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DEPARTMENT OF AEROSPACE ENGINEERING

19MEE304 Total Quality Management

Topic: Costs of quality

Introduction to Costs of Quality

- **Definition:** The cost incurred to **prevent, detect, and correct defective products**.
- **Objective:** Minimize costs while maximizing product quality.
- **Importance:** Understanding quality costs helps in **reducing waste, improving efficiency, and increasing profitability**.

Categories of Quality Costs

Quality costs are divided into **four main categories**:

A. Prevention Costs (Cost of Avoiding Defects)

- Costs incurred to **prevent defects** before they occur.
- **Examples:**
 1. **Quality Training Programs** – Educating employees on best practices.
 2. **Process Control & Standardization** – Implementing **ISO 9001, Six Sigma, TQM**.
 3. **Supplier Quality Audits** – Ensuring raw materials meet standards.
 4. **Preventive Maintenance** – Reducing machine breakdowns that cause defects.
 5. **Design for Quality (DFQ)** – Using **Failure Mode and Effects Analysis (FMEA)** to anticipate defects.

B. Appraisal Costs (Cost of Quality Inspection)

- Costs incurred for **testing, inspection, and quality control**.
- **Examples:**
 1. **Incoming Material Inspection** – Checking raw materials before production.
 2. **In-Process Quality Checks** – Using **Statistical Process Control (SPC)**.
 3. **Final Product Testing** – Ensuring compliance with **AS9100, ISO 9001** standards.
 4. **Third-Party Quality Audits** – External certification checks.

Trade-off: Higher appraisal costs improve defect detection but do not prevent defects.

C. Internal Failure Costs (Cost of Defects Before Reaching Customers)

- Costs of defects **detected before the product is shipped**.
- **Examples:**
 1. **Rework Costs** – Fixing defective products before delivery.
 2. **Scrap Costs** – Material wastage from rejected items.
 3. **Downtime Costs** – Stoppage due to defective parts.
 4. **Process Reengineering** – Adjusting production methods to eliminate defects.
 5. **Lost Productivity** – Resources wasted on fixing defective items.

D. External Failure Costs (Cost of Defects After Delivery)

- **Most expensive** category – impacts **customer trust, brand reputation, and revenue**.
- **Examples:**
 1. **Warranty Claims** – Repair or replacement of defective products.
 2. **Product Recalls** – Huge financial loss (e.g., **Samsung Galaxy Note 7 battery recall**).
 3. **Customer Complaints Handling** – Cost of support centers and compensation.
 4. **Loss of Customer Loyalty** – Reduced repeat sales due to poor quality.
 5. **Legal Costs & Fines** – Lawsuits and penalties due to regulatory non-compliance (e.g., **Volkswagen emissions scandal**).

Cost of Quality Formula

Total Cost of Quality (CoQ) = **Prevention Costs + Appraisal Costs + Internal Failure Costs + External Failure Costs**

Industry Benchmark:

- **World-Class Companies** aim for **2-4% of total revenue** spent on quality costs.
- **Poor Quality Management** can result in **15-25% of total revenue lost** due to defects.

Case Study: Toyota's Cost of Quality Approach

- **Prevention: Kaizen & Lean Manufacturing** to eliminate defects.
- **Appraisal: Automated quality checks** in assembly lines.
- **Internal Failure: Root Cause Analysis (5 Whys, Pareto Analysis)** for defect reduction.
- **External Failure: Just-in-Time (JIT) System** to minimize recalls.
- **Result:** Toyota maintains **high customer satisfaction with low quality costs**.

Conclusion

- **Investment in Prevention & Appraisal** reduces **Failure Costs** significantly.

- **Shifting from reactive to proactive quality management** improves efficiency and profitability.
- **Industries focusing on Six Sigma, TQM, and Lean reduce quality costs** while enhancing customer trust.