

PROJECT MONITORING

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PMG333

Lecture 06

QUALITY MONITORING

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- ①  **Introduction to Quality**
Defining quality principles and importance.
- ②  **Quality Monitoring**
Tracking performance and identifying deviations.
- ③  **Quality Assurance (QA)**
Proactive process improvement and standards.
- ④  **Quality Control (QC)**
Reactive product inspection and defect identification.
- ⑤  **QA vs QC Comparison**
Understanding the key differences and relationship.
- ⑥  **Historical Evolution of Quality**
From craftsmanship to modern management systems.
- ⑦  **Case Studies & Real-World Applications**
Practical examples and industry success stories.



Understand

- Explain Quality concepts
- Distinguish QA vs QC
- Summarize history



Apply

- Use PDCA cycle
- Pareto charts
- Flowcharts in real scenarios



Analyze

- Examine case studies (Toyota, Amazon)
- Compare tools
- Interpret data



Evaluate

- Assess quality impact
- Discuss ethical implications
- Critique costs

"Quality does not just happen;
it is achieved by conscious
effort." *Edwards Deming*

Quality = Conformance to Requirements + Fitness for Use

PMBOK 6th Edition



Popular Restaurant

- **Customer Expectation:**
 - Simple service.
- **Actual Service:**
 - Clean and fast.

Result: Excellent Quality



Luxury Restaurant

- **Customer Expectation:**
 - Royal service.
- **Actual Service:**
 - Average.

Result: Poor Quality



Lesson: Quality is not luxury, but meeting expectations!

PMBOK Definition

The degree to which a set of inherent characteristics fulfills requirements.

Key Dimensions



Conformance to Requirements:

The project's processes and products meet written specifications.



Fitness for Use: The product can be used as it was intended.

Importance of Quality

Customer Satisfaction



Happy Customer = Loyal Customer.

Bad news travels faster than good news.

Costs



Prevention is cheaper than cure.

Fixing a bug early is 100x cheaper.

Schedule



Rework causes delays.

Doing it right the first time saves time.

Cost of Error Timeline



Lesson: Quality is not a cost, it is an investment that saves money and time!

Story of the British Cycling Team

Source: Dave Brailsford - Performance Director

How to achieve a radical turnaround?

British cycling was mediocre for 100 years. No Tour de France wins.

1% Improvement in Everything.

- ✓ Redesigned bike seats.
- ✓ Rubbing alcohol on tires.
- ✓ Heated shorts for muscle temperature.
- ✓ Better pillows for sleep.
- ✓ Painted truck floor white to spot dust.



Key Lesson: Quality is the sum of small improvements, not just one giant leap!



Standards

Pre-defined requirements that must be achieved.

- **Practical Example:** Response time must be less than 2 seconds.
- This is the **Target** we aim for.



Metrics

Method of measuring actual performance.

- **Practical Example:** Actual response time = 1.8 seconds.
- This is the **Reality** we measure.

Standard (2s) → vs Metric (1.8s) →  **Result: Success (Pass)**



Lesson: Standards = Goals, Metrics = Reality. We compare them to know if we are on track.



Defects

Non-conformance to requirements.

Example:

Bug in code causing crash.



Variation

Difference from the mean/average.

Example:

Response times:
1.5s, 2.2s, 1.8s.



Deviation

Difference from the standard/target.

Example:

Target: 2.0s vs
Actual: 2.5s.



Key Distinction: Defect = Failure | Variation = Fluctuation | Deviation = Missed Target

What is Monitoring?

Monitoring = Continuous Tracking
Control = Corrective Action

Monitoring



Detects Problems
Issues Alerts

Control



Corrects Problems
Takes Action



Plan → Execute → Monitor → Control → Improve

Example: Water Bottling Plant



QUALITY ASSURANCE & QUALITY CONTROL

Prevention vs. Detection

**Step 1: The Call**

Boy calls a lady: "Do you need a lawn mower?"

Response:
"No, I am very satisfied with my current one."

**Step 2: The Offer**

Boy: "I will do it for half price!"

Response:
"No thank you, his quality is excellent."

**Step 3: The Reveal**

Shopkeeper asks:
"Why did you call?"

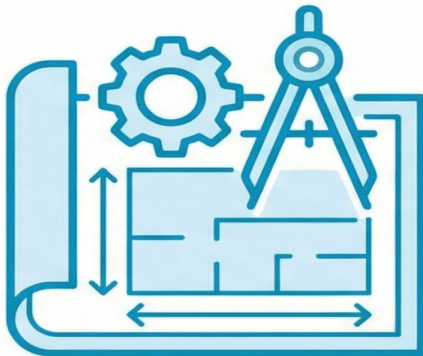
Boy's Answer: "I am the one working for her! I was just checking my performance."



Key Lesson: True Quality is Self-Monitoring—checking your own work before the customer does!

Quality Assurance (QA)

Defect Prevention = Doing it Right the First Time



- **Focus:** Process-oriented (Proactive).
- **Goal:** Prevent defects before they occur.
- **Tools:** Audits, Process Definition, Training.
- **Example:** Defining coding standards before software development begins.

Quality Control (QC)

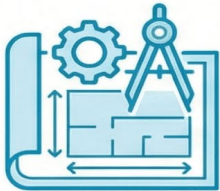
Defect Detection = Finding & Fixing Defects



- **Focus:** Product-oriented (Reactive).
- **Goal:** Identify defects after they occur.
- **Tools:** Testing, Inspections, Reviews.
- **Example:** Testing software code for bugs after development.

QA vs QC: The Comparison

QUALITY ASSURANCE (QA)



- **Focus:** Process-oriented (Prevention).
- **Goal:** Improve development process.
- **Technique:** Proactive.
- **Responsibility:** Everyone.

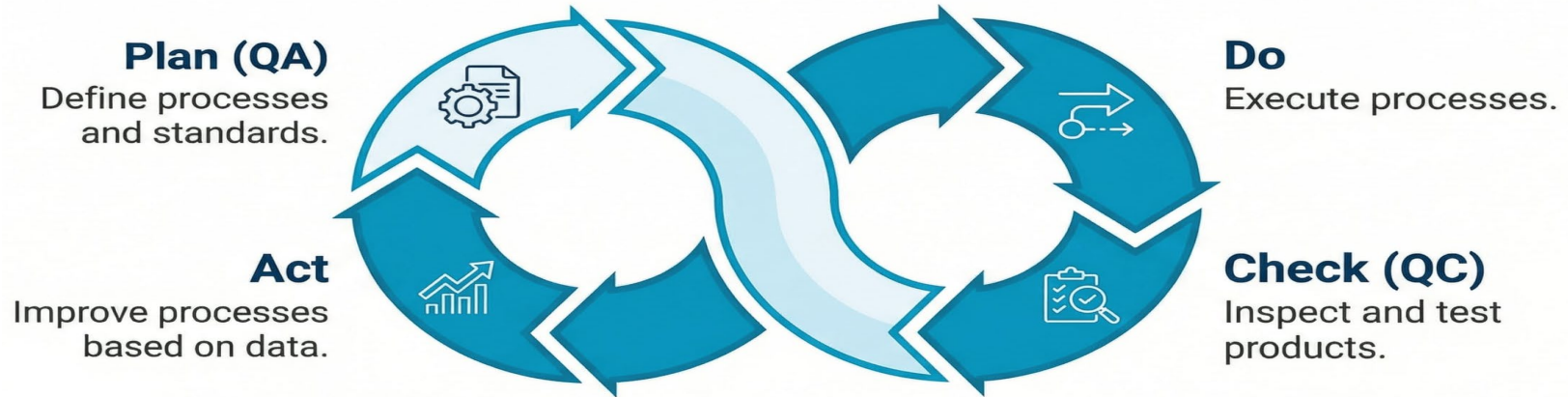
QUALITY CONTROL (QC)



- **Focus:** Product-oriented (Detection).
- **Goal:** Identify defects.
- **Technique:** Reactive.
- **Responsibility:** Testing Team.

Integration: The PDCA Cycle

QA and QC Working Together for Continuous Improvement



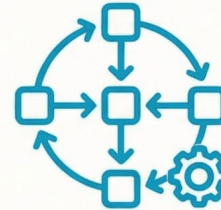
Key Insight: "QA is about Planning, QC is about Checking."

Montserrat 24px Cyan Scenario



- **Project:** Mobile Banking App.
- **Goal:** Zero critical bugs at launch.

Montserrat 24px Cyan Application



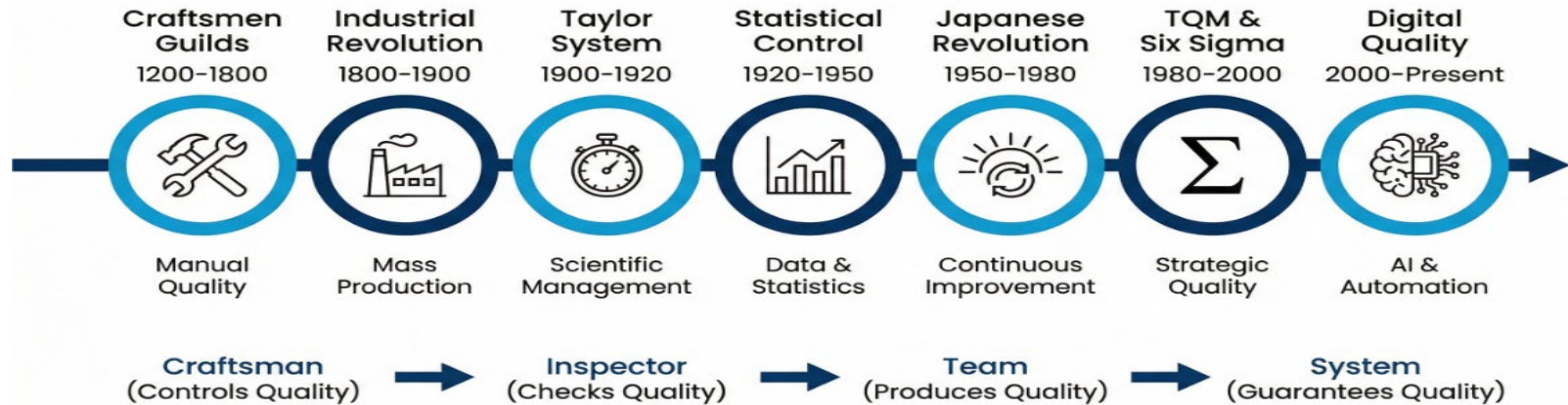
- **Plan:** Defined coding standards & test cases.
- **Manage (QA):** Code reviews & automated testing pipeline.
- **Control (QC):** User Acceptance Testing (UAT) & bug tracking.

Outcome: Detected 95% of bugs before release using automated testing (QA) and manual testing (QC).

Lesson: Early detection saves 10x cost compared to post-release fixes.

Historical Evolution

7 Stages from 13th Century to Today



Lesson: Quality evolved from an individual responsibility to a complete organizational culture. From Craftsman to AI!

Phase 1: Craftsmen Guilds (1200–1800)

The Craftsman's Code



Quality = Personal Reputation

- Master-Apprentice System
- Long training periods to achieve mastery
- "The Master is the Inspector"

Quality Assurance Method



Visual Inspection

- 100% Manual Inspection by the maker
- No separate quality department
- One product at a time, crafted to perfection

In this era, quality was a matter of honor and survival for the craftsman.

Phase 2: Industrial Revolution (1800s – 1900s)

From Craftsmanship to Mass Production



The Shift to Mass Production

Transition from individual artisans to factory systems.

The Challenges



Lack of Standardization

Parts were not interchangeable. Each product required manual fitting.



Quantity over Quality

Focus shifted to volume and speed, often compromising precision.



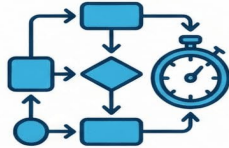
The Rise of Inspection

Quality control meant inspecting finished goods at the end of the line to sort good from bad.

Phase 3: Taylor System (1900–1920)

Scientific Management Ekiagement & Division of Labor

Scientific Management



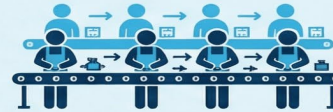
Shift from “Rule of Thumb” to Scientific Methods.

Break down complex tasks into simple, repeatable steps.

The Impact (Before vs. After)



Before (Craftsman)
1 Skilled Worker makes
100% of the product.
(High Cost, Low Speed).



After (Taylorism)
100 Unskilled Workers
each do 1% of the task.
(Low Cost, High Speed).

**Mass Production ↑ but
Worker Ownership of Quality ↓.**

Lesson: Productivity skyrocketed, but quality became a separate responsibility (Inspection), not the worker's pride.

Phase 4: Statistical Control (1920–1950)

The Paradigm Shift



Problem

100% Inspection
is Impossible

Context: Mass production of millions of units makes checking every single one too costly and slow.



Solution

Statistical
Sampling

Context: Inspecting a small, representative sample to judge the whole lot.

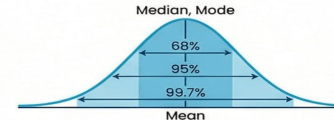


Control Charts (Walter Shewhart)



Distinguishing normal variation from special causes.

Normal Distribution



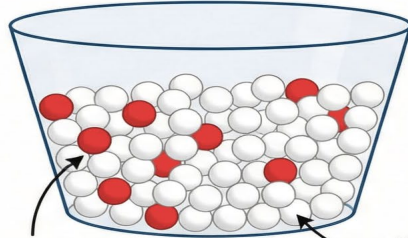
Understanding probability and standard deviation.

Quality Transformation: From subjective human judgment to objective scientific measurement.

The Red Bead Experiment

W. Edwards Deming's Lesson on System vs. Worker

The Experiment Setup



Red Bead =
Defect (Problem)

White Bead =
Quality (Good)

Task: Workers blindly scoop beads using a paddle. The system (container mix) is fixed and unchangeable by the worker.

The Result: Big Numbers

6%

Problems caused
by Workers

94%

Problems caused
by the System

Bottom Insight

**The Lesson: Don't blame the worker for defects caused by the system.
Improve the process.**

Japanese Quality Revolution (1950–1980)

From Devastation to Global Leadership

Top Section: The Context

Post-WWII: Japan embraced quality to rebuild its economy and reputation.

1950

1980

The Architects



W. Edwards Deming

Statistical Quality Control (SQC)

Management is responsible for **85%** of quality problems.



Joseph Juran

Quality Management

Quality Trilogy: Planning, Control, Improvement.

Key Innovations



Kaizen

Continuous Improvement



Just-in-Time

Efficiency



Quality Circles

Teamwork

Toyota Production System (TPS)

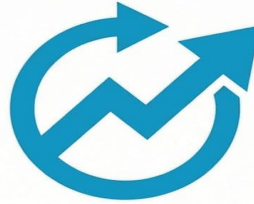
Pillars of Lean Manufacturing



Andon Cord

Stop the Line

Any worker can halt production immediately when a defect is found.



Kaizen

Continuous Improvement

Small, daily improvements by everyone, everywhere.



Gemba

Go to the Source

Management goes to the actual place of work to understand problems.

Toyota Case Study: Small Changes, Big Impact

Motion Waste (Muda)

The Problem (Before Kaizen)



Tools placed
50cm away.

Excessive Motion = Fatigue + Time Waste.

The Solution (After Kaizen)



Tools moved
10cm closer.

Simple adjustment, **zero cost.**

The Impact (The Power of 10cm)



Saved **2 seconds**
per cycle.



Multiplied by **1,000**
cycles/day = **33 minutes**
saved per worker.



Reduced worker
fatigue & injury risk.

Kaizen isn't about reinventing the wheel; it's about refining the revolution.

Japan: From Follower to Leader (1950–1980)

1950: Post-War Perception



- “Made in Japan” = Cheap & Low Quality
- High Defect Rates
- Limited Global Market Share

1980: Global Leadership



- “Made in Japan” = Gold Standard of Quality
- Superior Reliability & Innovation
- Dominating Automotive & Electronics Markets

The Result: By prioritizing quality, Japan didn't just catch up; they redefined the global standard.

Total Quality Management (TQM) & Six Sigma (1980–2000)

From Quality to Competitive Strategy



Total Quality Management (TQM)

Quality is everyone's responsibility.

- Customer Focus
- Employee Involvement
- Continuous Improvement



Six Sigma

Reducing variation and defects.

- Data-Driven
- DMAIC
- 3.4 Defects Per Million Opportunities (DPMO)

Key Figures



Bill Smith (Motorola)
Father of Six Sigma



Jack Welch (GE)
Scaled Six Sigma globally

The Motorola Story: Birth of Six Sigma (1986)

Revolutionizing Quality Measurement

The Origin



Context: "Goal: Survive Japanese Competition."

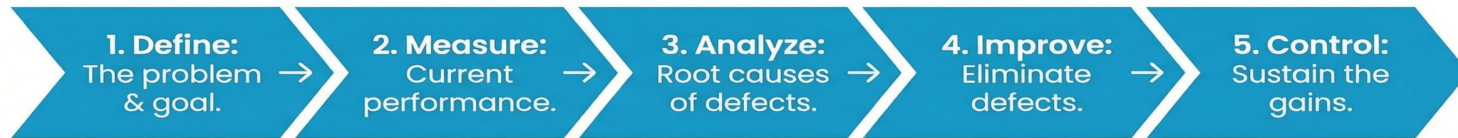


Innovator: Bill Smith (Motorola Engineer).



Concept: "Variation is the enemy of quality."

The DMAIC Methodology (5 Steps)



The Standard (3.4 DPMO)



Six Sigma = 3.4 Defects Per Million Opportunities.

99% Good = 20,000 lost letters/hour. Six Sigma = 7 lost letters/hour.

General Electric: Jack Welch & Six Sigma Culture

Scaling Excellence (1995–2000)

The Catalyst: Jack Welch's Mandate



“Six Sigma is **not just a program**;
it is the way we do **business**.”

The Belt System (Hierarchy)



The Results

\$12 Billion Saved

In just
5 years

Transformed GE's
DNA forever

Quality in the 21st Century: Quality 4.0

Digital Transformation, AI, and Sustainability



Pillar 1: Digital Quality (IoT)

Connected & Real-Time

- IoT Sensors monitoring every step.
- Cloud-based data analytics.
- From 'Inspection' to 'Prevention'.



Pillar 2: Artificial Intelligence (AI)

Predictive & Intelligent

- Machine Learning for anomaly detection.
- Predictive maintenance (fixing before breaking).
- Automated visual inspection.



Pillar 3: Sustainable Quality (ESG)

Green & Circular

- Reducing waste and carbon footprint.
- Circular economy principles.
- Quality = Sustainability.



Tesla: Over-the-Air (OTA) updates to fix quality issues remotely.



Netflix: Monitoring streaming quality in real-time for millions.

Amazon: The Digital Andon Cord

Protecting Customer Experience at Scale



The Challenge

Managing quality for millions of products in real-time.

The Digital Process



Trigger

Customer
Complaint / High
Return Rate



The Algorithm Digital Andon Cord

Automatically pulls the product
from the "shelf" (website).



Investigation & Fix

Product reinstated only after
quality is confirmed.

The Impact

- **Automated Quality Control** Protects customer trust instantly, without waiting for human intervention.

From Toyota's physical cord to Amazon's digital algorithm: The principle remains the same.

Virginia Mason Medical Center

Applying Toyota's Lean System in Healthcare

The Crisis (Context)

Hospital facing financial loss, medical errors, and long wait times.



The Transformation (Lean Application)

Before Lean (Left - Red/Grey Accent)



High Medical Errors



Long Patient Wait Times



Staff Burnout & Frustration



After Lean (Right - Sky Blue Accent #0099CC)



Gemba Walks: Managers observe actual care processes.



Standardized Work: Consistent procedures for safety.



Waste Removal: Eliminating non-value-added steps.

The Results (Metrics)



+40%

Patient Satisfaction



\$+\$100M

Financial Savings



-75%

Medication Errors



Lesson: Lean principles apply everywhere. Even in hospitals, eliminating waste saves lives.

NASA: Painful Lessons in Quality Culture

Challenger (1986) & Columbia (2003)

The Disasters (Timeline)

1986
Challenger



O-Ring failure in
cold weather.

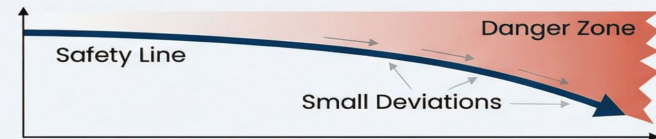
2003
Columbia



Foam debris damage
on launch.

Normalization of Deviance

Accepting small deviations from safety standards until they become the 'new normal'.



The Lessons Learned



Psychological Safety: Engineers must feel safe to speak up against management pressure.



No Compromise on Safety: Small deviations today lead to catastrophes tomorrow.

Quality is not just about specs; it's about the culture of listening to the data.

Quality Monitoring Tools

Statistical & Process Analysis Tools

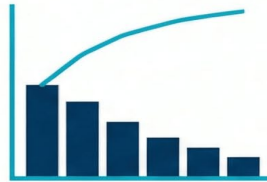


Statistical Tools (Data-Driven)



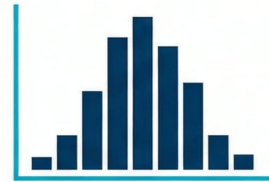
Control Charts

Monitoring process stability and identifying special cause variations.



Pareto Charts

Identifying key problems by focusing on the vital few (80/20 principle).



Histograms

Analyzing data distribution to understand central tendency and dispersion.



Scatter Diagrams

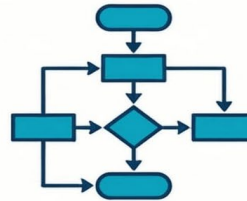
Checking variable relationships to determine correlation and causality.

Process Analysis Tools (Non-Statistical)



Fishbone Diagrams

Root cause analysis.



Flowcharts

Visualizing process steps.



Check Sheets

Systematic data collection.

"Don't settle for less. Always
strive for the best."

Steve Jobs

Thank You