UNIT -1

SIX SIGMA PRINCIPLES

Cost of Poor Quality (COPQ):

Cost of Poor Quality (COPQ) refers to the costs that an organization incurs due to the failure to deliver products or services that meet quality standards. COPQ is used to highlight the financial impact of inefficiencies, defects, or non-conformance in processes, products, or services. By measuring COPQ, organizations can identify areas of improvement, justify investments in quality initiatives, and quantify the benefits of reducing defects.

Breakdown of COPQ:

COPQ is typically divided into **four categories**: **Prevention Costs**, **Appraisal Costs**, **Internal Failure Costs**, and **External Failure Costs**. These categories help organizations identify where quality-related expenses are occurring.

*1. Prevention Costs **(Proactive Costs)***

These are the costs associated with activities designed to **prevent defects** before they occur. Investing in prevention reduces the likelihood of failures and defects in the first place.

Examples:

- **Training and development**: Teaching employees about quality standards, best practices, and continuous improvement methods.
- **Process improvement initiatives**: Activities like Kaizen, Six Sigma, or Lean programs to improve the design or manufacturing processes.
- **Quality planning**: Developing plans and strategies to ensure quality standards are met.
- **Supplier evaluation and certification**: Ensuring that suppliers meet quality standards to reduce the risk of defects from external sources.
- **Preventive maintenance**: Regularly maintaining machinery and equipment to avoid breakdowns.

Goal: To **reduce the likelihood of defects**, which, in turn, reduces the costs associated with defects (internal and external).

2. Appraisal Costs (Measurement and Detection Costs)

These are the costs related to **measuring and monitoring** quality to detect defects or issues before they reach the customer. Appraisal costs involve assessing whether products or services meet quality standards.

Examples:

- **Inspection and testing**: Quality control inspections, product testing, and final product checks.
- **Audits**: Internal and external audits of processes to ensure adherence to quality standards.
- **Measurement equipment**: Purchase and maintenance of tools and equipment used to measure product quality.
- **Quality assurance systems**: Systems to track and report on product quality.

Goal: To **detect defects early** in the process, ideally before the product reaches customers, to prevent internal failure costs.

3. Internal Failure Costs (Costs of Defects Found Before Delivery)

These are the costs incurred when defects are identified **before the product or service reaches the customer**. Internal failure costs reflect the inefficiencies and losses resulting from defects that are caught early in the process.

Examples:

- **Rework**: The cost of correcting defective products or processes before they are delivered to the customer.
- **Scrap**: Costs associated with materials or products that cannot be salvaged and must be discarded due to defects.
- **Downtime**: Lost productivity or delays caused by defective processes or the need to address quality issues internally.
- **Retesting**: The costs of re-inspecting or re-testing defective products to ensure they meet quality standards after rework.

Goal: To **minimize internal failure costs** by preventing defects through proactive quality measures.

4. External Failure Costs (Costs of Defects Found After Delivery)

These are the most expensive costs because they occur when defects **reach the customer**. External failure costs can significantly harm an organization's reputation and customer satisfaction, leading to financial losses and decreased brand loyalty.

Examples:

- **Product recalls**: The cost of retrieving defective products from customers.
- **Warranty claims**: Costs incurred when customers request repairs, replacements, or refunds for defective products.
- **Customer complaints**: Time and resources spent dealing with customer complaints related to quality issues.

- **Loss of business**: The potential loss of future sales or customers due to dissatisfaction with product or service quality.
- **Legal costs**: Expenses incurred from lawsuits or legal actions related to defective products or services.

Goal: To **minimize external failure costs** by ensuring products or services meet customer expectations before delivery.

Visualizing COPQ:

A typical COPQ breakdown is often visualized as a **pie chart** or **bar graph** showing the proportion of costs in each category. Here's a simple visualization of how costs might break down in an organization:

Category	Percentage of COPQ (Example)
Prevention Costs	5%
Appraisal Costs	15%
Internal Failure Costs	25%
External Failure Costs	55%

This breakdown highlights the **disproportionate impact** that external failure costs can have on a business. It's a key reason why many companies focus on reducing failure costs (internal and external) by investing more in prevention and appraisal activities.