DEPARTMENT OF AEROSPACE ENGINEERING
19MEE304 Total Quality Management

Topic: Six Sigma Process – Case Studies

1. Introduction to Six Sigma

- **Definition:** A data-driven methodology that aims to reduce defects and improve quality by minimizing variation in processes.
- **Origin:** Introduced by **Motorola in 1986**, later popularized by **General Electric (GE)**.
- **Objective:** Achieve **near-perfect quality** with **3.4 defects per million opportunities (DPMO)**.
- **Key Benefit:** Enhances efficiency, customer satisfaction, and profitability.

2. Six Sigma Methodologies

1. DMAIC (For Process Improvement)

- **Define:** Identify the problem and customer requirements.
- **Measure:** Collect data and analyze current performance.
- **Analyze:** Identify root causes of defects using statistical tools.
- **Improve:** Implement solutions to eliminate root causes.
- **Control:** Maintain improvements through monitoring and standardization.

📌 Example (Automotive - Ford Motor Company)

- Used **DMAIC** to reduce assembly line defects.
- Improved **vehicle manufacturing efficiency by 20%**.

2. DMADV (For New Process/ Product Design)

- **Define:** Establish goals aligned with customer needs.
- **Measure:** Identify critical factors affecting quality.
- **Analyze:** Develop process alternatives.
- **Design:** Optimize the best solution.
- **Verify:** Validate performance before full-scale implementation.

📌 Example (Electronics - Samsung)

- Used **DMADV** to design **high-quality smartphone screens**.

- Achieved **a defect rate reduction of 40% in OLED displays**.

3. Key Tools Used in Six Sigma

◈ **Cause-and-Effect Diagram (Ishikawa/ Fishbone Diagram)** – Identifies root causes of defects.
◈ **Pareto Chart** – Focuses on the most significant defect contributors.
◈ **Control Charts** – Monitors process stability over time.
◈ **Failure Mode and Effects Analysis (FMEA)** – Assesses risk levels.
◈ **Statistical Process Control (SPC)** – Ensures consistent quality control.

4. Industry Case Studies on Six Sigma Implementation

1. General Electric (GE) – Reducing Process Defects

- CEO **Jack Welch** made Six Sigma a company-wide initiative.
- Improved **operational efficiency** in manufacturing and finance.
- **Savings:** Over **$10 billion in cost reductions**.

2. Motorola – Pioneering Six Sigma

- Implemented Six Sigma in **production lines**.
- Reduced **defects per million (DPMO) by 80%**.
- **Outcome:** Increased product reliability and customer satisfaction.

3. Amazon – Enhancing Warehouse Efficiency

- Applied **DMAIC** to optimize logistics and reduce shipping errors.
- Reduced **delivery defects by 50%**.
- Implemented **machine learning for real-time quality checks**.

4. Boeing – Reducing Aircraft Manufacturing Errors

- Used Six Sigma to **reduce defects in aircraft assembly**.
- Saved **millions in rework costs** by improving part precision.
- Implemented **Lean Six Sigma to streamline supply chains**.

5. Toyota – Lean Six Sigma for Production Efficiency

- Combined **Lean and Six Sigma** for waste reduction.
- **Outcome:** Reduced **cycle time by 30%** and improved customer satisfaction.
- **Kaizen and JIT (Just-in-Time) techniques** were integrated.

5. Challenges in Six Sigma Implementation

❌ Resistance to change in organizational culture.
❌ High initial training and implementation costs.
❌ Requires strong **management commitment** for success.
❌ Complex statistical tools need skilled professionals.

6. Benefits of Six Sigma in Industries

✅ Reduces **defect rates and process variation**.
✅ Enhances **customer satisfaction and product quality**.
✅ Leads to **cost savings and increased profitability**.
✅ Improves **efficiency in production and supply chains**.

7. Conclusion

- **Six Sigma is a globally recognized quality management approach**.
- Industries that apply **Six Sigma gain a competitive advantage**.
- The integration of **AI and real-time analytics** enhances Six Sigma effectiveness.
- Continuous improvement ensures **sustainable quality and operational excellence**.