

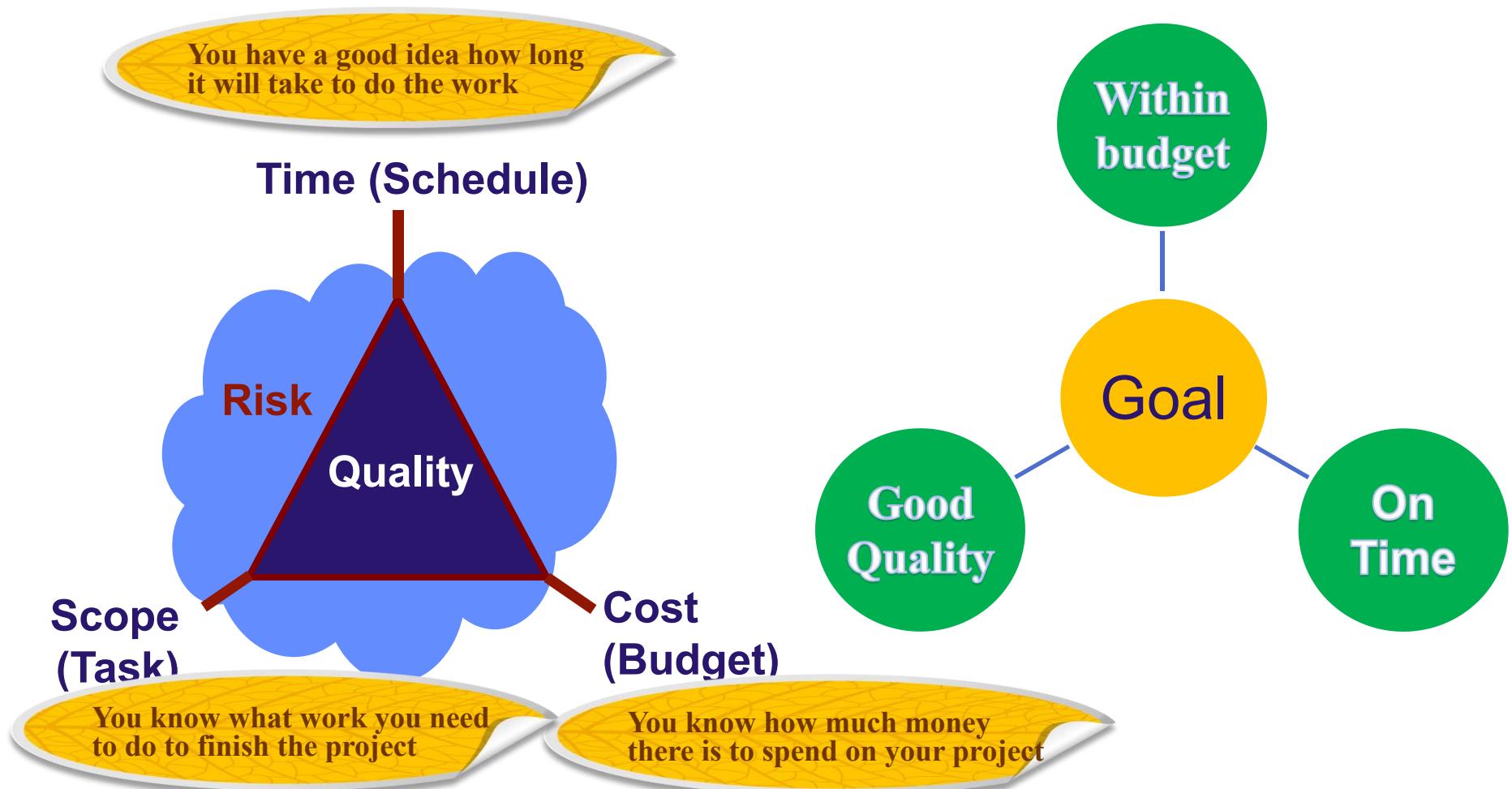
# Software Project Management



# Structure of this course

	5 process groups				
10 knowledge areas	Initiating	Planning	Executing	Monitoring & Controlling	Closing
1. Integration management					
2. Scope					
3. Time					
4. Cost					
5. Quality					
6. Human resource					
7. Communications					
8. Risk					
9. Procurement					
10. Stakeholder					

# Quality Management



# Quality Management Overview

## □ What is Quality?

Quality is the measurement of how closely your product meets its requirements

### Quality

The degree to which a set of inherent characteristics fulfill requirements (ISO 9000)

### Grade

A category assigned to deliverables having the same functional use but different technical characteristics

Higher-grade stuff typically costs more

# Quality Management Overview



**It may **not** be a problem**

**if a suitable low-grade software product (one with a limited number of features) is of high quality (no obvious defects, readable manual)**

# Quality Management Overview

## □ What is Quality Management?

Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken.

Project Quality Management works to ensure that the project requirements, including product requirements, are met and validated.

Project Quality Management

```
graph LR; A[Project Quality Management] --> B[Project Management Quality: scope, schedule]; A --> C[Project Product Quality]
```

# Quality Management Overview

These approaches recognize the important of 5 aspects:

**1**

## Customer satisfaction

Conformance to requirements and fitness for use

**2**

## Prevention over inspection

Cost of preventing mistakes is generally much less than the cost of correcting mistakes

# Test

The applications being built by your programming team have lots of bugs. So, you write up **coding standards** that will **guide** everyone in building the product with more attention to quality.

Prevention

Inspection

You set up code reviews at important milestones in your project to catch defects as early as you can.

Prevention

Inspection

# Quality Management Overview

## Continuous improvement

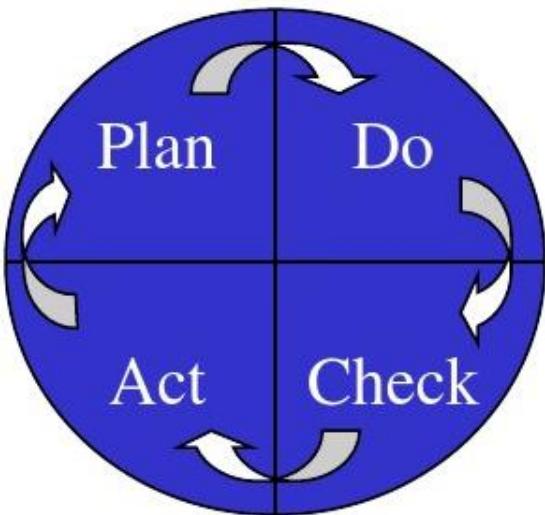
PDCA (plan-do-check-act) cycle is the basis for quality improvement

3

## Management responsibility

Success requires the participation of all members of the project team

4



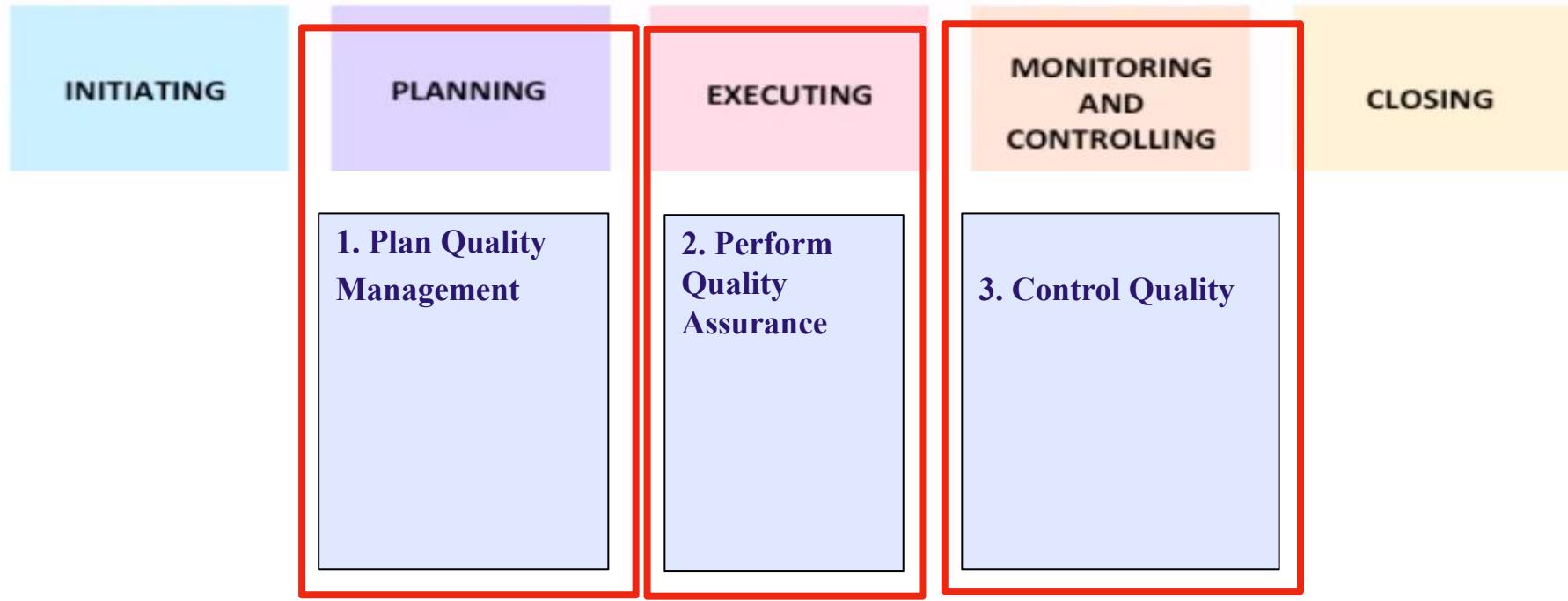
## Cost of Quality (COQ)

Total cost of Conformance work and the nonconformance work

5

# Quality Management Overview

5 Process Groups



3 Quality Management processes

# Chapter 6 Quality Management

1

Plan Quality Management

2

Perform Quality Assurance

3

Control Quality

# Section 6.1: Plan Quality Management

## *Plan Quality Management*

The process of **identifying quality requirements** and/or standards for the project and its deliverables, and **documenting how** the project will demonstrate **compliance** with relevant **quality requirements**

The key benefit of this process is that it provides **guidance** and **direction** on how quality will be managed and validated throughout the project.

The better your quality planning, the less inspection you need to do!

# Section 6.1 Plan Quality Management



# Section 6.1 Plan Quality Management

- 
1. Cost of Quality (COQ)
  2. Seven basic quality tools

# Section 6.1 Plan Quality Management

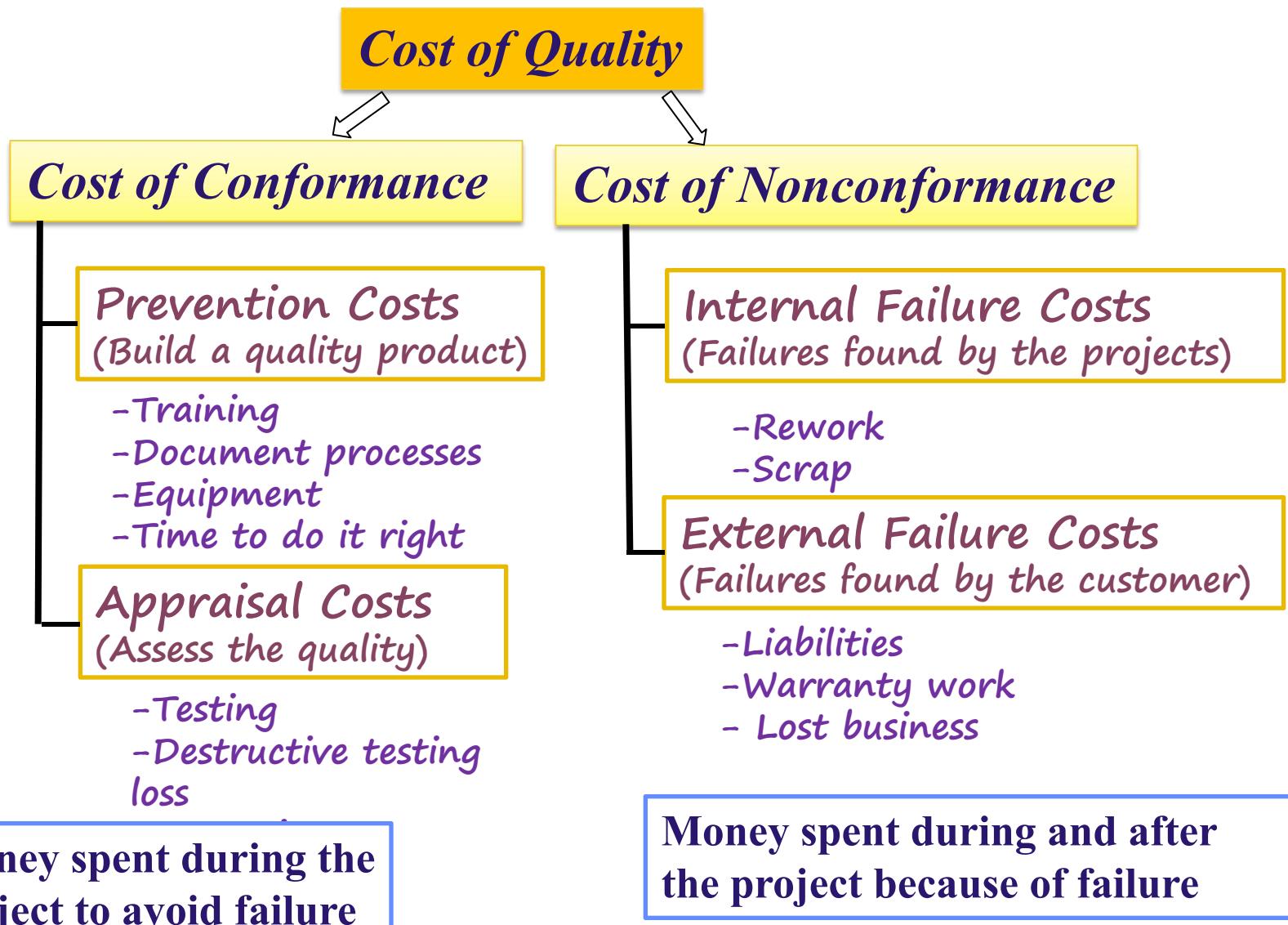


Cost of quality includes **all costs** incurred over the life of the product by **investment in**:

- **preventing nonconformance to requirements;**
- **appraising the product or service for conformance to requirements;**
- **and failing to meet requirements (rework)**

**COQ: PAF (Prevention / Appraisal / Failure)**

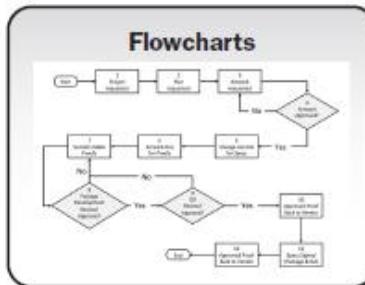
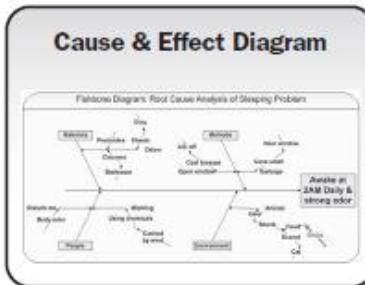
# Section 6.1: Plan Quality Management



# Section 6.1 Plan Quality Management

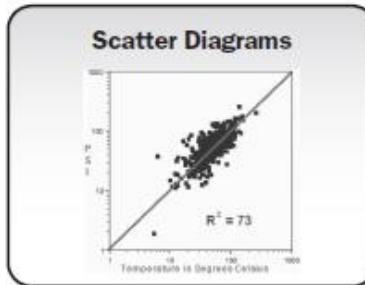
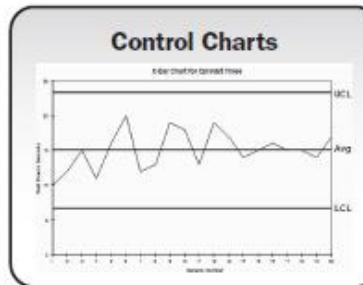
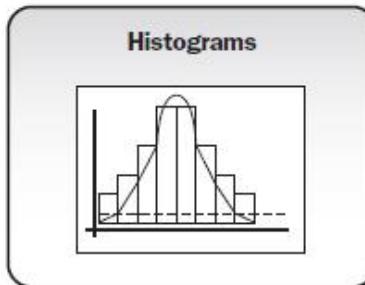
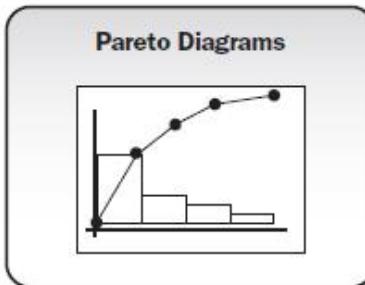


1. Cost of Quality (COQ)
2. Seven basic quality tools



**Checklists**

Category	Strokes	Frequency
Attribute 1		
Attribute 2		
Attribute $\vdash$		
Attribute $n$		



# Section 6.1: Plan Quality Management

7  
Quality  
tools

## 1

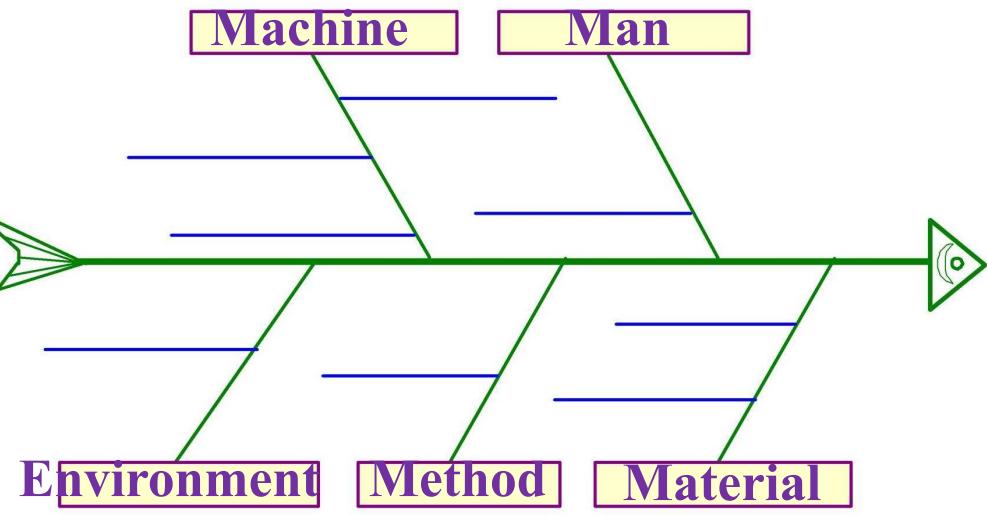
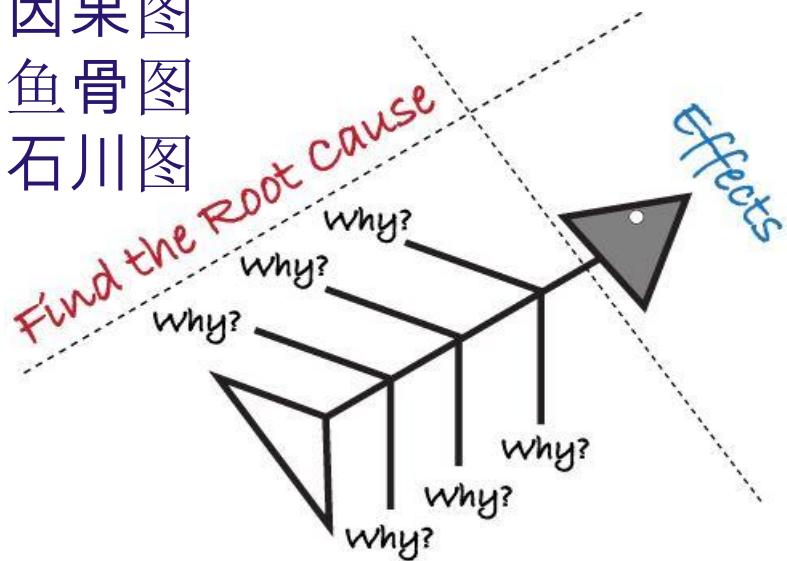
### Cause-and-effect diagrams

**fishbone diagrams or Ishikawa diagrams.**  
**Problem statement placed at the head of the fishbone is used as a starting point to trace the problem's source back to its actionable root cause.**



石川馨(Kaoru Ishikawa, 07/13/1915 – 04/16/1989) was Japanese organizational theorist, <Quality Control>

因果图  
鱼骨图  
石川图



# Section 6.1: Plan Quality Management

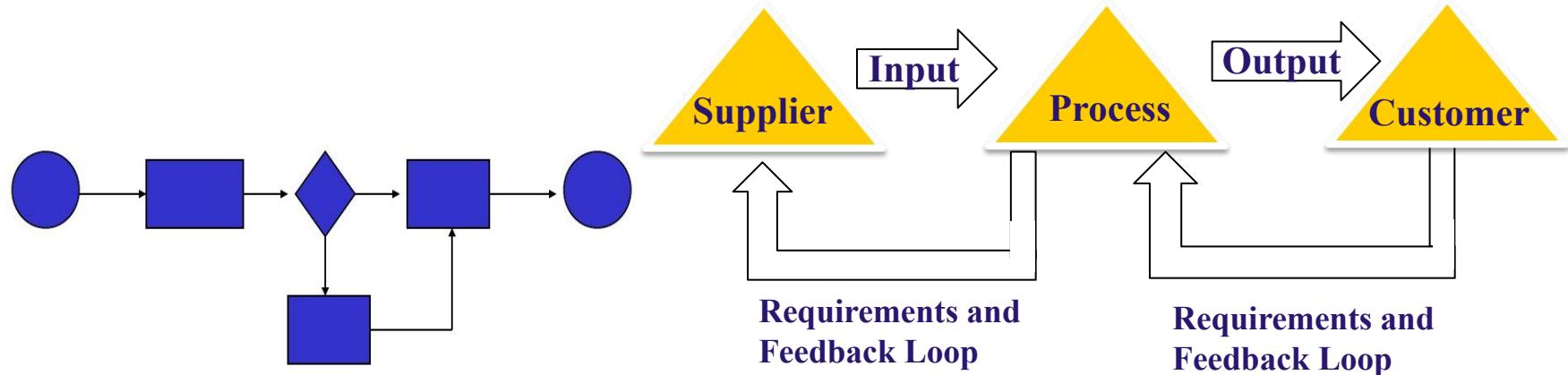
## 2

### Flowcharts

Referred to as **process maps**, they display the **sequence of steps** and the branching possibilities that exist for a process that **transforms** one or more **inputs** into one or more **outputs**.

Flowcharts show the **activities**, **decision points**, **branching loops**, **parallel paths**, and the **overall order of processing** by mapping the operational details of procedures that exist with a horizontal value chain of a **SIPOC** model

**(Deming).**



# Section 6.1: Plan Quality Management

## 3

### Checklists

Tally sheets, may be used as a **checklist** when gathering data.

They are **especially useful for gathering attributes data while performing inspections to identify defects.**

Item	A	B	C	D	E	F	G
-----			✓✓	✓		✓	✓
-----	✓✓✓				✓✓✓	✓	✓✓
-----		✓✓	✓	✓✓		✓	

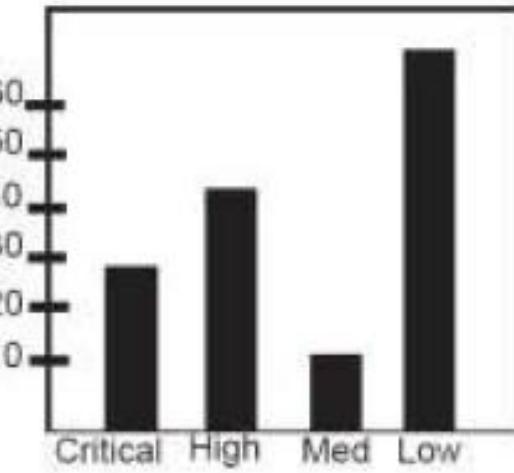
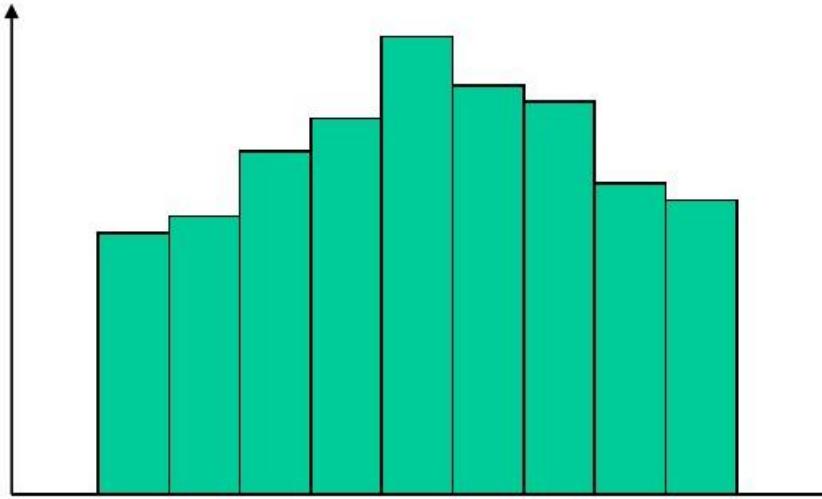
# Section 6.1: Plan Quality Management

## 4

## Histogram

A special form of bar chart, used to **describe the central tendency, dispersion, and shape of a statistical distribution.**

Frequency



**priority of defects**

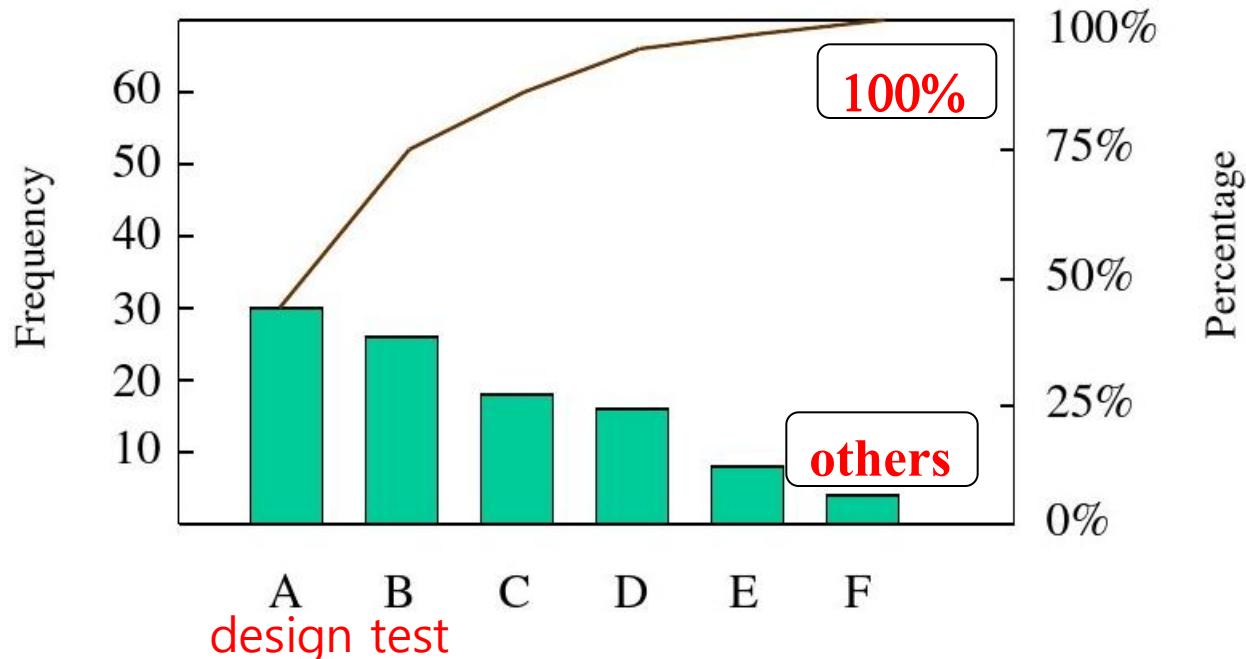
# Section 6.1: Plan Quality Management

## 5

### Pareto diagrams

A special form of vertical bar chart and are used to identify the vital few sources that are responsible for causing most of a problem's effects.

帕累托图



# Section 6.1: Plan Quality Management

## Pareto 80/20 rule

For many events, roughly 80% of the effects come from 20% of the causes

80% of the land in Italy was owned by 20% of the population

### Economics

20% of the world population controlling 80% of the world's income



### Business

80% of sales come from 20% of clients

### Software

The hardest 20% of the code takes 80% of the time



### Others

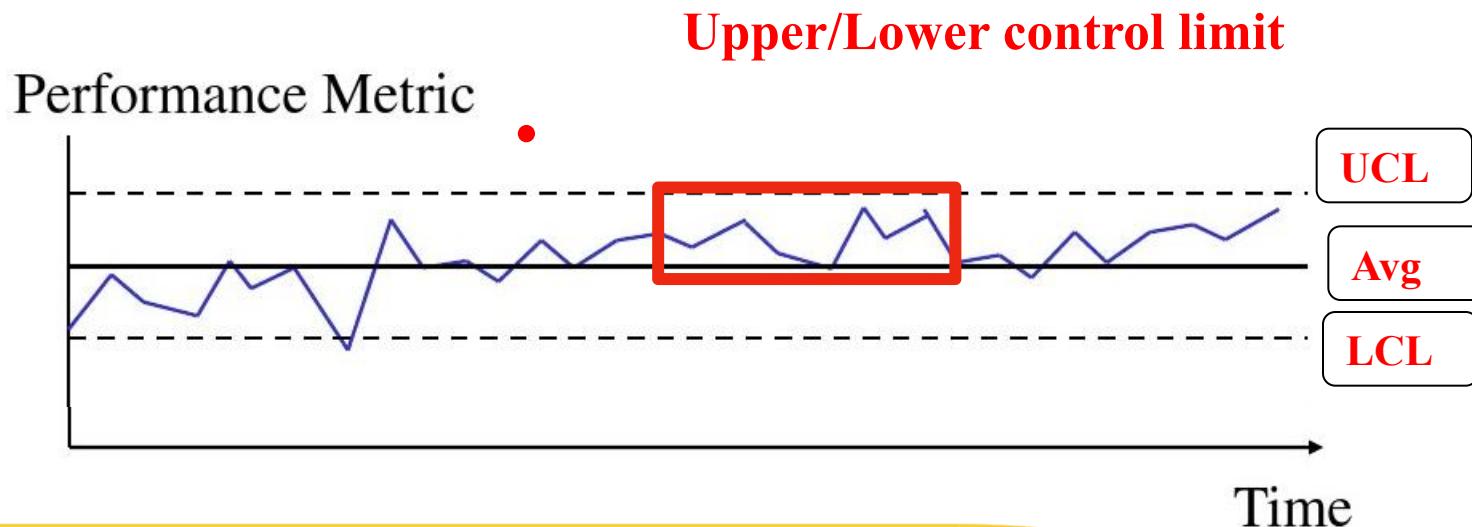
20% of patients have been found to use 80% of health care resources

# Section 6.1: Plan Quality Management

## 6

## Control charts

Used to determine whether or not a process is stable or has predictable performance.



- A process is considered out of control when
- (1) A data point exceeds a control limit;
  - (2) Seven consecutive plot points are above the mean
  - (3) Seven consecutive plot points are below the mean

**Rule of Seven**

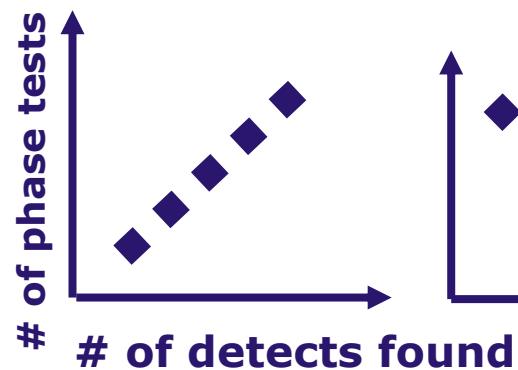
# Section 6.1: Plan Quality Management

## 7

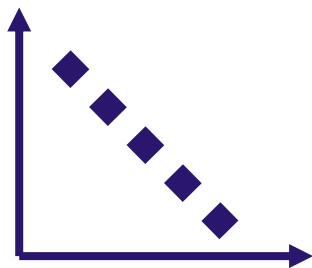
## Scatter diagrams

Plot ordered pairs (X,Y) and are sometimes called **correlation charts** because they seek to explain a change in the dependent variable, Y, in relationship to change observed in the corresponding independent variable, X.

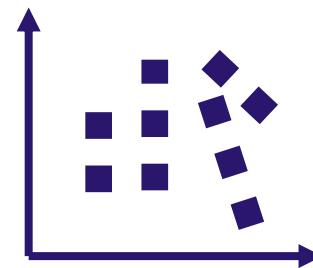
Positive correlation



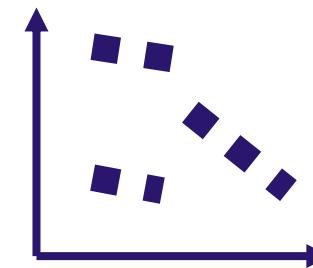
Negative correlation



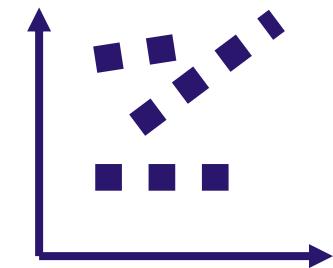
Zero correlation



Negative weak correlation



Positive weak correlation



# Test

Which of the following tools and techniques is used to show which categories of defects are most common?

- A. Control charts
- B. Pareto charts
- C. Run charts
- D. Flow charts

Which quality control tool is sued to analyze processes by visualizing them graphically?

- A. Checklists
- B. Histograms
- C. Pareto charts
- D. Flowcharts



# Chapter 6 Quality Management

1

Plan Quality Management

2

Perform Quality Assurance

3

Control Quality

# Section 6.2: Perform Quality Assurance

## *Perform Quality Assurance*

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.

The key benefit of this process is that it facilitates the improvement of quality processes.

# Section 6.2: Perform Quality Assurance

## 5 Process Groups



1. Plan Quality Management

2. Perform Quality Assurance

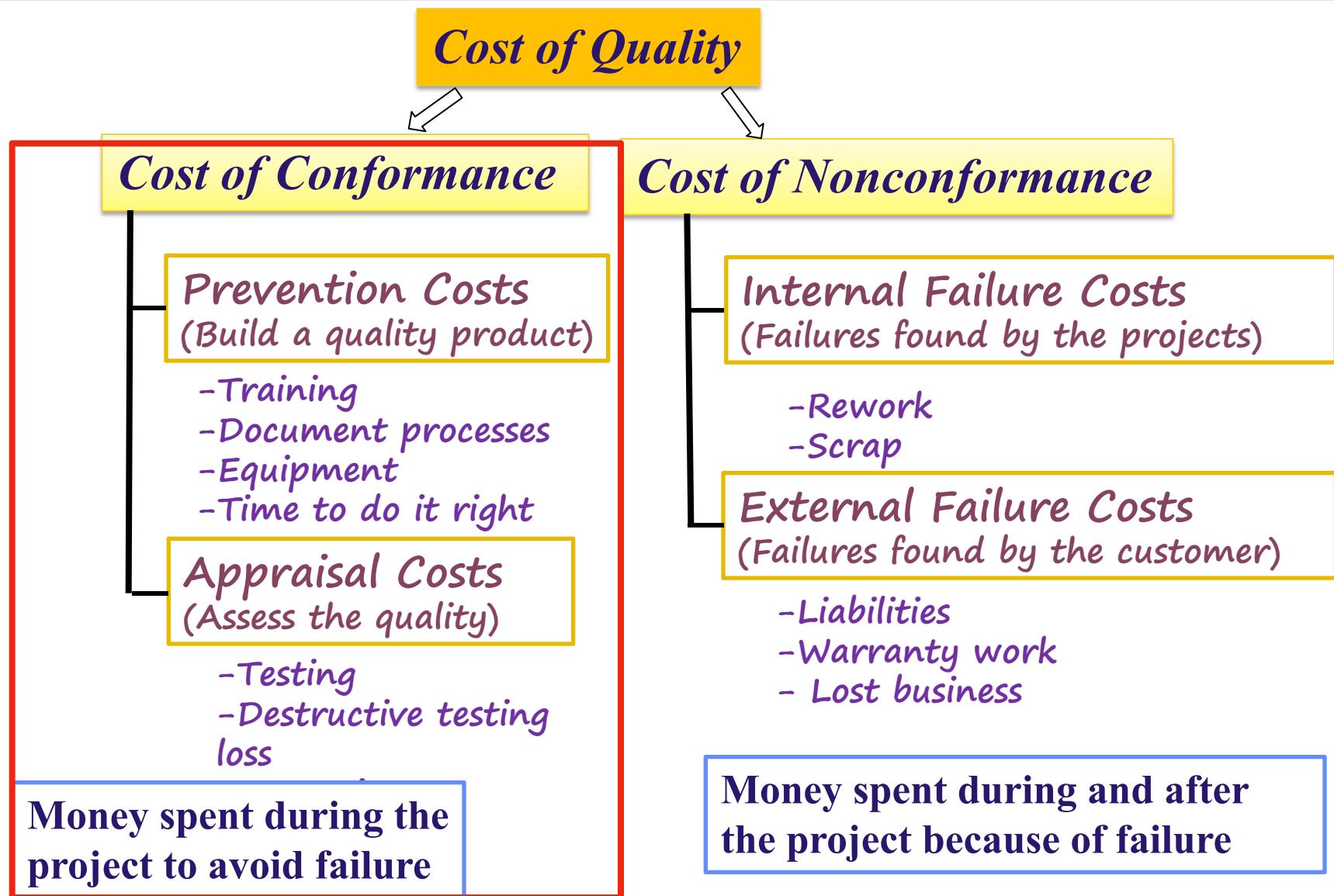
3. Control Quality

QA should be used during the project's planning and executing phases to **provide confidence** that the **stakeholder's** requirements will be met

QA:

1. **preventing** defects through the planning processes;
2. **inspecting** out defects during the work-in-progress stage of implementation.

# Section 6.2: Perform Quality Assurance



# Section 6.2: Perform Quality Assurance



## 1. Change Requests

- Change requests are created and used as input into the Perform Integrated Change Control process (Integration management) to allow full consideration of the recommended improvements.
- Change requests are used to take **corrective action**, **preventive action**, or to perform **defect repair**.

The key benefit of this process is that it **facilitates** the **improvement of quality processes**.

# Section 6.2: Perform Quality Assurance

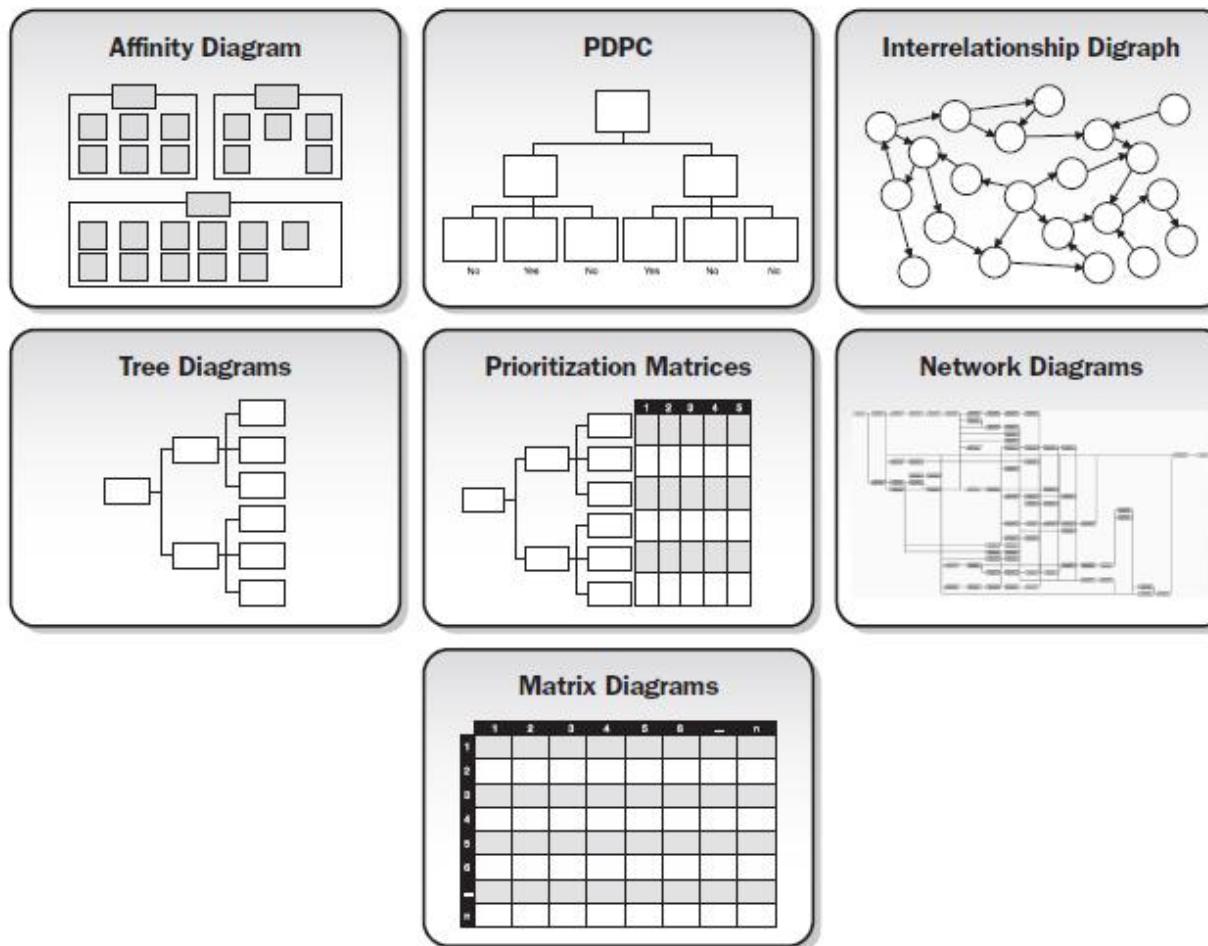


## 1. Quality Management and Control Tools:

The Perform Quality Assurance process uses the tools and Techniques of the Plan Quality Management and Control Quality processes. In addition, other tools include:

1. Affinity diagrams
2. Process decision program charts (PDPC).
3. Interrelationship digraphs
4. Tree diagrams
5. Prioritization matrices.
6. Activity network diagrams.
7. Matrix diagrams

# Section 6.2: Perform Quality Assurance

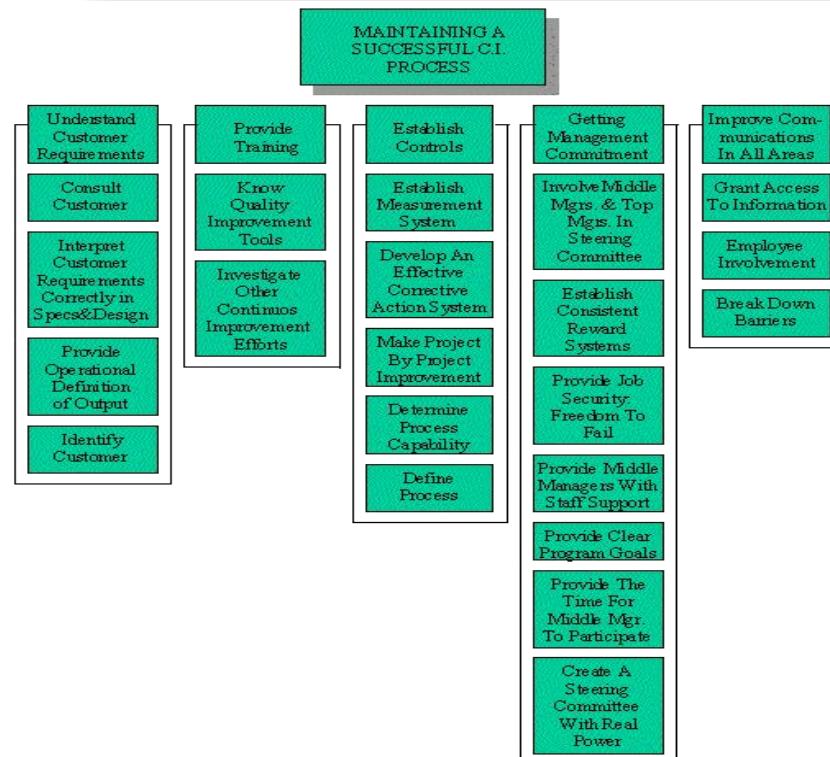


# Section 6.2: Perform Quality Assurance

## 1

## Affinity diagrams

The affinity diagram is similar to mind-mapping techniques in that they are used to generate ideas that can be linked to form organized patterns of thought about a problem.

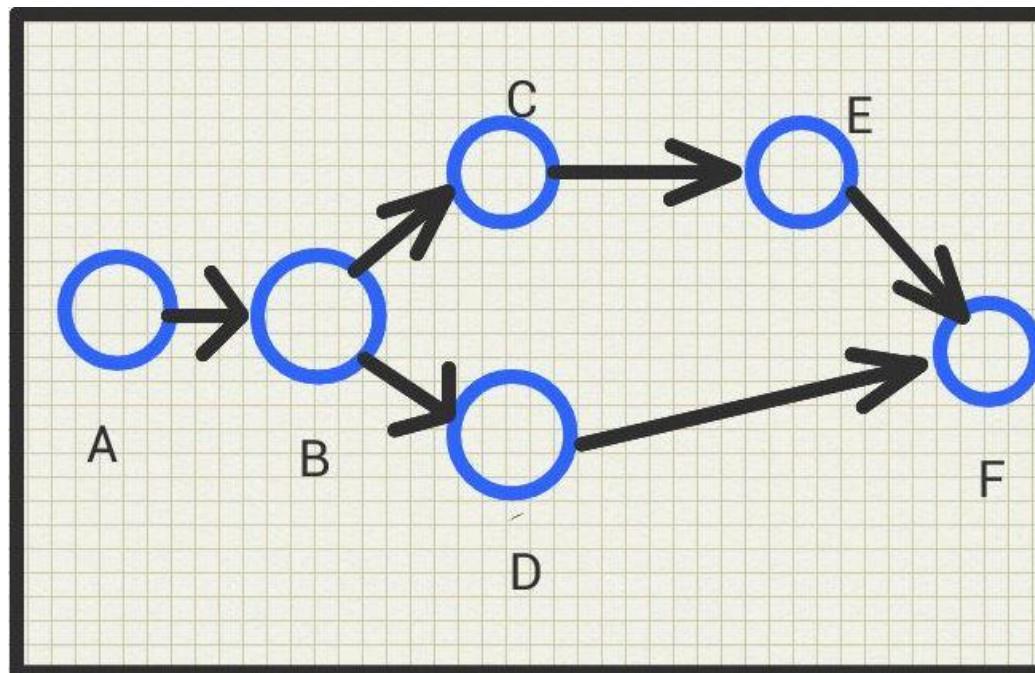


# Section 6.2: Perform Quality Assurance

## 2

## Activity network diagrams

Previously known as arrow diagrams. They include both the AOA (Activity on Arrow) and most commonly used, AON (Activity on Node) formats of a network diagram.

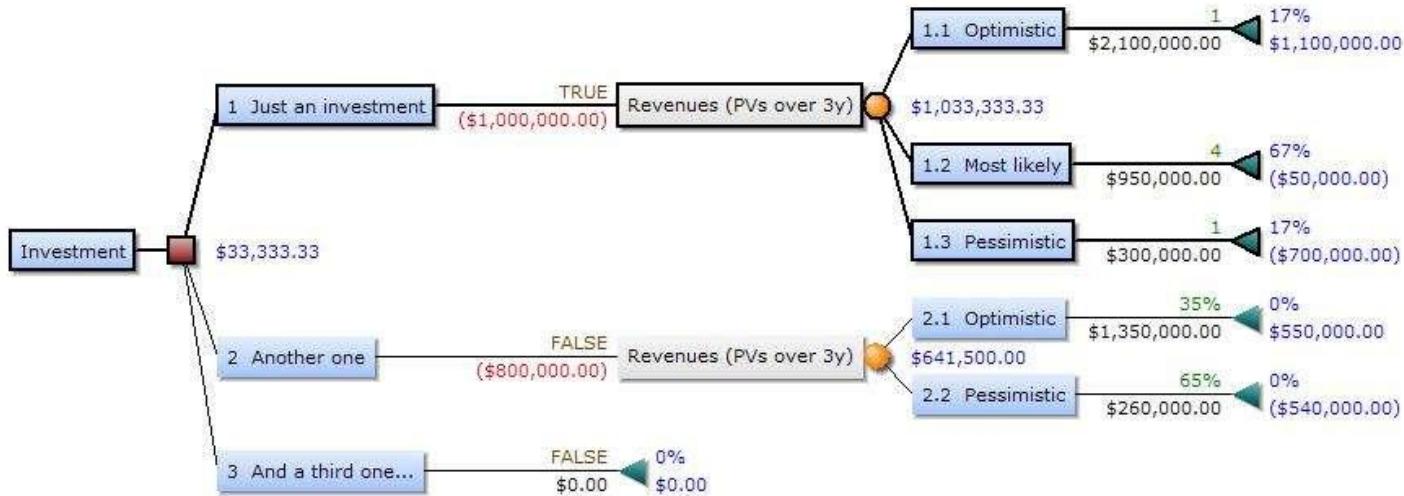
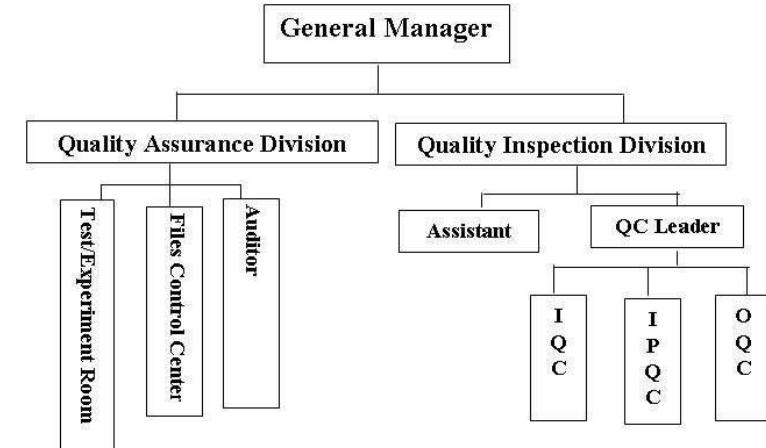


# Section 6.2: Perform Quality Assurance

3

## Tree diagrams

Also known as **systematic diagrams** and may be used to represent decomposition hierarchies such as WBS, RBS and, OBS

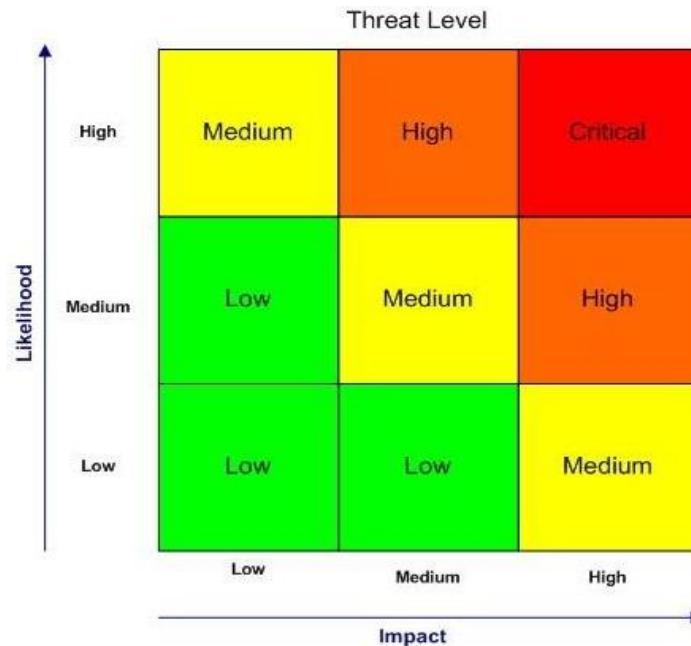


# Section 6.2: Perform Quality Assurance

## 4

## Matrix diagrams

A tool used to perform **data analysis** within the organizational structure created in the matrix. The matrix diagram seek to show the **strength of relationships** between factors, causes and objectives that exist **between the rows and columns** that form the matrix.



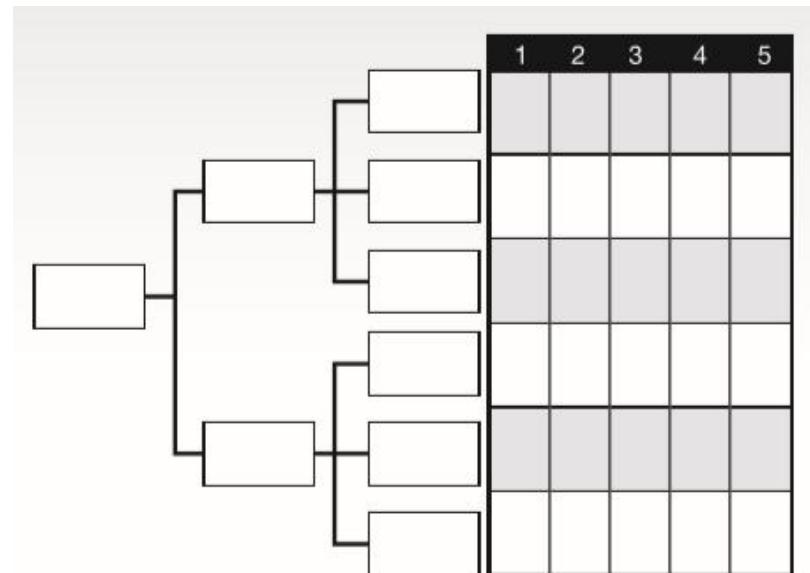
## Section 6.2: Perform Quality Assurance

5

## Prioritization matrices

**Identify the key issues and the suitable alternatives to be prioritized** as a set of decisions for implementation. Criteria are prioritized and weighted before being applied to all available alternatives to obtain a mathematical score that ranks the options.

*A combination of tree diagrams and matrix diagrams*

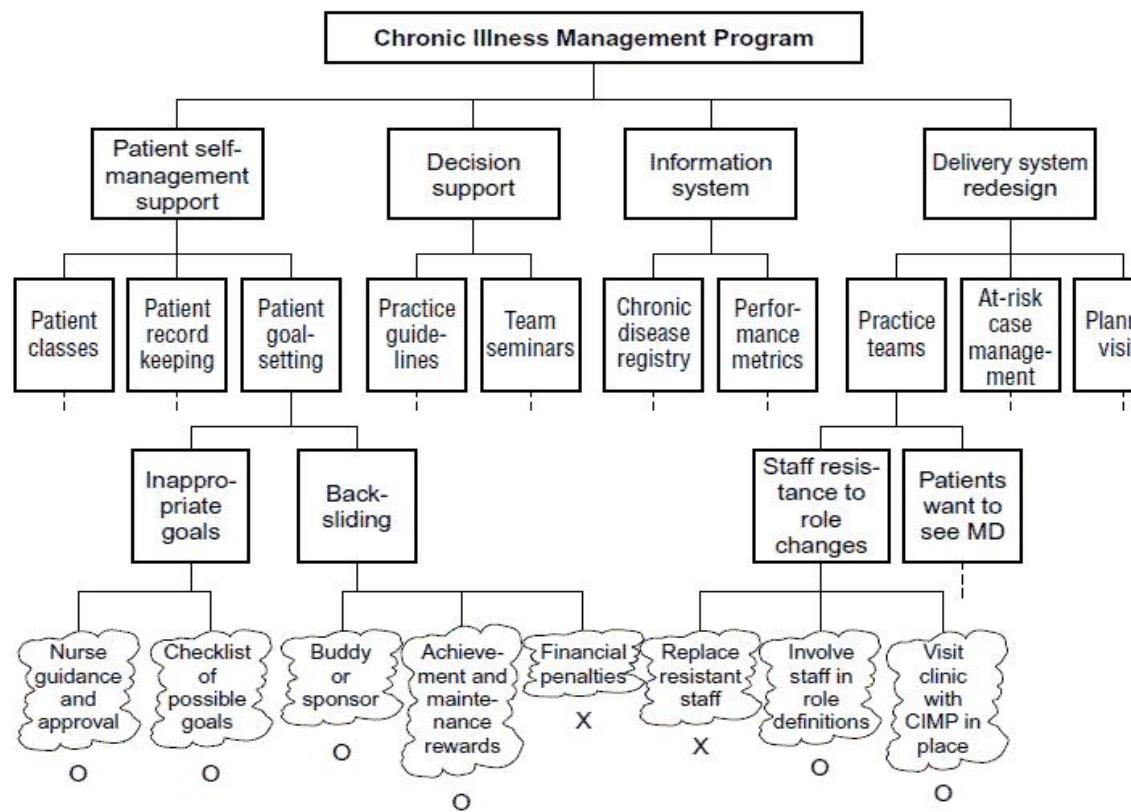


# Section 6.2: Perform Quality Assurance

## 6

### Process decision program charts (PDPC)

Used to understand a goal in relation to the steps for getting to the goal. The PDPC is useful as a method for contingency planning because it aids teams in anticipating intermediate steps that could derail achievement of the goal.



1. Obtain or develop a tree diagram of the proposed plan
2. For each task on the third level, brainstorm what could go wrong.
3. Review all the potential problems and eliminate any that are improbable or whose consequences would be insignificant.
4. For each potential problem, brainstorm possible countermeasures.
5. Decide how practical each countermeasure is. Mark impractical countermeasures with an X and practical ones with an O.

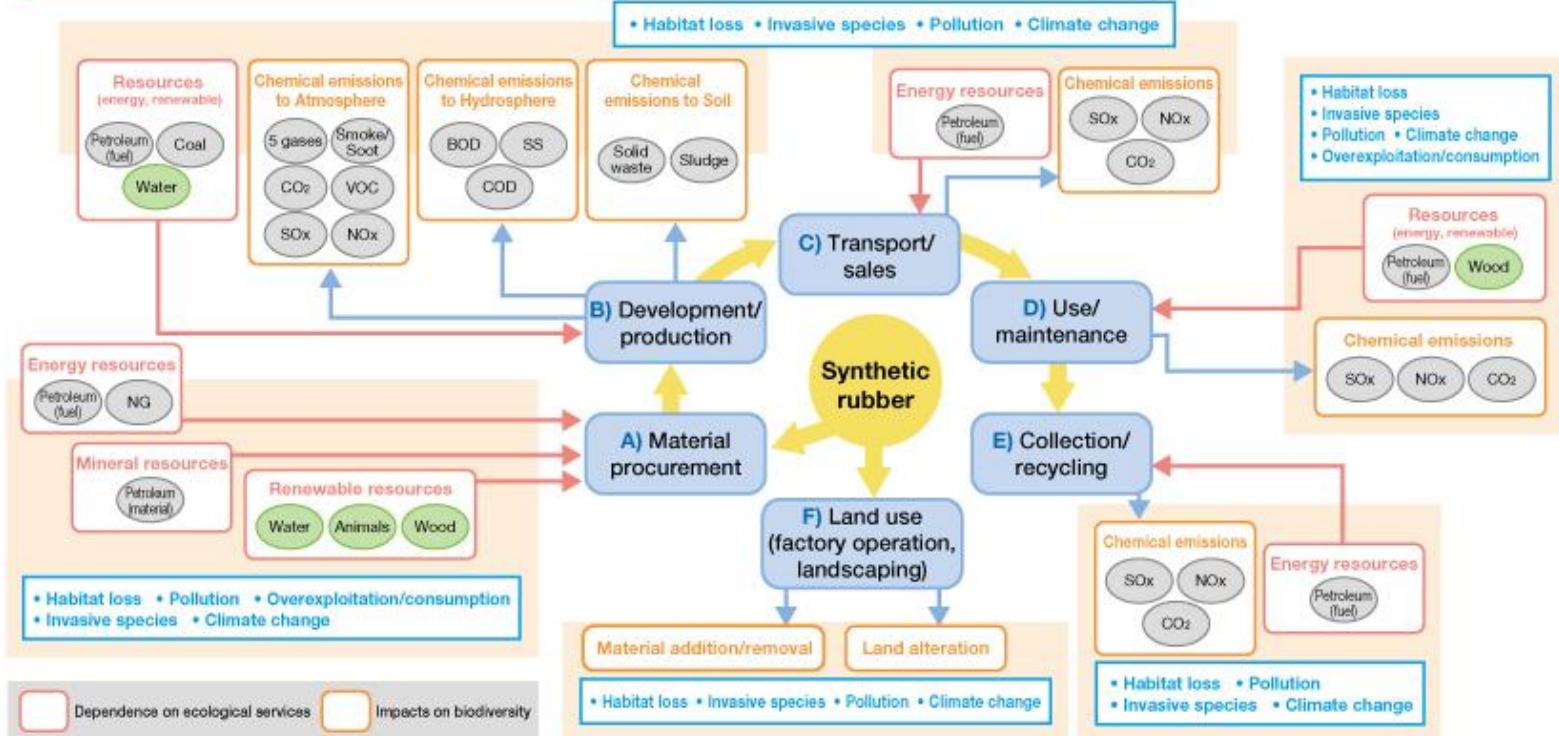
# Section 6.2: Perform Quality Assurance

## 7

## Interrelationship diagrams

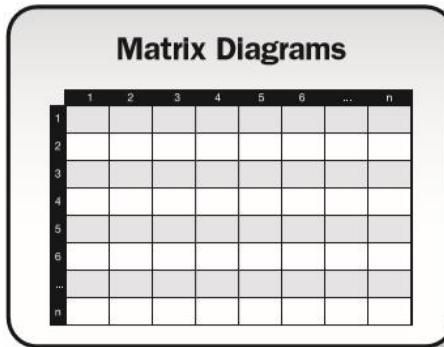
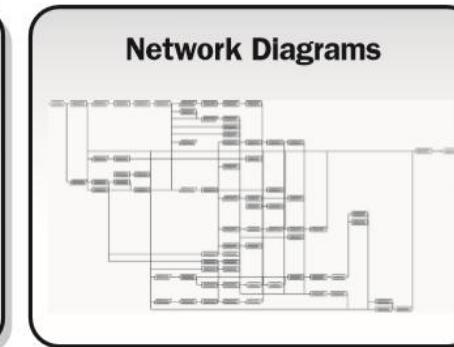
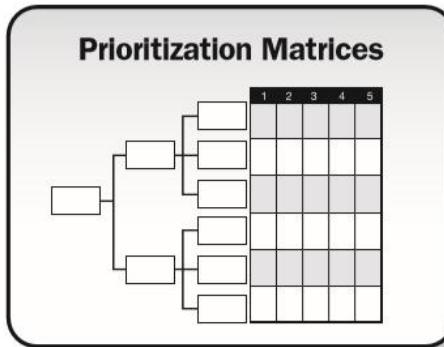
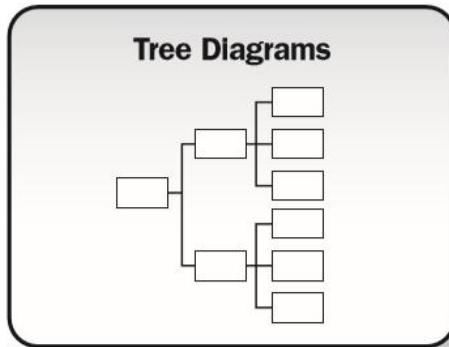
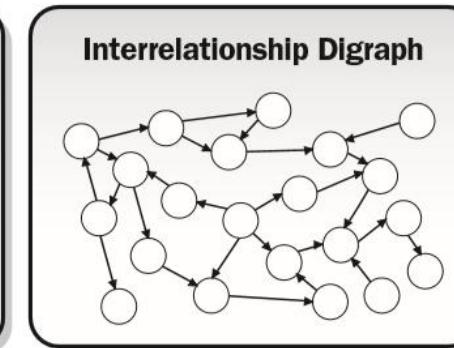
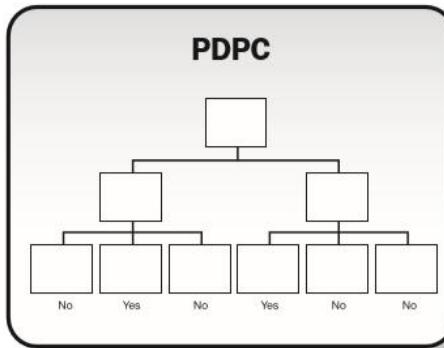
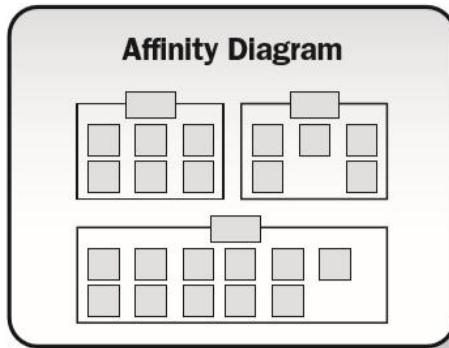
An adaptation of relationship diagrams. The interrelationship digraphs provide a process for creative problem solving in moderately complex scenarios that possess intertwined logical relationships for up to 50 relevant items.

**Business & Biodiversity Interrelationship Map: Synthetic Rubber's Dependency and Impacts on Ecosystems**



\* Based on a "Map of Corporate Activities and Biodiversity," a product of research by the JBIB

# Section 6.2: Perform Quality Assurance



# Chapter 6 Quality Management

1

Plan Quality Management

2

Perform Quality Assurance

3

Control Quality

# Section 6.3: Control Quality

## **Control Quality**

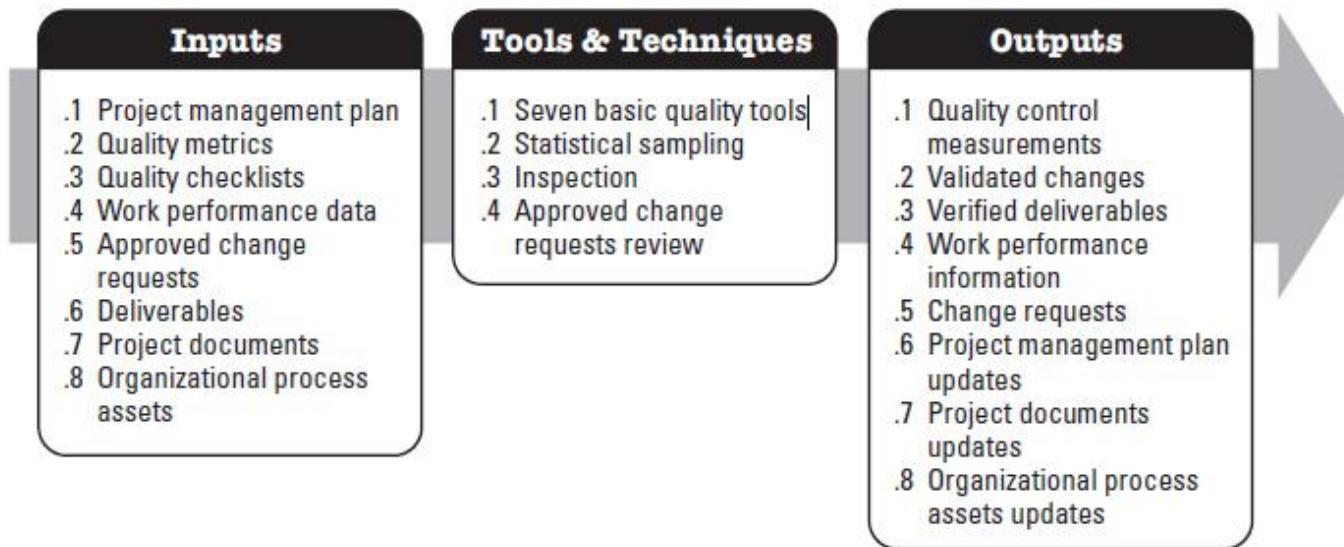
The process of **monitoring** and **recording results** of executing the quality activities to **assess** performance and recommend necessary changes.

The key benefit of this process include:

- (1) **Identifying the causes of poor process or product quality** and recommending and/or **taking action to eliminate them**
- (2) **Validating that project deliverables and work meet the requirements** specified by key stakeholders necessary for final acceptance

Uses a set of operational techniques and tasks to verify that the delivered output will meet the requirements

# Section 6.3: Control Quality



1. Seven basic quality tools

1. Verified deliverables

# Section 3.5 Validate Scope

Validate Scope process

primarily concerned with  
acceptance of the deliverables

Control Quality process

primarily concerned with correctness of  
the deliverables and meeting the quality  
requirements specified for the deliverables.

Control Quality is generally performed before validate scope, although the two processes may be performed in parallel

# Section 6.3: Control Quality

## Control Quality

VS

## Quality Assurance

CQ should be used during the project **executing** and **closing** phases to formally demonstrate, with reliable data, that the sponsor and/or customer's acceptance criteria **have been met**.

QA should be used during the project's **planning** and **executing** phases to provide confidence that the stakeholder's requirements **will be met**

# Test

1. You use a Pareto chart to figure out which root causes are responsible for the most defects in the current batch of products. It looks like most of them are coming from a Machine Calibration problem. So you **run them back through the machine after re-calibrating it.**

Perform Quality Control

Perform Quality Assurance

2. You use a histogram to look at the root cause category for all defects that have been found **over the past year**. You find that Machine errors are habitually responsible for the largest number of errors across all batches of products. You schedule Machine calibration checks **at the start of every shift** to be sure that the machine is always set properly.

Perform Quality Control

Perform Quality Assurance

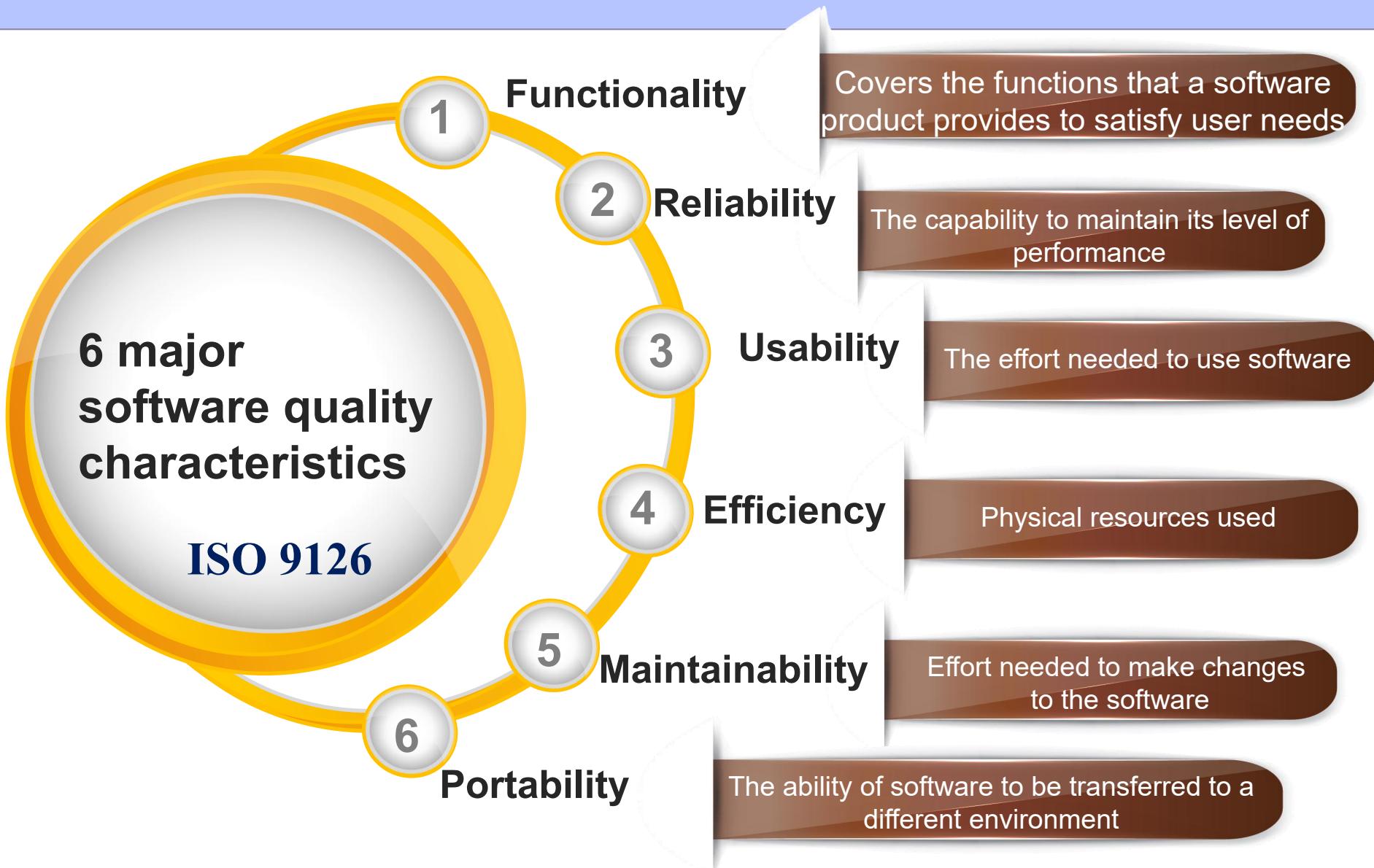
# Software quality management

## What is Software quality

The degree that the software meets the explicit or implicit requirements.

- ◆ User requirements are the basis for measuring software quality
- ◆ In addition to meet the needs with a clear definition. It also should meet the implicit needs.

# Software quality management



# Software quality management

ISO 9126 provides guidelines for the use of the quality characteristics.

Once the requirements for the software product have been established, the following steps are suggested:

1. Judge the importance of each quality characteristic for the application
2. Select the external quality measurements within the ISO 9126 framework
3. Map measurements onto ratings that reflect user satisfaction
4. Identify the relevant internal measurements and the intermediate products in which they appear
5. Overall assessment of product quality

# Software quality management

## Mapping measurements to user satisfaction

Response time (seconds)	Rating
<2	Exceeds expectation
2-5	Within the target range
6-10	Minimally acceptable
>10	unacceptable

Response time (seconds)	Quality score
<2	5
3-4	4
5-6	3
7-8	2
>9	1

# Chapter 6 Summary

A

Understand the concept of Quality Management and  
Plan quality management

B

Mastering the seven quality tools

C

Understanding the difference between QA and QC

D

Understanding software quality

# Summary

## 5 process groups

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work	4.6 Close Project or Phase

It works to ensure that the project requirements, including product requirements, are met and validated.

		6.4 Estimate Activity Resources 6.5 Estimate Activity Durations 6.6 Develop Schedule			
7. Project Cost Management		7.4 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
9. Project Human Resource Management		9.1 Plan Human Resource Management	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Control Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Engagement	

## 5. Quality Management

1. Plan Quality Management
2. Perform Quality Assurance
3. Control Quality

10  
knowledge  
areas

# Summary

## 5 Process Groups

It provides guidance and direction on how quality will be managed and validated throughout the project.

G

CONTROLLING

CLOSING

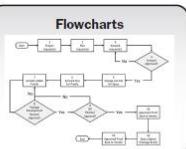
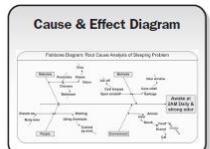
### 1. Plan Quality Management

### 2. Perform Quality Assurance

### 3. Control Quality

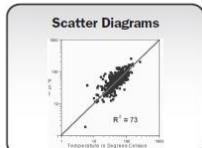
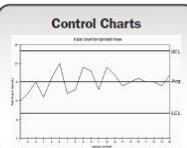
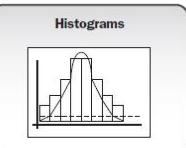
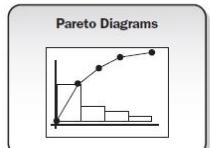
T&amp;T:

1. Cost of Quality (COQ)
2. Seven basic quality tools



A Checksheet template with columns for Category, Strokes, and Frequency, listing attributes A through n.

Category	Strokes	Frequency
Attribute 1		
Attribute 2		
Attribute n		

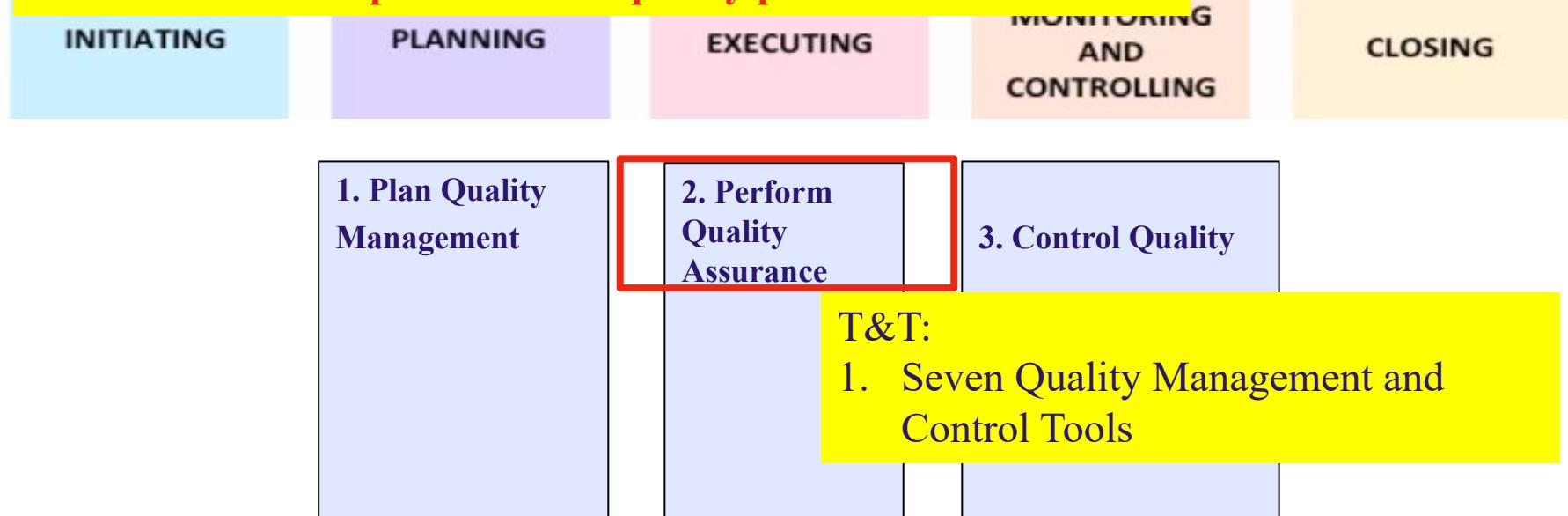


Quality Management processes

# Summary

## 5 Process Groups

It facilitates the improvement of quality processes.



## 3 Quality Management processes

# Summary

## 5 Process Groups

It uses a set of operational techniques and tasks to verify that the delivered output will meet the requirements

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CONTROLLING

CLOSING

1. Plan Quality Management

2. Perform Quality Assurance

3. Control Quality

T&T:

1. Seven basic quality tools

## 3 Quality Management processes

QA vs. QC

Validate scope vs. control quality