PM Notebook

Summarizing Project Management Concepts for the PMP Exam

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Road to PMP

No great man ever complains of want of opportunity.
Ralph Waldo Emerson

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CHAPTER 8 – QUALITY MANAGEMENT

Key Terms

Quality –

- The totality of an entity that bears on its ability to satisfy stated or implied (nonfunctional) needs.
- It is the degree to which the project fulfills requirements.
- It is planned, designed, and built-in.

Responsibility

- Responsibility of the entire organization.
- Senior management has ultimate responsibility for quality in the whole organization.
- Project manager has ultimate responsibility for quality in his project.
- Each team member must check his work by inspecting it himself.
- Quality should be checked before an activity or work package is completed.
- According to W. Edwards Deming, **58 percent of quality problems** are attributable to the **management environment and the system** in which the team works**.**

Quality Control vs. Quality Assurance

Quality Control (QC) – monitoring specific project results to determine if they comply with relevant quality standards and identifying ways to assess performance, recommend necessary changes, and eliminate causes of unsatisfactory performance.

- Focuses on **inspecting** for defects in deliverables.
- Done by PM, project team, or third party.
- It keeps errors out of customer's hands.

Quality Assurance (QA) – A management process that ensures that the quality expectations are met by means of implementing standards and verifying compliance.

- QA aims to **plan quality** into the project rather than to inspect quality into a deliverable.
- Focuses on **prevention**.
- Implies **auditing**.
- It keeps errors out of the process.
- **Quality Policy/Program –**
    - Includes the overall intentions and the direction of the organization regarding quality.
    - Formally expressed by **top management.**
    - If a quality policy does not exist, the **project manager must create one** for the project.
    - Examples of international policies –

- **ISO Program –** help ensure that organizations **have quality procedures and that they follow them**. **It does not tell what quality should be, or describe a recommended quality system.**
- **OSHA –** standards for American safety.
- **CISG –** standard that governs international sales transactions.

Quality Approaches

Top-Down Quality –

- Initiated from management and senior leaders.
- Comes in forms of projects and scheduled events.
- Looks for big problems and major overhauls with high risk and/or cost.

Bottom-Down Quality –

- Initiated from managers and staff members.
- Happens all day.
- Typically small, low-cost, low-risk changes.

Precision vs. Accuracy

Precision – The closeness of two or more measurements to each other. I.e. The measure of **exactness**.

Accuracy – The closeness of a measured value to a standard or known value. I.e. the measure of **correctness**.

Quality vs. Grade

Quality – Meeting project scope, conformance to requirements and fitness for use. **Low quality is always a problem**.

Grade – The class or category assigned to products or services having the **same functional** use but **different technical** characteristics. **Low grade is not always a problem**.

Standards vs. Regulations

Standards – **Optional.** Established generally by private-sector bodies and that are available for use by any person or organization, private or government. The term includes what are commonly referred to as 'industry standards' as well as 'consensus standards.

Regulations – Required. A rule of order having the force of law, prescribed by a superior or competent authority, relating to the actions of those under the authority's control. Regulations are issued by various government departments and agencies.

Examples of regulations are building code for a city, the documented way to dispose old paint, and the zoning for an industrial area.

Auditing

It is the process of a systematic examination of a quality system carried out by an internal or external quality auditor or audit team. Auditing is used to –

- **Part of quality assurance.**
- Document the **best practices** used.
- Document any **variances**.
- **Implement recommendations**.
- Document quality audits in **lessons learned register**.
- **Confirm the implementation** of approved change requests including updates, corrective actions, defect repairs and preventive actions.
- Involves sharing good practices introduced or implemented in similar projects in the organization and/or industry.
- Modules to be audited are picked up based on the quality management plan.

Quality auditing is usually done by quality assurance department. PM can lead this effort if the organization does not have such a department.

Processes

1 – Plan Quality Management (Planning)

- Defines quality policy.
- Defines quality assurance requirements.
- Defines how quality control activities will occur.
- Defines how to deal with nonconformance, corrective actions procedures, and continuous improvement procedures.

Inputs

1. **Project Management Plan**
   - **Requirements Management Plan**
   - **Stakeholder Management Plan**

   - **Scope Baseline**
2. **Project Documents**
   - **Risk Register**
   - **Assumptions Log**
   - **Requirements Documentation**
3. **EEFs**
   - **Quality Policy**
4. **OPAs**

Tools

1. **Expert Judgment**
2. **Data Gathering Techniques**
   - **Benchmarking**
   - **Brainstorming**
   - **Nominal Group Technique (NGT)**
3. **Data Analysis Techniques**
   - **Cost-Benefit Analysis**
   - **Design of Experiments (DOX)**
4. **Seven Basic Quality Tools**
5. **Decision-Making Techniques**
6. **Meetings**
7. **Cost of Quality (COQ)**

Outputs

1. **Quality Management Plan**
2. **Process Improvement Plan –**
3. **Quality Metrics –** The system or standard for measurements and variances.
   - On-time performance
   - Cost control
   - Defect frequency
4. **Quality Checklists –** the list of items to inspect or steps to be performed. It can also be a picture with the item to inspect with space to note any defects found.
5. **Project Document Updates**

2 – Manage Quality / Quality Assurance (Executing)

- **Occurs before and during the project**.
- Continuous process improvement.
- Project team's responsibility.
- Ensure that activities and processes comply with organizational and project policies.
- During this process, PM has the greatest impact on this quality of the project.

Inputs

1. **Project Management Plan**
   - **Quality Management Plan**
   - **Process Improvement Plan**

2. **Project Documents**
   - **Quality Metrics**
   - **Quality Control Measurements**
3. **OPAs**

Tools

1. **Data Gathering Tools**
   - **Checklists**
2. **Data Analysis Tools**
   - **Alternatives Analysis**
   - **Root Cause Analysis (RCA)**
   - **Process Analysis**
3. **Decision Making Techniques**
4. **Quality Audits**
5. **Quality Improvement Analysis**
6. **Design for X**

Outputs

1. **Quality Reports**
2. **Test and Evaluation Documents**
3. **Change Requests**
4. **Project Management Plan Updates**
5. **Project Document Updates**

3 – Control Quality (Monitoring & Controlling)

- All about **inspection**.
- **Occurs throughout the project**.
- Monitor and measure project results, deliverables, project management processes, performance, cost, schedule, etc.
- Apply corrective actions.
- For problems, you have to do **root-cause analysis**.
- Implies statistical quality control, such as **attribute and variable sampling** and **probability.**
- Checking tolerances and observing control limits.

Inputs

1. **Project Management Plan**
   - **Quality Management Plan**
2. **Project Documents**
   - **Quality Metrics**
   - **Quality Checklists**
   - **Test and Evaluation Documents**
3. **Deliverables**
4. **Work Performance Data**
5. **Approved Change Requests**
6. **OPAs**

Tools

1. **Data Gathering Tools**
   - **Statistical Sampling**
   - **Checklists**
2. **Data Analysis Techniques**
   - **Performance Reviews**
   - **Root-Cause Analysis**
3. **Inspection –** Checking deliverables for defects. Also called **walkthrough** and **product review.**
4. **Decision Analysis Techniques**
5. **Testing and Evaluating Deliverables –**
6. **Seven Basic Quality Tools**
7. **Meetings**

Outputs

1. **Quality Control Measurements –** Numerical observations.
2. **Validated Changes**
3. **Verified Deliverables**
4. **Change Requests**
5. **Work Performance Information**
6. **Project Document Updates**
   - **Lesson Learned Updates**
   - **Test and Evaluation Documents**
   - **Completed Checklists**

Quality Theories

Conformance to Requirements (Philip Crosby) – How well a product/service/project meets requirements?
Zero Defects / Prevention (Philip Crosby) – management tool aimed at the reduction of defects through **prevention**. It is directed at motivating people to prevent mistakes by developing a constant, conscious desire to **do their job right the first time**.
Monetary Value (Philip Crosby) – Quality is measured in monetary value.
Fitness for Use/Purpose (Joseph Juran) – The effectiveness of the design of a product for its intended purpose.
80/20 Rule / Vilfredo Pareto Principle / Principle of Factor Sparsity / Law of Vital Few (Joseph Juran) – A rule that says that 80 percent of quality problems are caused by 20 percent of potential sources of problems.

Deming's 14 Points

Deming's 14 Points on Quality Management, a core concept on implementing total quality management, is a set of management practices directed by the **top management** to help companies increase their quality and productivity –

1. Create purpose for improvements.
2. Adopt the new philosophy.
3. Cease dependence on inspection to achieve quality.
4. End the practice of awarding business on price alone; instead, minimize total cost by working with a single supplier.
5. Continuous and forever improvement.
6. On-the-job training.
7. Leadership.
8. Drive out fear.
9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations and targets for the workforce.
11. Eliminate numerical quotas for the workforce and numerical goals for management.
12. Remove barriers that rob people of pride of workmanship, and eliminate the annual rating or merit system.
13. Institute education and self-improvement programs.
14. Involve all workers in the transformation.

David Garvin's Attributes of Quality

According to David A. Garvin, there are eight attributes of quality –

Aesthetics – individual's personal preference.
Conformance – meeting the standards.
Duration – the length of product's life.
Features – additional characteristics that enhance the appeal.
Perceived Quality – the quality attributed to a good or service based on indirect measures.
Performance – primary operating characteristics.
Reliability – the likelihood that the product will not fail with a specific time period.
Serviceability – the speed with which the product can be put into service when it breaks down.

Quality Improvement Techniques

Constancy of Purpose –

- Documented and well-disseminated statement of purpose and vision.
- A set of strategic and tactical plans.
- An awareness by all members of the organization of the purpose, vision, goals, and objectives and their roles in achieving them.
- Should be provided by top management.

Define, Measure, Analyze, Improve and Control (DMAIC) – a data-driven improvement cycle used in **Six Sigma** projects for improving, optimizing and stabilizing business processes and designs.

Kaizen Technique – A Japanese management philosophy (established by Masaaki Imai) that seeks achieving small, incremental changes in processes.

Plan-Do-Check-Act/Adjust (PDCA) / Shewhart Cycle / Deming Circle/Cycle/Wheel – Invented by Walter Shewhart and popularized by W.E. Deming, it is an iterative approach about improving your process.

Process Analysis – Focuses on identifying improvements that might be needed in process. It relies on **process improvement plan**.

Six Sigma – A methodology for organizational process improvement and achieving high levels of **correctness** with extremely reduced variances.

Total Productive Maintenance (TPM) – is a **system (or set of tools)** that aims at **getting the most efficient use of equipment** and includes maintenance prevention, preventive maintenance, and improvement-related maintenance for the company.

Total Quality Management (TQM) – a business **philosophy** to find methods to continuously improve products, services, and business practices. It is concerned with **meeting the needs and expectations of customers.** It attempts to move the focus of quality away from being a purely operational activity into a major concern for the whole organization.

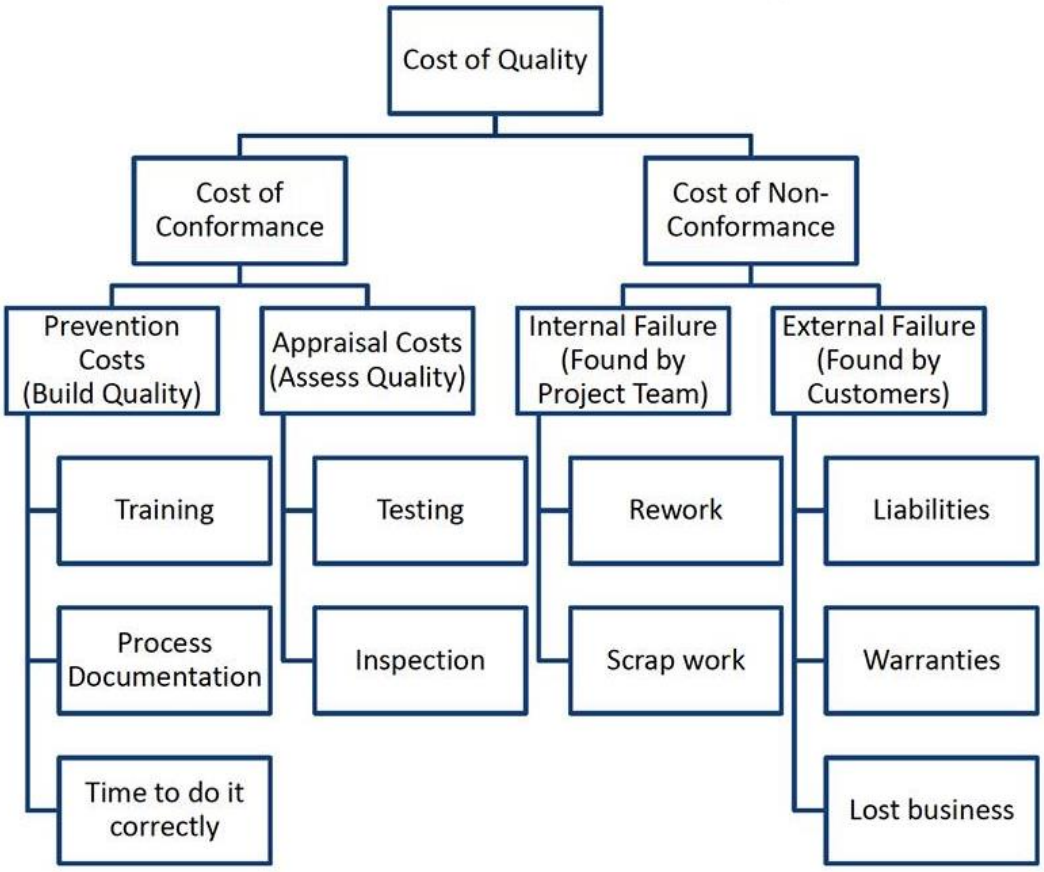
Quality Costs

Cost of Quality (COQ) / Cost of Conformance (COC) – The costs associated with preventing, detecting, and remediating product issues related to quality. It should be **lower than the cost of nonconformance.**

- **Prevention / Quality Assurance Costs –** Team **training**, safety measures, right tools, process documentation, etc.
- **Appraisal / Quality Control Costs –** Measuring, testing, inspection, time consumed, etc.

Cost of Poor Quality / Nonconformance – The monies spent to recover from not adhering to the expected level of quality.

- **Internal Failure Costs –** Rework, scrap, loss of sales, downtime, etc.
- **External Failure Costs –** Liabilities, warranties, lost business, etc.



Inspection

Testing

Regression Testing – a type of **software** testing that ensures that previously developed and tested software still performs the **same way** after it is changed or interfaced with other software. Changes may include software enhancements, patches, configuration changes, etc.

Stability Testing – method to check the quality and how the system or software behaves in different environmental parameters like temperature, voltage etc.

Statistical Sampling

Selecting random part of a population for inspection.

- Must be completed on a constant basis throughout the project.
- Can reduce the costs of quality control.
- The sample can be used for application of **destructive** tests.

Types

Attribute Sampling – Looking at the attributes of what we are creating and testing it so results are either **product conforms / pass / go / present** or **does not conform / fail / no-go / absent** to requirements (i.e**. defect or not**.)

Variable Sampling – Results are rated on a continuous scale that measures **the degree of conformity** (i.e. **how far** from quality acceptance.) Examples of variable measurement data are weight, diameter, strength, etc.

Additional Terms

Control Limits – Identify the boundaries of common variation in a statistically stable process or process performance.

Mutual Exclusivity – When two events cannot occur in a single trial.

Statistical Independence – Probability of one event occurring does not affect the probability of another event occurring.

Tolerances – Specified range of acceptable results.

Confidence Interval (CI) – it is the range of statistical values within which a result is expected to fall with a specific probability. Instead of estimating the parameter by a single value, an interval likely to include the parameter is given.

- The smaller the confidence interval, the more accurate the measurement is.

- If we want to **decrease the confidence interval**, i.e. we want a closer estimate, we need to **increase the sample size**.

Design for X

Design for X / Design for Excellence (DFX) – is a general term that serves as a placeholder for different design objectives. It is about considering all components of the design and how they affect the X variable. An example is **Design for Cost (DFC)** where probability and cost reduction are the main goals.

Seven Basic Quality Tools (7QL)

1. **Cause-and-effect diagram** (also known as the **fishbone** or **Ishikawa diagram**)
2. **Check sheet**
3. **Control chart**
4. **Histogram**
5. **Pareto chart**
6. **Scatter diagram**
7. **Flow Chart**

Variation Causes

One of the core advantages of **control charts** is the ability to distinguish variations and causes of those variations.

Causes

5Ms – Manpower, Material, Method, Measurement, Machine
6Ms – Manpower, Material, Method, Measurement, Machine, Mother Nature
E Cause – Environment

Variation

Common Cause Variation / Random Variation / Noise / Non-controllable Variation / Within-Group Variation / Inherent Variation / Natural Patterns / Chronic Losses – a fluctuation caused by unknown factors resulting in a steady but random distribution of output around the average of the data.

- It is the **usual**, **historical**, **quantifiable** variation in a system.
- Normal process variation is attributable to common causes that are part of the system.
- It is a **measure** of how well the process can perform when special cause variation removed.
- A **fundamental change** is required to improve a process with a common cause. For example, upgrade equipment, change procedures, or provide more training.

- Example – Many X's with a small impact.

Common Cause Variability – is a **source** of variation caused by unknown factors that result in a steady but random distribution of output around the average of the data.

Breakthrough – the accomplishment of any improvement that takes the organization to unprecedented levels of performance by attacking common cause of variation.

Special Cause Variation – are unusual, not previously observed, and non-quantifiable variation.

- It is when data points fall outside the control limits, or show trend.
- Variation inherently unpredictable, even probabilistically;
- Evidence of some inherent change in the system or our knowledge of it.
- **Easier to predict and handle** than common causes.
- Examples are human errors and power failures.

Additional Terms

Cost of Quality/Conformance – This is the cost associated with the monies spent to attain the expected level of quality.

Criticality Analysis – a techniques for analyzing design reliability. Involves the following steps:

- Developing a list of potential failure modes for each element.
- Then, each mode is given a numeric rating for frequency of occurrence (i.e. criticality) and probability of detection.
- These data are used to assign risk priority number for prioritizing problems and guiding the design effort.

Just-in-Time – Keeping only the inventory you need on hand when you need it. It is also about delivering raw materials just when or before they are needed.

- **Decreases** the inventory investment**.**
- **Too risky.**
- A company uses JIT **must achieve a high level of quality.**

Prevention over Inspection – The cost of preventing mistakes is generally much less the cost of correcting them.

Quality Function Deployment (QFD) - a method developed in Japan beginning to help transform the **voice of the customer (VOC)** into engineering characteristics for a product.

- Provides better product definition and product development.
- Captures customer's requirements.
- Ensures cross-functional teamwork.
- Links the main phases of product development, product planning, part deployment, process planning, and production planning.
- A type of **facilitated workshops**.

- Needs are objectively **sorted and prioritized**, and **goals are set** for achieving them.

Taguchi Method – quality **control** approach to engineering that emphasizes the roles of **research and development**, **product design** and **product development** in **reducing the occurrence of defects and failures** in products.

- The Taguchi method considers **design to be more important** than the manufacturing process in quality control and tries to **eliminate variances** in production before they can occur.
- The Taguchi method uses statistical techniques to compute a **loss function** to determine the cost of producing products that fail to achieve a target value.
- **Loss Function / Cost Function -** a function that maps an event or values of one or more variables onto a real number intuitively representing some "cost" associated with the event.

Warranty – One party's assurance to the other that goods will meet certain standards of quality, including condition, reliability, description, function, or performance.