Chapter 6 : Project Quality Management

1. Quality Concepts
2. Quality Tools
3. Quality Planning, Quality Assurance & Quality Control

Project Quality Management

- **Project quality management** is all of the processes and activities needed to determine and achieve project quality.

- ***But what does "quality" really mean?***

At its most basic level, **quality means meeting the needs of customers.** This is also known as « fit for use »
This occurs as a result of four activities:

- Understanding customer requirements.
- Designing products and services that satisfy those requirements.
- Developing processes that are capable of producing those products and services.
- Controlling and managing those processes so they consistently deliver to their capabilities

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6.1 - Project Quality Concepts

- **Customers Satisfaction**
  Each company, each organization, … depend on Customers so :
  - Need to ***understand customers requirements*** by evaluating and defining customers expectations
  - ***Meet customers requirements*** by managing their expectations
  - Try ***to exceed customers expectations***

- **Prevention versus Inspection :** Preventing errors in a process is typically less expensive than fixing / correcting them when they are found by inspection or by usage.

  ↳The **Cost of Quality (COQ)** includes money spent during the project to avoid failures and money spent during and after the project because of failures. These are known as the **Cost of Conformance** and the **Cost of Nonconformance**
  → **Preventing errors is typically less expensive than fixing them by inspection**

6.1 - Project Quality Concepts

- **Cost of Quality (COQ)**

Cost of Conformance	Cost of Nonconformance
•**Prevention Costs:** *Ex :* *New product review, quality planning, supplier surveys, process reviews, quality improvement teams, education and training*	• **Internal Failure Costs** *Ex :* *Example: Scrap, rework, re-inspection, re-testing,…*
•**Inspection (appraisal) Costs :** *Ex :* *New Inspection, testing, process or service audits, calibration of measuring and test equipment.*	•**External Failure Costs** *Ex :* *Processing customer complaints, customer returns, warranty claims, product recalls.*

Cost incurred **to prevent** (keep failure and appraisal cost to a minimum) **poor quality**.

Cost incurred to **determine the degree of conformance to quality requirements** (measuring, evaluating or auditing)

Cost associated to defect found **before the customer receives the product or service**.

Cost associated to defect found **after the customer receives the product or service**.

6.1 - Project Quality Concepts

- **Continuous Improvement**

  Continuous improvement is a concept that exists in all of the major quality management approaches such as **PDCA Cycle or simply Deming Cycle , Six Sigma & Lean Six Sigma, Total Quality Management (TQM) but also CMMI**.

  In fact, it is a key aspect of the last concept, *prevention over inspection*.

  → Continuous improvement is simply the ongoing effort to improve your products, services, or processes over time. These improvements can be small, incremental changes or major type changes.

  → **From a project perspective, this concept can be applied by analyzing the issues that were encountered during the project for any lessons learned that you can apply to future projects. The goal is to avoid repeating the same issues in other projects.**

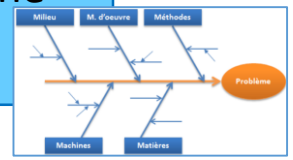
6.1 - Project Quality Concepts

- **Continuous Improvement : W.Edwards Deming :**
  - Pioneer of the quality management approach and for introducing statistical process control techniques for manufacturing to the Japanese Companies.
  - He provided a simple yet highly effective technique that serves as a practical tool to carry out continuous improvement in the workplace. This technique is called **PDCA Cycle or simply Deming Cycle**.

  → **PDCA** is acronym of **Plan, Do, Check and Action**.

The ACT stage focuses on implementing the process within the organization or with its customers and suppliers

PLAN stage involves analyzing the current situation, gathering data, real causes and define corrective actions



The four steps Plan, Do, Check and Action should be repeated over time to ensure continuous learning and improvements in a function, product or process.

The CHECK stage requires determining whether the trial process is working as intended, whether any revisions are needed, or whether is should be scrapped.

ge involves testing tives experimentally establishing a pilot process, or trying it out with small number of customers

5-G Method

6.1 - Project Quality Concepts

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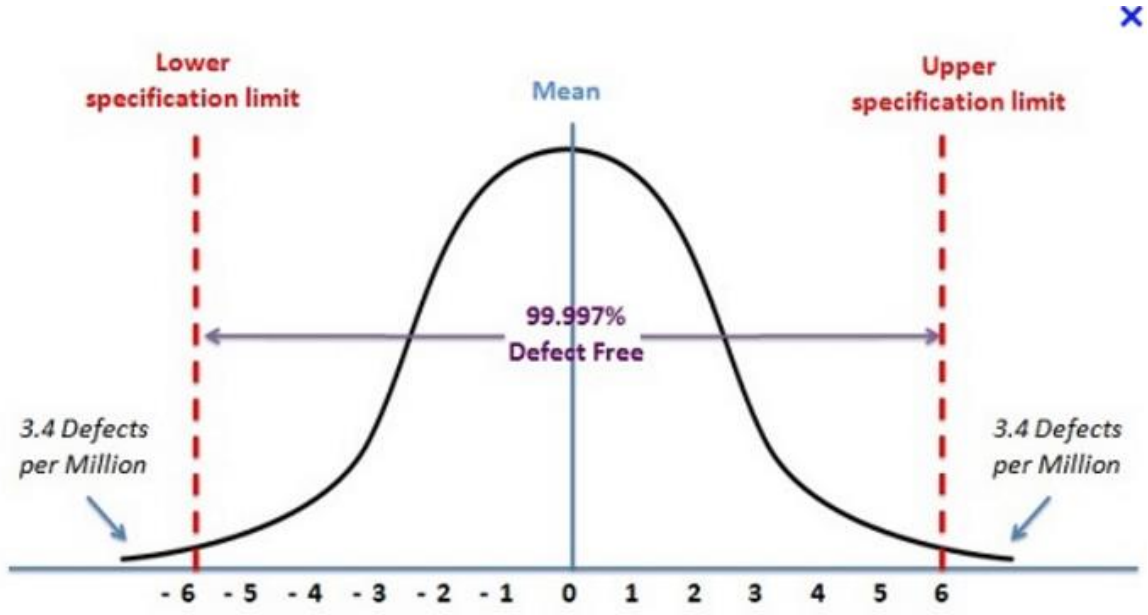
5G (Gemba, Gembutsu, Genjitsu, Genri, Gensoku)

- Les 5G sont 5 étapes fondamentales à accomplir l'une après l'autre, afin de résoudre efficacement un problème posé.
  C'est une méthode japonaise de résolution des problèmes dont le but est essentiellement basé sur l'arbitrage du conflit entre :
  - la théorie (les concepts)
  - la pratique (la réalité) ce que nous voulons faire et ce qui peut être effectivement fait

6.2 - Project Quality Concepts

- **Continuous Improvement : Six Sigma** :
  - Six Sigma began in 1986 as a statistically-based method to reduce variation in electronic manufacturing processes in Motorola Inc in the USA.
  - Six Sigma is a quality Management model that incorporates a strategy using statistical tools within a structured methodology to gain the knowledges to deliver products and services better, faster and less expensive.
  - The objective of Six Sigma quality is to reduce process output variation so this will result in **no more than 3.4 defect parts per million (PPM) opportunities (or 3.4 defects per million opportunities – DPMO).**
  - **Six Sigma represents six standard deviations from mother mean to the upper and lower specification limits**



6.2 - Project Quality Concepts

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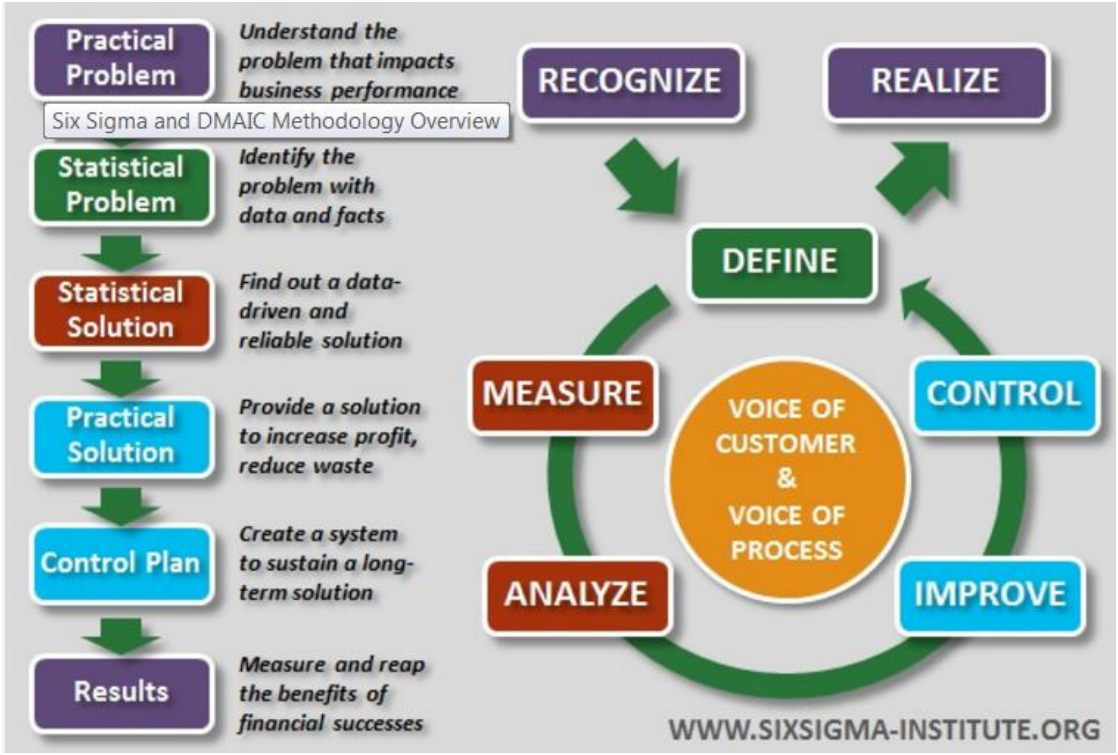
- **Continuous Improvement : Six Sigma**
  - The Six Sigma approach is built around the **DMAIC process** :

- Define the problem, improvement activity, opportunity for improvement, the project goals, and customer (internal and external) requirements,
- **Measure** process performance,
- **Analyze** the process to determine root causes of variation, poor performance (defects),
- Improve process performance by addressing and eliminating the root causes.
- **Control** the improved process and future process performance.



6.2 - Project Quality Concepts

- **Continuous Improvement : Total Quality Management (TQM) from Dr Armand Feigenbaum**
  - **Total Quality Management** TQM, also known as total productive maintenance, describes a management approach to long-term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work.

  - **6 Cs approach :**

    1. **Commitment** from ALL Employees → There must be a quality improvement commitment from all employees of the organization.
    2 **.** Quality Improvement **Culture** → Organization must follow a modern quality improvement culture on a constant basis.
    3. **Continuous** Improvement in Process → Continuous improvement must take place in all policies, procedures, and activities laid down by management for the organization.
    4. **Cooperation** from Employees → Cooperation and experience of employees must be utilized to improve strategies and enhance performance.
    5. Focus on **Customer** Requirements → Focus on customers' requirements and satisfaction of their expectations are very important for long-term survival of the business.
    6. Effective **Control** shall be laid down → Effective controls must be laid down to monitor and measure the real performance of the business.

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6.2 - Project Quality Concepts

- **Continuous Improvement :**
  - **The Andon** cable is part of the **Jidoka production system -** read about Jidoka here.
  - Every Toyota member is viewed as an expert in their field and each and every one is permitted to stop the production line if they spot something they perceive to be a threat to vehicle quality – and they do so by using the Andon cable.

    Andon (English: 'Sign' or 'Signal'): A visual aid that highlights where action is required. It is a typical tool in applying the Jidoka, or 'autonomation', principle, which means highlighting a problem as it occurs in order to immediately countermeasure the issue and prevent re-occurrence

    Originating from the word for a paper lantern, Andon is a term that refers to an illuminated signal notifying others of a problem within the quality-control or production streams.

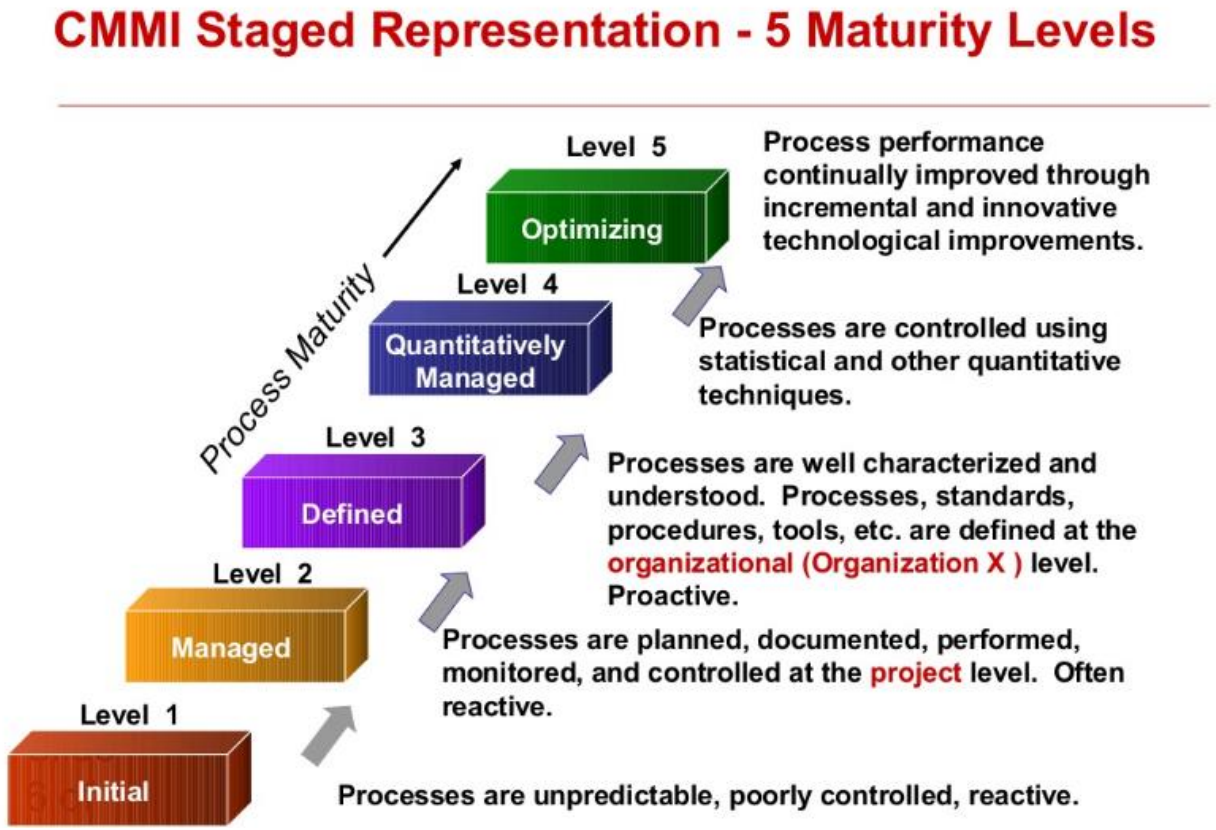
    Activation of the alert – usually by a pull-chord or button – automatically halts production so that a solution can be found. The warning lights are incorporated into an easily visible, overhead signboard (or Kanban), which also identifies the area or specific workstation that has the problem. The frequency and nature of these occasional issues are analyzed as part of Toyota's program of continual improvement (Kaizen).

    https://www.youtube.com/watch?v=r_-Pw49ecEU

6.2 - Project Quality Concepts

- **Continuous Improvement :**

  - **The Capability Maturity Model Integration (CMMI®)** is a capability improvement model that can be adapted to solve *any* performance issue at *any* level of the organization in *any* industry.
  - CMMI uses 5 levels to describe the maturity of the organization
  - CMMI describes the key elements of an effective Software process



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6.1 - Project Quality Concepts

- **Main Quality Movements / Major Contributors** :

Contributors	Principles
W.E Deming (1900-1993)	▪ **PDCA Cycle** ▪ Statistics and sampling ▪ **Rule of 85 : 85% of the cost of quality is the responsibility of management** ▪ Continuous improvement
Joseph M.Juran (1904-2008)	▪ **"Quality is free"** **Pareto Principle *(80/20 Rule)* : 80% of a problem is caused by 20% of the causes** *(or some other principles as : 80% of our complaints come from 20% of our customers. 80% of our quality issues occur with 20% of our products)* ▪ Adds the human dimension to quality management. He pushed for the education and training of managers. For Juran, human relations problems and resistance to change were the root cause of quality issues ▪ Juran's trilogy is composed of three managerial processes: quality planning, quality control, and quality improvement. Without change, there will be a constant waste, during change there will be increased costs, but after the improvement, margins will be higher and the increased costs get recouped.
Philip B.Crosby (1926-2001)	▪ His principle : "**Doing It Right the First Time**" ▪ **Crosby's Zero Defects is** a performance method and standard that states that people should commit themselves to closely monitoring details and avoid errors. By doing this, they move closer to the zero defects goal.

6.1 - Project Quality Concepts

- **Main Quality Movements / Major Contributors** :

Contributors	Principles
Dr Genichi Taguchi (1924-2012)	▪ **Statistical methods**, or sometimes called robust design methods ▪ Improvement of product quality at the design stage by integrating quality control into product design, using experiment and statistical analysis (Design of Experiments).
Dr Kaoru Ishikawa (1915-1989)	▪ **Cause and effect diagram** (also called the "Ishikawa" or "fishbone" diagram) ▪ Common uses of the Ishikawa diagram are product design and quality defect prevention to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify these sources of variation.
Dr Armand Feigenbaum (1922-2014)	▪ **Total Quality Management (TQM).**

Chapter 6 : Project Quality Management

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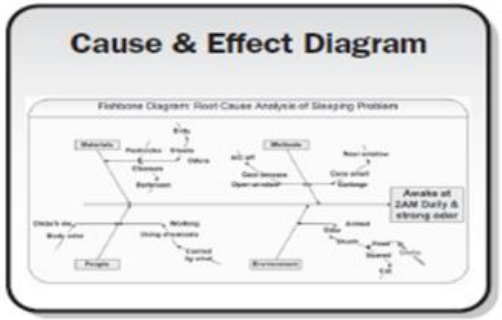
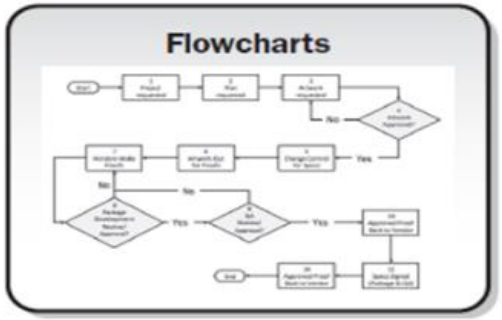
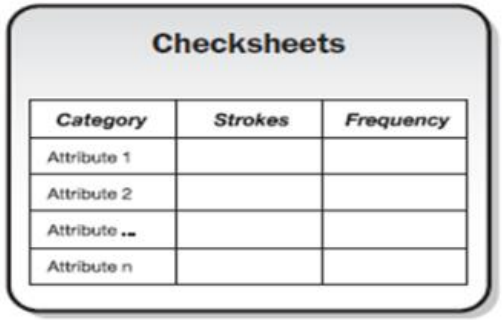
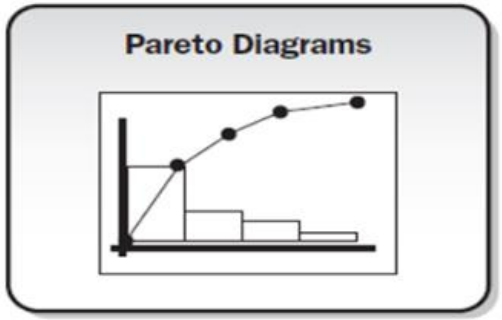
6.2 - Quality Tools

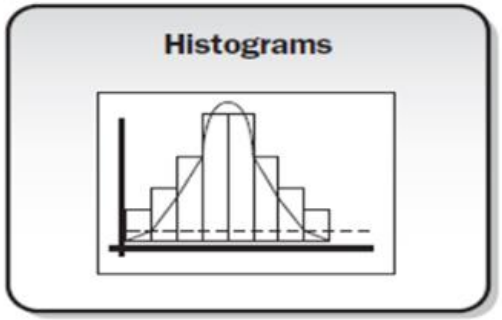
- **Seven Basic Quality Tools** : also call in the industry as 7QC tools.

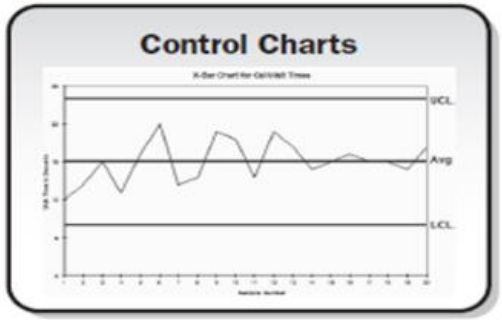


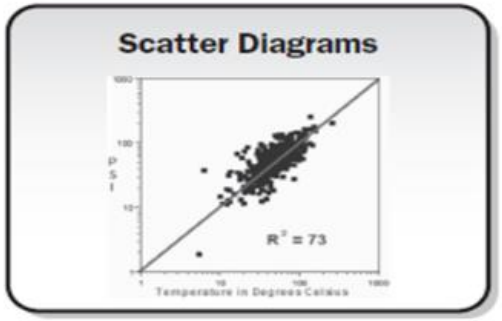








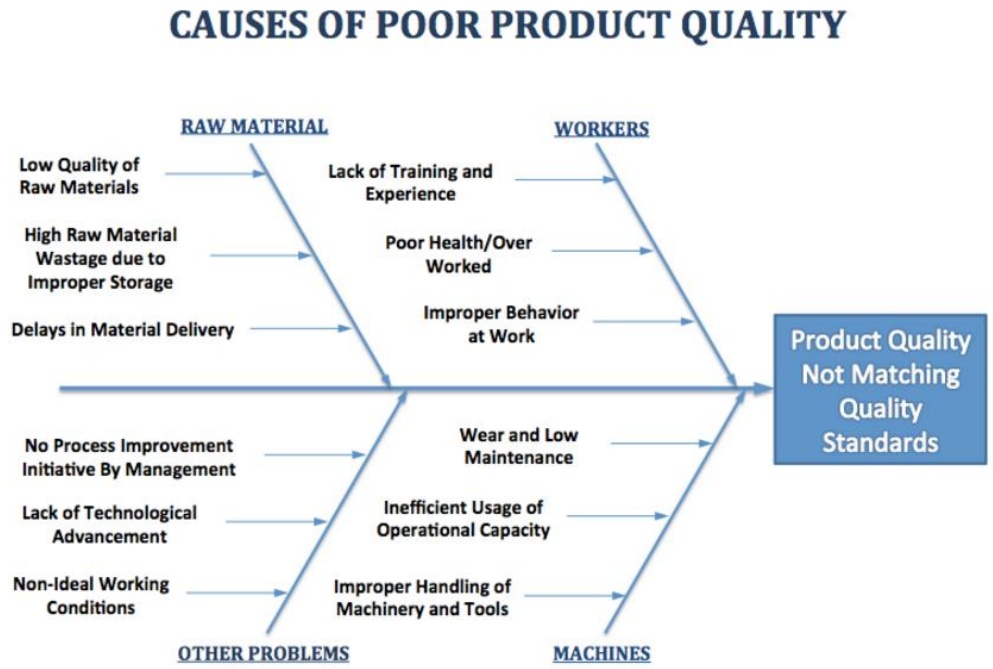




6.2 - Quality Tools

- **Seven Basic Quality Tools** :
  - **Cause and effect diagram or also called Ishikawa diagram or Fishbone diagram :** Used to identify the root causes or contributors to a problem, error, or defect.
    → The problem statement is the effect and the possible contributing factors are the causes.

    → There are four steps to using the tool.
    - Identify the problem
    - Work out the major factors involved.
    - Identify possible causes.
    - Analyze your diagram.



6.2 - Quality Tools

- **Seven Basic Quality Tools** :
  - **Cause and effect diagram or also called Ishikawa diagram or Fishbone diagram :**

→ This tool is most effective when used in a team or group setting.

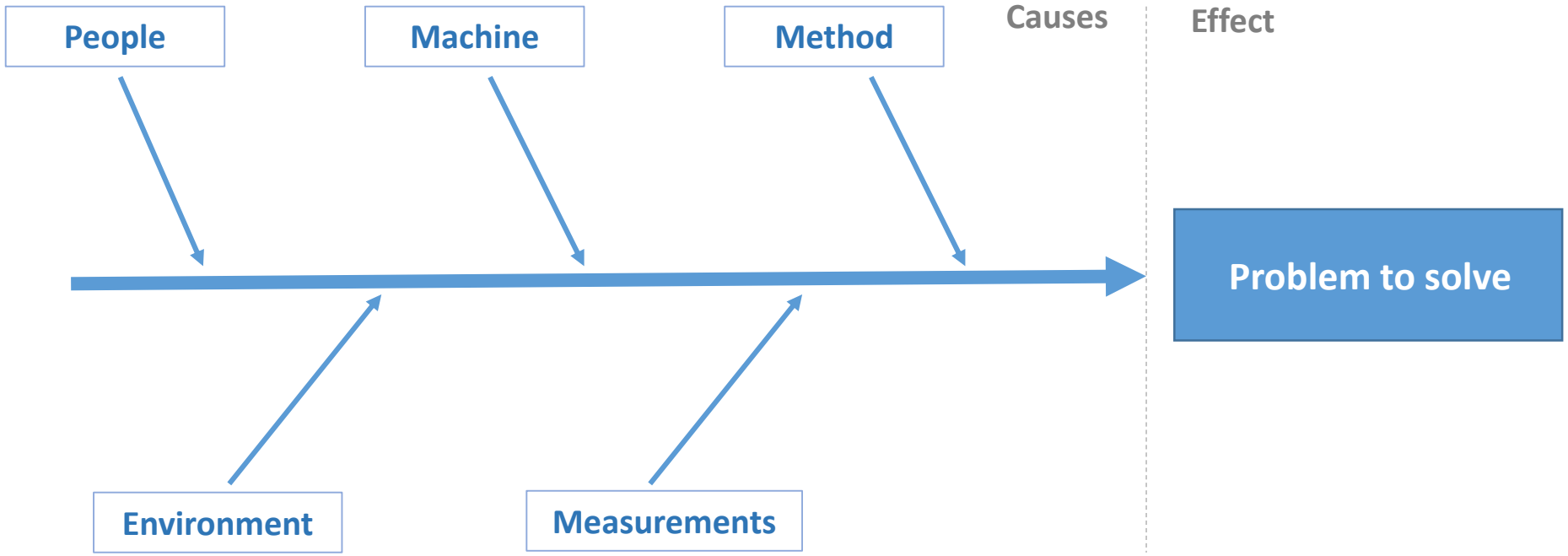
Steps :
1 - To create a Fishbone Diagram, you can use any of a variety of materials. In a group setting you can use a white board or a flip chart to get started… You may also want to use “PostIt” notes to list possible causes but have the ability to re-arrange the notes as the diagram develops.

2 - Write the problem to be solved (the EFFECT) as descriptively as possible on one side of the work space, then draw the "backbone of the fish", as shown below.

6.2 - Quality Tools

- **Seven Basic Quality Tools** :
  - **Cause and effect diagram or also called Ishikawa diagram or Fishbone diagram :**

Steps :
3 - The next step is to decide how to categorize the causes. There are **two basic methods: A) by function, or B) by process sequence.** The most frequent approach is to categorize by function. In manufacturing settings the categories are often: Machine, Method, Materials, Measurement, People, and Environment. In service settings, Machine and Method are often replaced by Policies (high level decision rules), and Procedures (specific tasks).



6.2 - Quality Tools

- **Seven Basic Quality Tools** :
  - **Cause and effect diagram or also called Ishikawa diagram or Fishbone diagram :**

Steps :
3 - There are usually many contributors to a problem, so an effective Fishbone Diagram will have many potential causes listed in categories and sub-categories. The detailed sub-categories can be generated from either or both of two sources:

- Brainstorming by group/team members based on prior experiences.
- Data collected from check sheets or other sources.

A closely related Cause & Effect analytical tool is **the "5-Why" approach**, which states: **"Discovery of the true root cause requires answering the question 'Why?' at least 5 times".**
The 5 Whys is a technique used in the Analyze phase of the **Six Sigma DMAIC** (Define, Measure, Analyze, Improve, Control) methodology.

Sakichi Toyoda, one of the fathers of the Japanese industrial revolution, developed the technique in the 1930s. He was an industrialist, inventor and founder of Toyota Industries. His method became popular in the 1970s, and Toyota still uses it to solve problems today.

For your information only

6.2 - Quality Tools

- **Seven Basic Quality Tools** :

Example of 5 Why's Analysis

Problem Statement: The pizza delivery personnel's motorbike stopped while on his way to deliver several orders of pizza resulting to delay
Cost Impact: All delayed pizza were given free of charge to the customers amounting to a total of Php4,000.00

Why 1: Why did the motorbike stopped?
Answer 1: Because it ran out of gas while on its way to deliver pizzas

Why 2: Why did then gas run out?
Answer 2: Because the delivery personnel did not gas up the motorbike that morning

Why 3: Why didn't the personnel gas up the motorbike that morning?
Answer 3: Because the personnel did not have money to buy the gas

Why 4: Why did the personnel not have money to buy the gas?
Answer 4: Because he was not able to ask money from his manager

Why 5: Why was he not able to ask money from his manager?
Answer 5: Because he came in late and was not able to find the manager

Solution: The pizza delivery personnel should come to the office on time or earlier to find the manager and ask for gas money before the deliveries.

6.2 - Quality Tools

- **Seven Basic Quality Tools** :
  - **Cause and effect diagram or also called Ishikawa diagram or Fishbone diagram :**

    4 – **Analyze your diagram :**
    By this stage you should have a diagram showing all of the possible causes of the problem that you can think of.

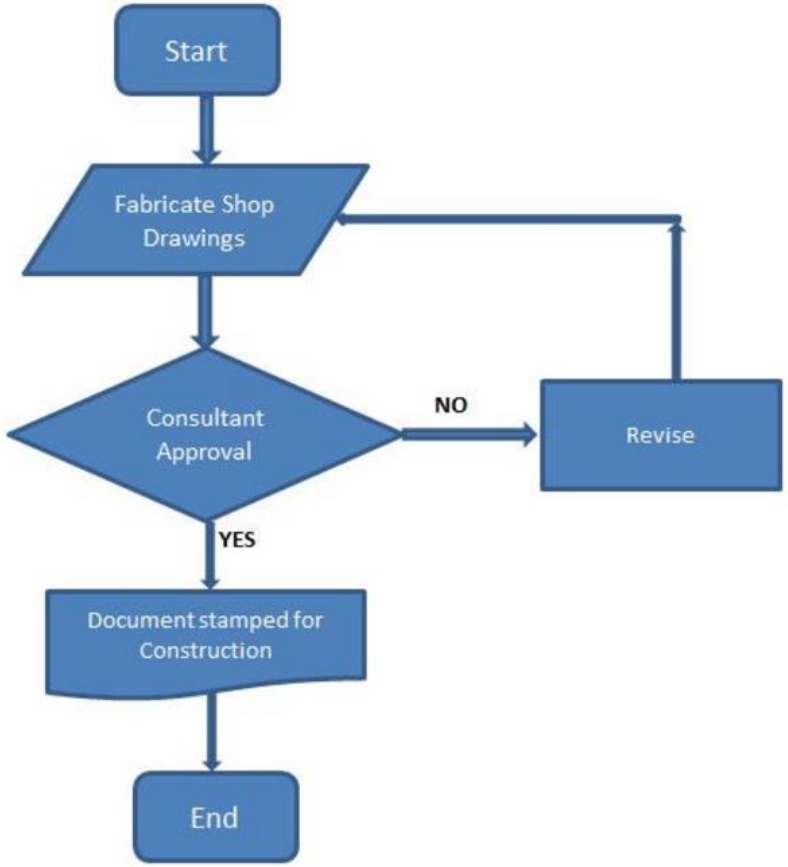
    Depending on the complexity and importance of the problem, you can now investigate the most likely causes further. This may involve setting up investigations, carrying out surveys, and so on. These will be designed to test which of these possible causes is actually contributing to the problem.

6.2 - Quality Tools

- **Seven Basic Quality Tools** :

  - **Flow chart :** it helps to see the relationship between the process steps.
    → You can use this information to optimize the process and to see where problems and defects can occur.
    → Flowcharts are useful in process improvement projects or to document any process.

    Example : Flowchart for a process of drawing's distribution.



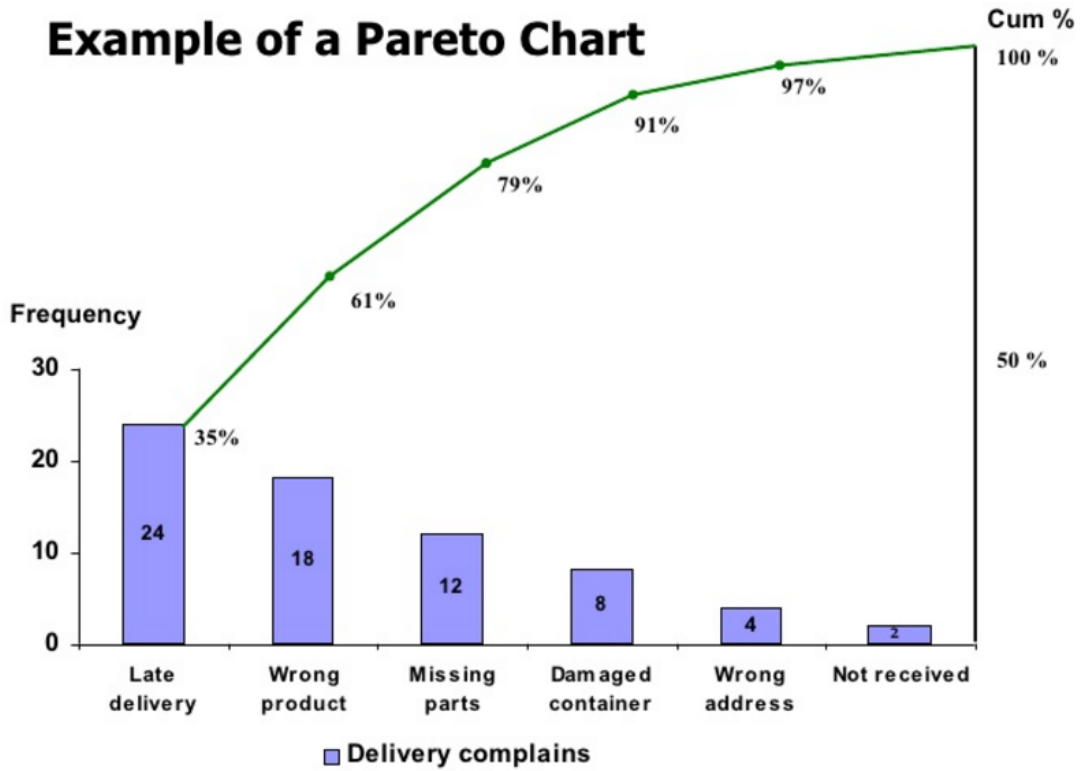
6.2 - Quality Tools

- **Seven Basic Quality Tools** :
  - **Control Chart :** Used to determine whether a process is stable and predictable. The planned value of a process is the centerline. For many processes, the upper and lower control limits are +/–3 standard deviations from the plan, or the mean, depending on the circumstances. The upper and lower specification limits are the limits specified in the quality requirements.

    → If a measurement is getting close to the control limit, you should take action to get it back toward the midline.

6.2 - Quality Tools

- **Seven Basic Quality Tools** :
  - **Pareto Diagram :** Vertical bar chart that creates a graphic display of events (such as causes of defects or types of defects) in descending order. The objective is to rank problems based on the frequency of occurrence to determine the order in which to resolve them.



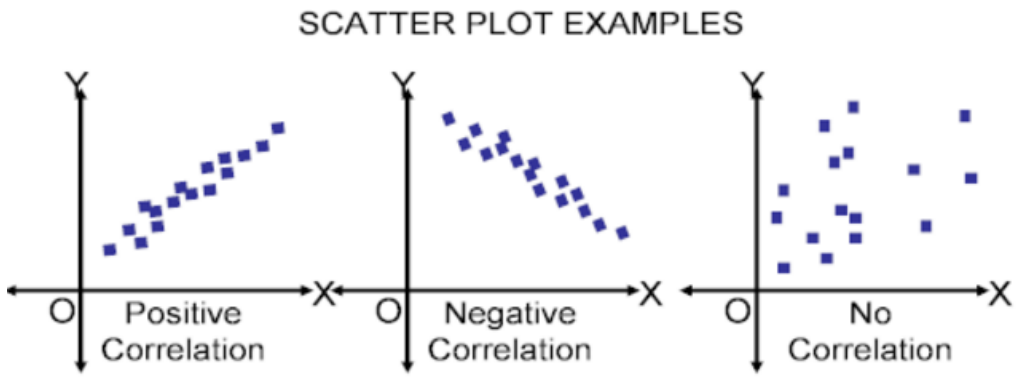
6.2 - Quality Tools

- **Seven Basic Quality Tools** :

  - **Histogram :** A vertical bar chart (like the Pareto diagram), but a histogram is arranged to show the shape of distribution of an event. It can show the spread of results *(dispersion)* and the median (or mean or mode).

  - **Checksheet :** Used to ensure that a series of steps are followed consistently.
    Checksheets (or tally sheet) can be also used to organize data around a quality problem. For example, you can tally the number of times that a specific cause is the source of a defect, and then use that when creating a histogram or Pareto chart to prioritize quality problems.

  - **Scatter Diagrams or Scatter Plot correlation :**
    An X,Y matrix that plots the relationship between two variables to determine whether a relationship exists



6.2 - Quality Tools

- **Quality Tools** : In addition of the 7 Basic Tools – **8D Report**

  - **Eight Disciplines (8Ds) Problem Solving** is a method adapted by **Ford Motor Company used to approach and to resolve problems,** typically employed by engineers or other professionals.

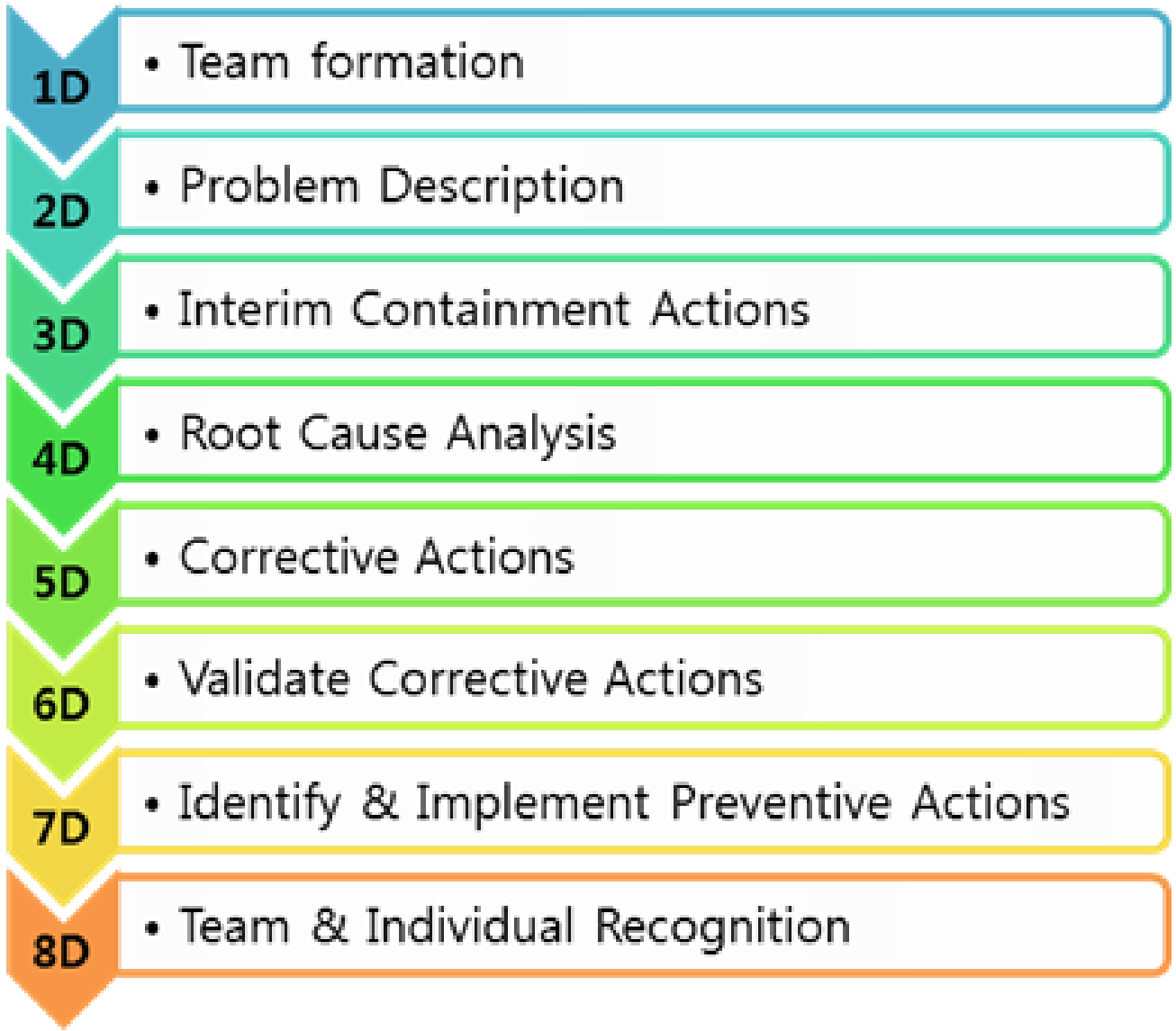
    It is a methodology that emphasizes “No problem should be repeated but fixed permanently”.

  - Focused on product and process improvement, its purpose is to identify, correct, and eliminate recurring problems.
  - It establishes a **permanent corrective action** based on statistical analysis of the problem and on the origin of the problem by determining the root causes.
  - Although it originally comprised eight stages, or 'disciplines', it was later augmented by an initial planning stage (D0).

  - 8D follows the **logic of the PDCA cycle**.

6.2 - Quality Tools

- **Quality Tools** : In addition of the 7 Basic Tools – **8D Report**
  - The disciplines are:



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6.3 - Quality Assurance & Quality Control

Quality Planning

- Identify **which quality standard are relevant to the project and documenting HOW to satisfy them**

Quality plan that describes the processes and metrics that will be used

TOOLS & TECHNIQUES

- ❑ **Cost of Quality**
- ❑ **Seven basic quality tools**
- ❑ **Other Quality Planning Tools**

Quality Assurance

- Auditing the Quality results to **ensure that appropriate quality standards / processes / Procedures are used**

Management Aspect : How to perform

- ❑ **Process checklists**
- ❑ **Project audits (internal / external / customers) as ISO9001**

Quality Control

- Monitoring and recording results **to determine if they comply with relevant quality standards**

Technical Aspect : Is the outcome acceptable?

- ❑ **Seven basic quality tools**
- ❑ **Statistical Sampling**
- ❑ **Inspection**

Annex : ISO9001 Introduction

ISO9001 Introduction

For your information only

What is ISO 9001?

- *ISO for "International Organisation for Standardisation"*
- Internationally agreed business management model
- Model for quality management and continuous improvement of the organization

Why ISO 9001?

- To give our customers a level of confidence that the organisation is able to fulfil the customer requirements within the business constraints
  - Internal and external reference to all staff and to customers
  - Defining organization, roles and processes necessary to manage, control and improve the business

→ **To improve the competitive strength in the market**

To achieve ISO 9001 certification, companies must:

- Meet their customer's quality requirements
- Apply all relevant regulatory requirements
- Enhance customer satisfaction
- Ensure continuous improvements in line with these objectives

Changes to the Quality Standard ISO9001

For your information only

- ISO9001:2008 had a major revision and is now ISO9001:2015. This standard allows:
  - to better align with business strategic direction,
  - become more compatible with other management system standards,
  - Incorporate the Plan-Do-Check-Act approach.
  - Risk based thinking.

- Goal of the standard is a quality management system that:
  - provides for continual improvement,
  - emphasizes defect prevention,
  - Reduces of variation and waste in the supply chain.
  - Improves the organization’s performance

  - ISO9001-2015 : Standard / Presentation

Quality – Summary