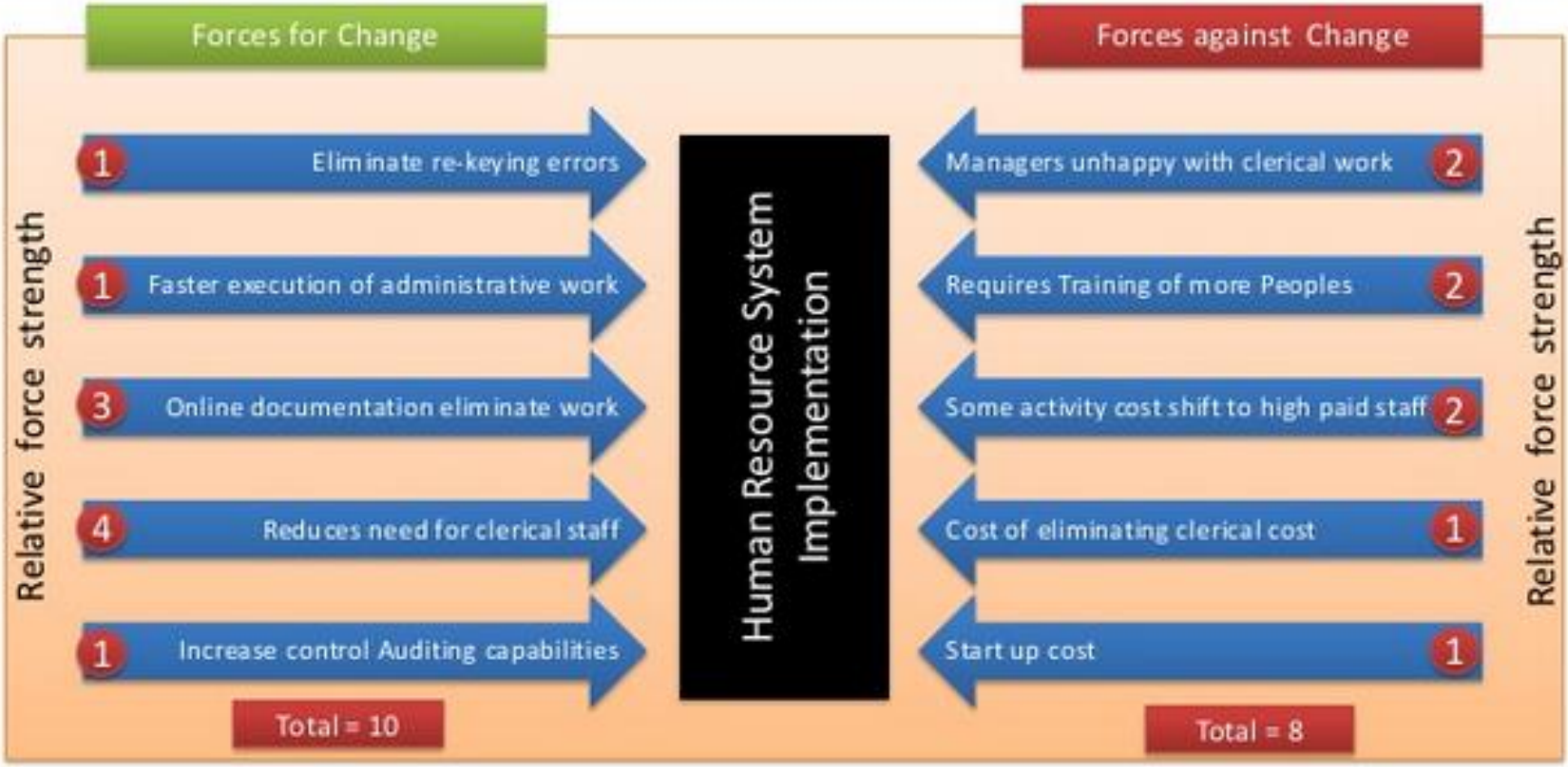
Quality Control and Management Tools:

This tools will be explained in the **next process**.

8.1 Plan Quality Management->T&T->Add. QPT

Force Field Analysis:

- It is a decision-making technique.
- Helps to make a decision by analysing forces for & against a change.



8.1 Plan Quality Management->Outputs ->QMP

Quality Management Plan

Quality management plans explains how organizations quality policies will be implemented.

Depending on project, plan can be very detailed or simple.

Planned should be reviewed early.

Sharper focus on projects value proposition. (Cost of Quality, Cost benefit analysis)

Details how Quality requirements are captured.

Should refer to Quality management standard followed by product.

May contain sample size of process to calculate it.

8.1 Plan Quality Management->Outputs->PIP

Process Improvement Plan

It details the steps that will help improving various process.

It helps you to analyse the existing business **processes**, identify problems and rectify them to improve the.

It is implemented in the QA and QC processes. It contains:

Process Boundaries:	• The purpose of process, inputs & outputs, Owner etc
Process Configuration:	• Graphical depiction of the process.
Process Metric:	• Used for measuring process efficiency (Control limits).
Targets for Improved Performance:	• Targets for improvement.

8.1 Plan Quality Management->Outputs->Quality Metrics

Quality metrics

Description of a project/product attribute & how to measure it.

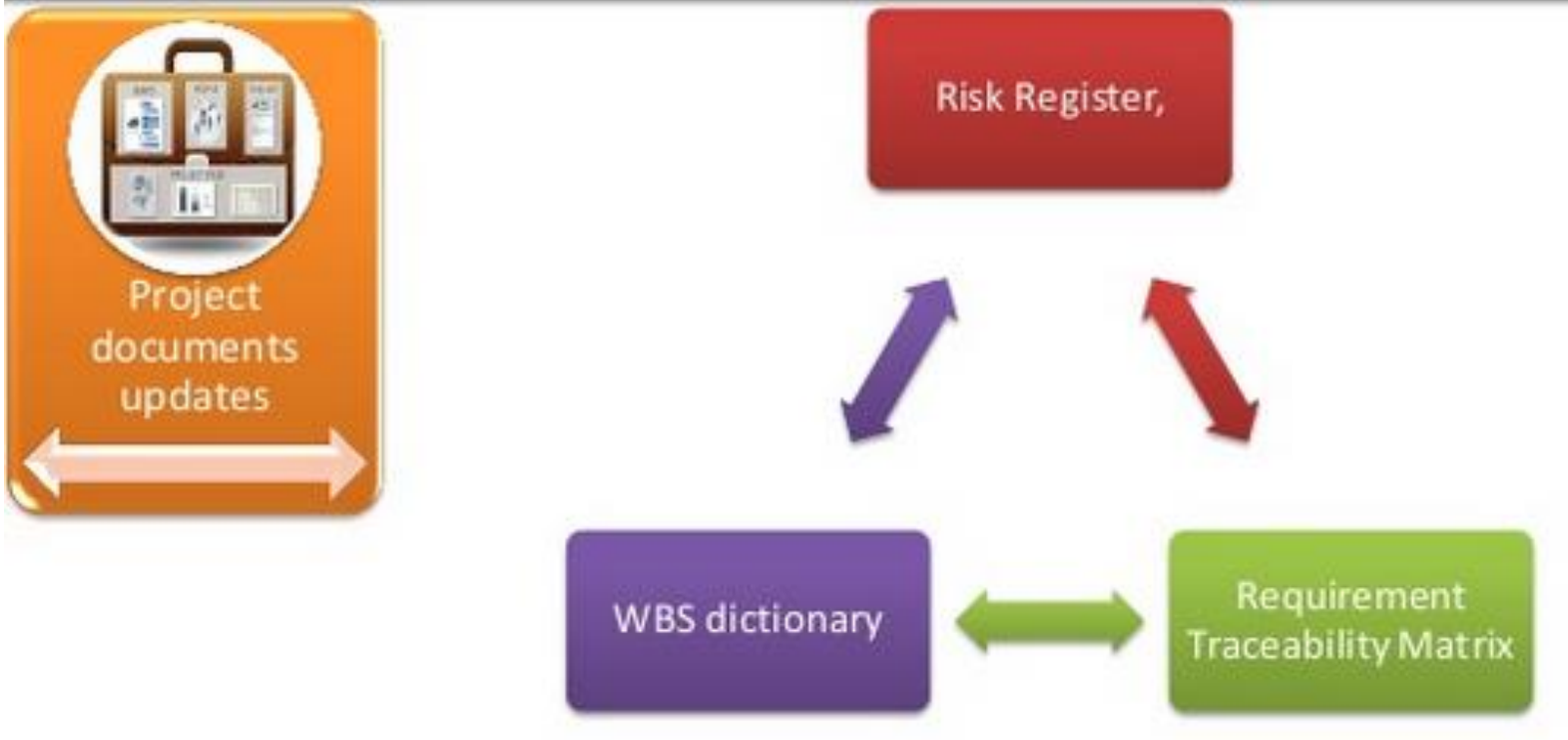
They are used to directly translate customer needs into acceptable performance measures in both products and processes.

E.g., Finishing project within budget & time, freq. of defects, failure rate

The metrics & tolerance level for variation is set in Quality plan.

Tactical Measure	Sample Indicator
Time	Schedule Performance Index (SPI) = Earned Value / Planned Value
Cost	Cost Performance Index (CPI) = Earned Value / Actual Cost
Resources	Amount of hours overspent per Testing cycle
Scope	Number of Change Requests

8.1 Plan Quality Management->Outputs



Quality checklists

A list of items to inspect, step to be performed and note if any defects found

Self Assessment

Your are executing a Software Performance Test. According to the PT acceptable each transaction should execute within 1 to 30

milliseconds. After the execution results were as 16, 18,16, 17, 17, 18, 16,18,16, 16, 17,15 milliseconds respectively. How you will interpret this data using control chart.

a. Performance is within control as all results are close to mean value.

b. Performance is within control as all results fall within acceptable range.

c. Performance is out of control as results are constantly varying.

d. Performance is out of control as 7 consecutive results are above the mean.

Answer: ?

Self Assessment

You are producing doors. The control limits set for the thickness of doors for this process set to 9.8cm and 10.2cm. The business specification limits are 9.7 cm and 10.3cm. During Inspection, it was noticed that last 6 doors continuously has thickness of 10.25 cm long. Select appropriate answer.

a. Business will accept the doors

b. Quality parameters are not meet

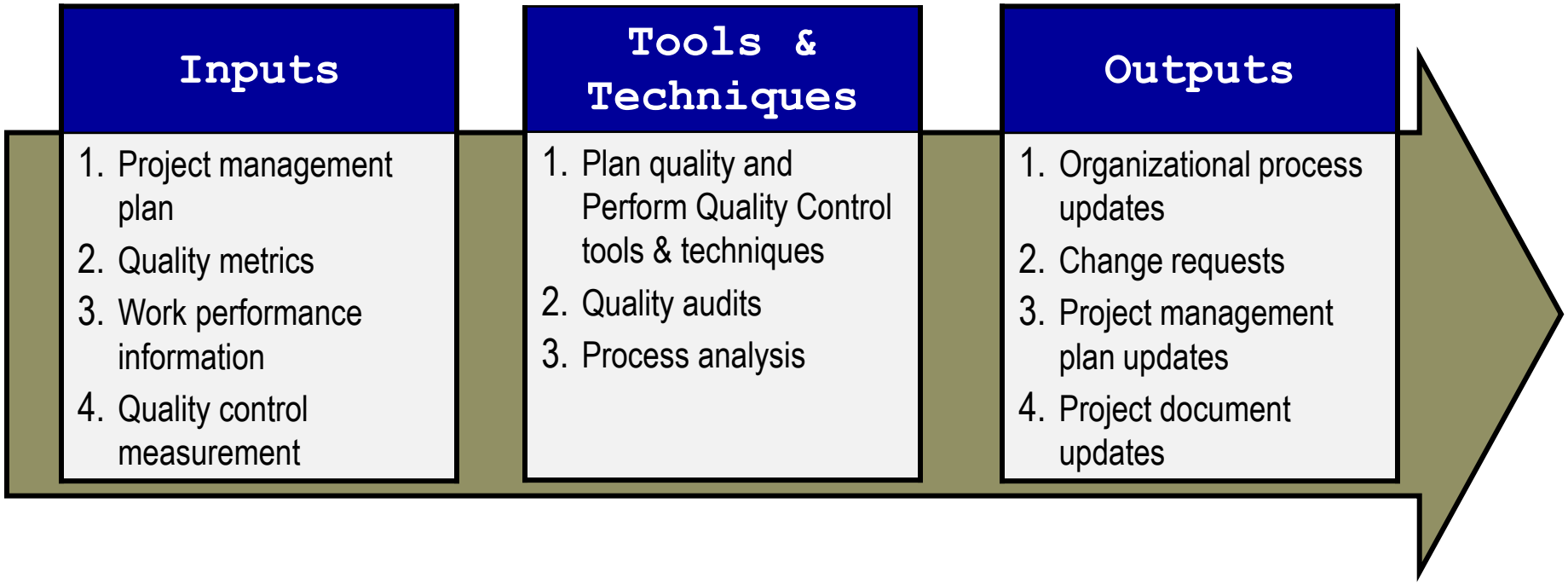
c. Business will reject the doors

d. The process is out of control and needs to be adjusted.

Answer: ?

8.2 PERFORM QUALITY ASSURANCE

The process of auditing the quality requirement and the result of quality control measurements to ensure appropriate quality standards and operational definitions are used.



QUALITY ASSURANCE

Are we using the standard?

Can we improve the standard?

Quality Audits

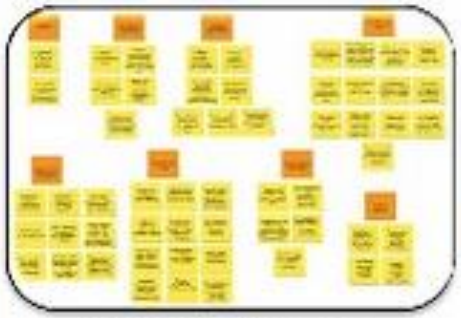
- To see if you are complying with company policies, standards & procedures
- Determine whether they are used efficiently & effectively
- Identify all the good practices being implemented
- Identify all the gaps/shortcomings
- Look for new lesson learned & good practices

Process Analysis

- Includes root cause analysis

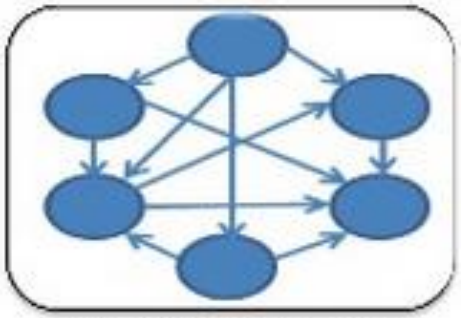
8.2 Perform Quality Assurance->T&T->QM&CT

Quality Management & Control Tools

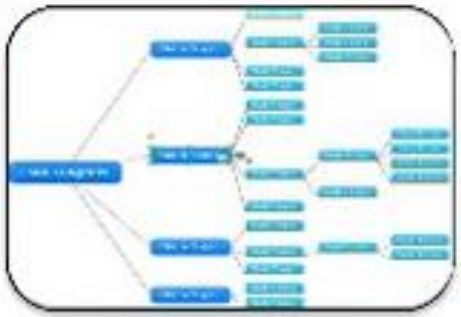


Affinity diagram

PDPC

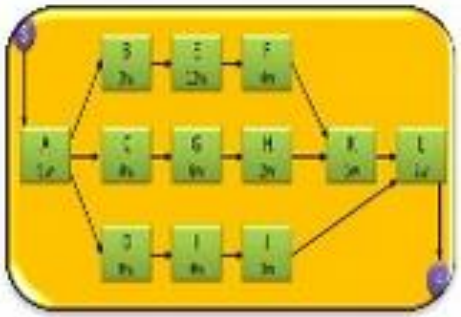


Interrelationship Digraph



Tree Diagram

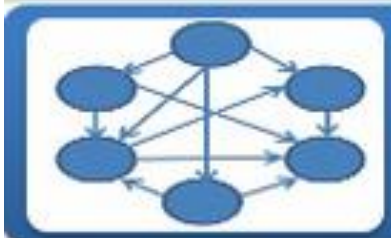
Prioritization Matrix



Network Diagram

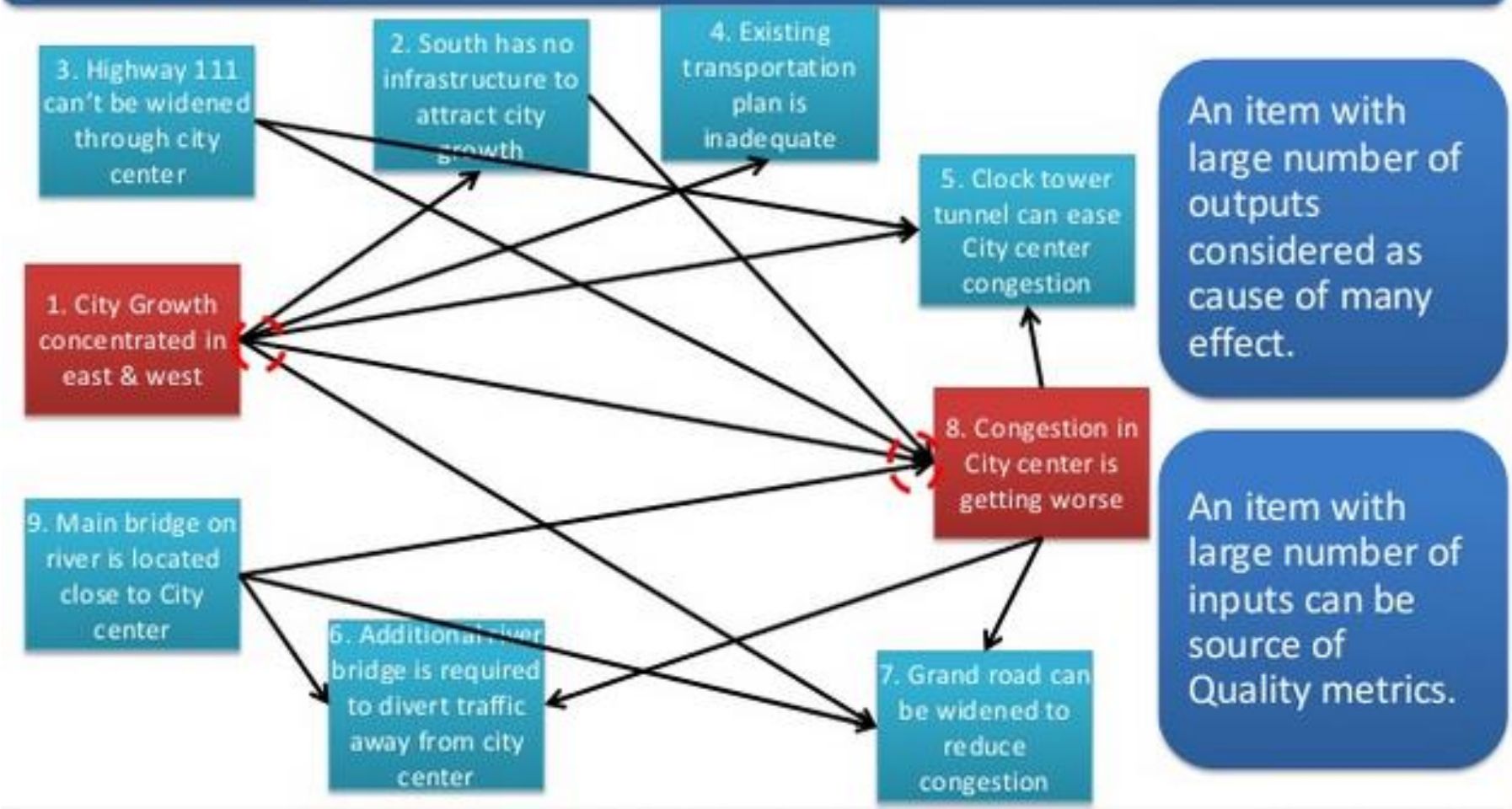
Matrix Diagram

8.2 Perform Quality Assurance->T&T->QM&CT



Interrelationship Digraph:

Provide a process for creative problem-solving in moderately complex scenarios that possess logical relationships.



8.2 Perform Quality Assurance->T&T->QM&CT

Process Decision Program Chart (PDPC) :

Used to understand a goal in relation to steps for getting to goal.

It identifies what might go wrong in a plan under development.

8.2 Perform Quality Assurance->T&T->QM&CT

Prioritization Matrices :

To prioritize tasks, issues or possible options based on known, weighted criteria.

#	Defect description	Duration	Complexity	Impact on other modules	Total
1	System is calculating wrong totals	10	10	10	30
2	System not meeting Performance	5	5	5	15
3	Background colour is not as per specification.				
4	Validation message box has wrong message.				
5	System				

#	Development complexity	Value
1	Complex	5
2	Medium	7
3	No impact	10

#	Development Duration	Value
1	More than a week	5
2	2 to 7 days	7
3	Less than 2 days	10

#	Impact to other area's	Value
1	Major	5
2	Medium	7
3	Minor	10

Weighted Criteria's

8.2 Perform Quality Assurance->T&T->QM&CT

2

Scoring:
1 = meets criteria poorly
5 = meets criteria very well

Weighting:
1 = unimportant,
5 = very important

	Criteria					
	Low cost of implementation	Low running costs	High chance of success	High chance of being approved	*Unweighted total*	*Weighted total*
Weight 3	2	5	3	4		5
1 Full supplier review system	1	3	5	2	11	40
New supplier managers	5	4	3	1	13	43
Short education program	3	1	3	4	11	36
Reselection of suppliers	2	1	2	3	8	27

5x2 + 4x5 + 3x3 + 1x4

4

1. List items to prioritise → 2. Identify criteria → 3. Identify weights → 4. Score items → 5. Total scores → 6. Interpret → 7. Take action

6 New suppliers managers would need work to get approved.

7 Work on getting sponsorship. Support with short education program.

Self Assessment

Which of the following is most TRUE regarding quality?

a. It is cheaper to build quality into a project.

b. Quality is driven by Inspection.

c. Quality is driven by Prevention.

d. Quality always costs more in the long run

Answer : ?

Self Assessment

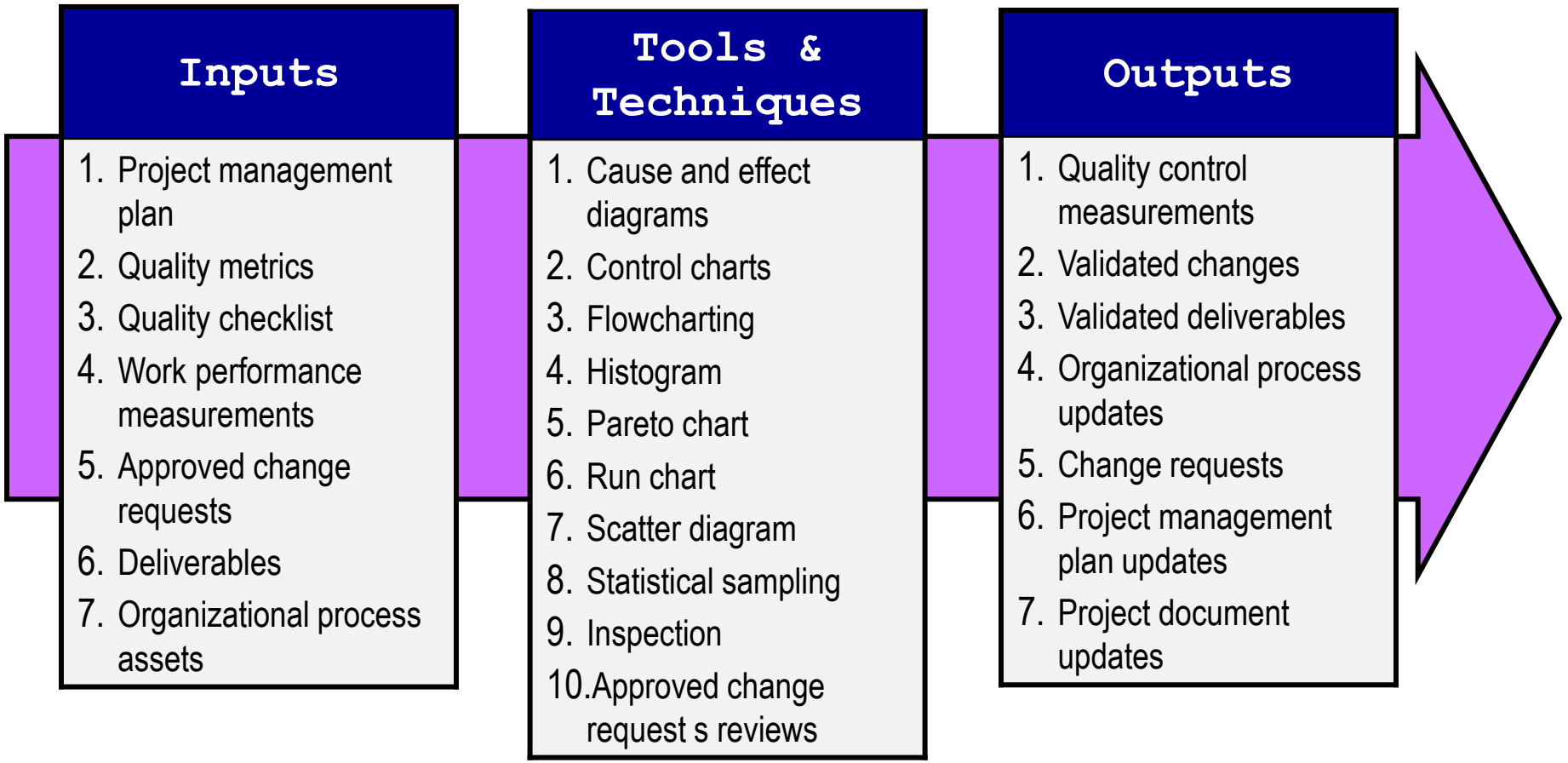
A customer is constantly concerned about the product quality & thinking that quality process are not being followed as agreed in the quality management plan. How project manager can verify this claim?

- a. Invite customer to perform the quality inspections
- b. Increasing the sample size
- c. Review the results of quality audit's.
- Request customer to review quality management plan

Answer : ?

8.3 PERFORM QUALITY CONTROL

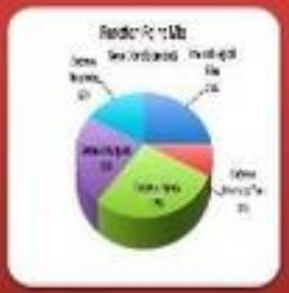
The process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes.



8.3 Control Quality -> Input->Quality Metrics

Quality metrics

It describes how project or products attributes will be measured.



Function Points (FP):

- In IT, FP are used to count number of function, an information system providing to a business.
- Can be used for estimation.

Mean time between Failures (MTBF):

- It shows reliability of product.
- It specifies time between two failures.
- E.g., hard disk will have a failure after 300,000 hours.

Mean time to repair (MTTR):

- It is average amount of time a device/product will need to be repaired.

QUALITY CONTROL

Cause and Effect Diagram (Ishikawa Diagram or Fishbone Diagram)

- Helps stimulate thinking, organize thoughts, and generate discussion
- Can be use to explore the factors that will result in a desire future outcome

Histogram

- Showing how often a particular problem/situation occurred

Pareto Chart/Diagram (80/20 principle)

- Histogram ordered by frequency of occurrence which used to focus attention on the most critical issues
- 80% of the problems are due to 20% of the causes

Run Chart

- To look at history and see a pattern of variation

Scatter Diagram → Regression analysis

8.3 Control Quality->Output->WPI

Work performance information

WPI is performance related data that is output to many monitoring and controlling processes

This is used in Monitor & control project work for further analysis.

WPI will show:

- Projects achievement against requirements.
- Information about rejections.
- Reasons for the rejections.
- Rework required.
- Need for change in quality processes.

Self Assessment

Quality is achieved when ___

a. We exceed customer's every expectation.

b. We exceed customer's expectation is some way or other.

c. The defined requirements of the customers are fulfilled.

d. The number of benefits far outweighs the number of defects.

Answer : ?

NEXT TOPIC:
PROJECT HUMAN RESOURCE MANAGEMENT

Thank You