Crosswind Learning

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Project Management Professional (PMP)® Exam

Crosswind Success Series: PMP® Exam Bootcamp Manual

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Version 6.1 aligned with the Project Management Institute, *A Guide to the Project Management Body of Knowledge, (PMBOK® Guide)* - Sixth Edition, Project Management Institute Inc., 2017

13.8. Plan Quality Management (Planning Process Group)

Know the Key Inputs, Tools & Techniques, and Outputs for Plan Quality Management.

Planning quality management consists of determining and designing the standards, policies, and procedures for the project. It requires giving careful consideration to the rules that will define quality and establishing the procedures that will be used to ensure that the product, service, or result of the project fulfills expected requirements and meets the project's quality standards.

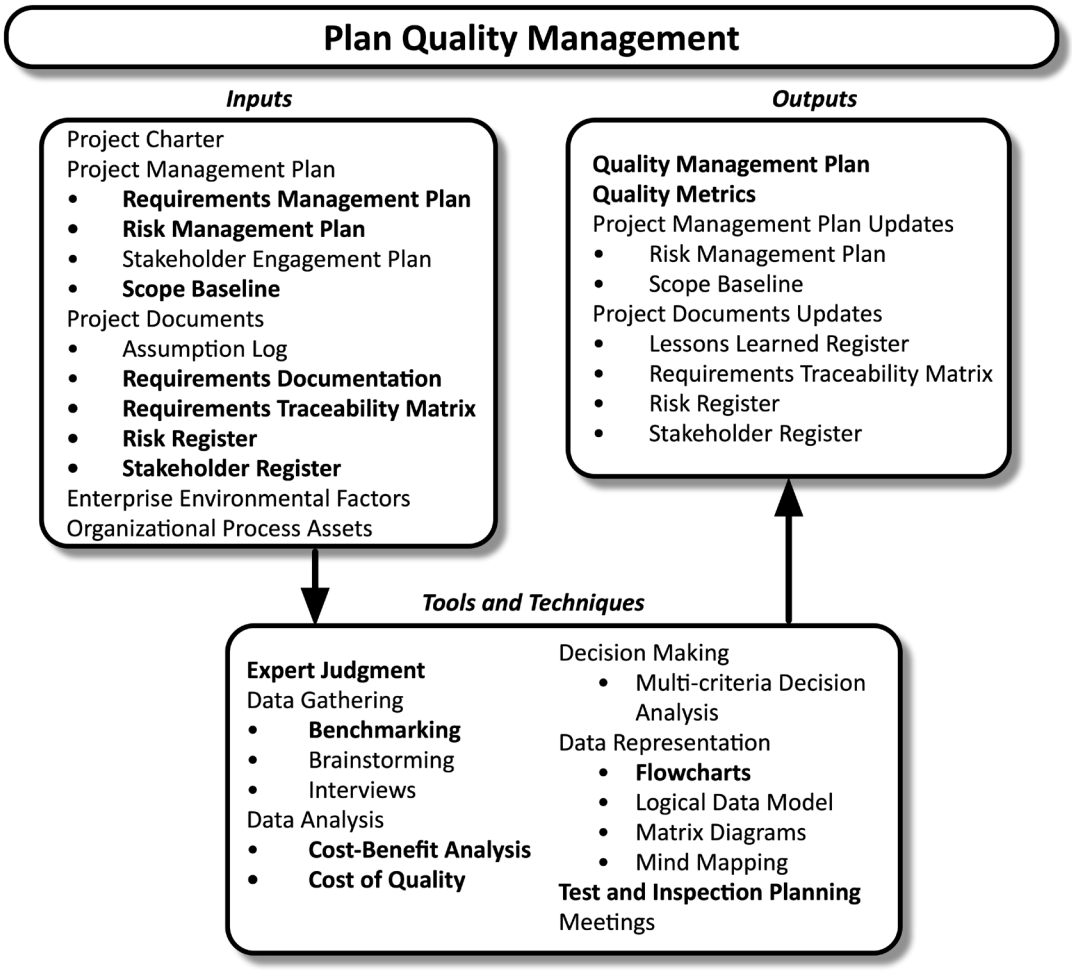

Figure 13-3: Plan Quality Management Data Flow Diagram

The source for the above figure is the Project Management Institute, *A Guide to the Project Management Body of Knowledge*, (*PMBOK® Guide*) – Sixth Edition, Project Management Institute Inc., 2017, Figure 8-3, Page 277

Plan Quality Management (Planning)		
Key Inputs	Requirements Management Plan	The requirements management plan is a component of the project management plan that details the evaluation, documentation, and administration of project requirements. It includes the methods for designing, monitoring, and reporting requirement activities and configuration activities; prioritizing requirements; determining requirement metrics; and capturing attributes for the requirements traceability matrix. It also includes the requirements for project approval, measurable project goals, and related success criteria that impact the quality management of the project.
	Risk Management Plan	The risk management plan is a component of the project management plan that details the manner in which risk management activities are configured and implemented. Typically it addresses risk strategy, risk methodology, roles and responsibilities, financing, timing, and classification. It documents processes and controls that influence the estimation and administration of cost. The risk management plan and the quality management plan are considered together to ensure product and project success.
	Scope Baseline	The scope baseline is the authorized version of project scope. It contains the project scope statement, the work breakdown structure (WBS), the work package, one or more planning packages, and the WBS dictionary. It describes the work the project is trying to complete. The baseline is subject to change management and is a component of the project management plan. The WBS and the scope statement (specially the deliverables, constraints, and assumptions) are referenced in order to establish appropriate quality standards and goals.
	Requirements Documentation	Requirements documentation delineates how requirements fulfill the business needs of the project. In order to baseline requirements, they must be measurable, testable, traceable, complete, consistent, and acceptable to appropriate stakeholders. Requirements may be categorized as **business requirements**, **stakeholder requirements**, **solution requirements** (both **functional** and **non-functional**), **transition requirements**, **project requirements**, and **quality requirements**. Once categorized, requirements can be refined as they evolve. Requirements related to quality are used to establish the manner in which project quality control is executed.

Plan Quality Management (Continued)		
Key Inputs (Cont.)	Requirements Traceability Matrix	To ensure that requirements add value, the requirements traceability matrix is a grid used to align requirements to the deliverables that satisfy them. The matrix allows the requirements to be monitored throughout the project life cycle and provides a framework for managing scope changes. At a minimum, requirements can be traced to business needs, project aims, project scope and WBS deliverables, product design and development, testing, and high-level requirements. The matrix associates product requirements with deliverables in an effort to ensure that each requirement is tested and that the tested requirements increase overall project quality.
	Risk Register	The risk register lists all identified risks, along with the owner of and potential response(s) to each risk. The register may also contain, for each risk, a short title, category, status, source(s), impact(s), trigger(s), WBS reference for affected activities, and timing data. Additionally, the register lists details regarding threats and opportunities that could impact quality, especially in areas that coincide with the needs and expectations of the customer and sponsor.
	Stakeholder Register	The stakeholder register delineates stakeholder information that includes, but is not limited to, identification data (name, position, location, contact information, and project role), assessment information (important requirements, expectations, and level of influence), and classification (internal or external, influence, or other classification model). The register is used to determine which stakeholders have an interest in or influence on quality, especially in areas that coincide with the needs and expectations of the customer and sponsor.
Key Tools & Techniques	Expert Judgment	Expert judgment is judgment based on expertise acquired in a specific area. It is often more significant and accurate than the best modeling tools available and can be provided by stakeholders, organizational personnel external to the project, professional organizations or groups, and consultants. It is important to consider expertise related to quality assurance, control, metrics, improvements and systems.

Plan Quality Management (Continued)		
Key Tools & Techniques (Cont.)	Benchmarking	Benchmarking is used to compare an organization's practices to those of corresponding organizations in order to identify best practices, ideas for improvement, and performance metrics. Benchmarking may involve projects inside or outside of the organization and from inside or outside the same application area.
	Cost-benefit Analysis	Cost-benefit analysis is a tool used to determine the most cost effective course of action by establishing and assessing the positives and negatives of those considered. If the planned quality activities are the most cost effective, quality requirements will be met and the project is likely to experience less rework, higher productivity, increased stakeholder satisfaction, and increased profitability.
	Cost of Quality	The cost of quality (COQ) considers **preventative costs** (costs associated with preventing unsatisfactory quality), **appraisal costs** (costs associated with evaluation and testing), and/or **failure costs** (costs associated with failure to meet the stakeholders' expectations) that relate to the result of the project (products, deliverables, and services). The cost of prevention and appraisal should be compared to the cost of failure in order to achieve the optimal balance. Models demonstrate that there is an optimal quality cost for a project.
	Flowcharts	Flowcharts graphically display the progression of activities (and their branching potential) for a process that converts one or more inputs into one or more outputs. They display the activities, decision points, branching loops, parallel paths, and order of processing. Flowcharts may be useful in determining the cost of quality for a process.
	Test and Inspection Planning	Test and inspection planning occurs during planning. The project manager and project team establish the manner in which the product, deliverable, or service will be tested or inspected in order to meet stakeholders' needs or expectations, correspond with the appropriate industry (e.g. strength tests for construction projects), and satisfy performance and reliability goals.

Plan Quality Management (Continued)		
Key Outputs	Quality Management Plan	The quality management plan is a component of the project management plan that details the manner in which the policies, methods, and criteria of the organization are executed. It details activities and necessary resources to accomplish quality goals. Typically the plan addresses quality criteria, roles and responsibilities, tools, objectives, control and quality management activities, and procedures (including those for continuous improvement). It also identifies the processes and deliverables subject to quality review.
	Quality Metrics	Quality metrics delineate the manner in which the Control Quality process verifies compliance with a project or product through its defined attributes. Quality metrics include cost performance, failure rate, defect frequency, maintainability, test coverage, and reliability among others.

Situational Question and Real World Application
Failure to effectively perform the Plan Quality Management process often produces project results that are out of alignment with the project scope statement. If the quality management plan does not reference the acceptance criteria included in the scope baseline, there can be no effective verification of acceptability or determination of the specific areas of unacceptability.

13.8.1. Quality Management Plan

The purpose of the quality management plan is to assist the project team in:

- Establishing the definition of quality for the project and its work (quality baseline)
- Establishing checklists to ensure processes are followed
- Defining all process steps
- Validating that established quality processes are effective
- Testing throughout development
- Formatting project/process data for communication to project stakeholders
- Responding effectively to any changes in the project's quality standards and processes

13.8.2. Grade vs. Quality

Understand the differences between grade and quality and how to apply them.

It is very important to understand the difference between grade and quality: while **grade** refers to the **characteristics of the product, quality** refers to the **stability or predictability of the product.**

A high-grade product is a product with high functionality (for instance, an automatic nail gun that can be used with 10 kinds of nails and can apply various levels of pressure, essentially meeting any type of nailing need). A low-grade product is a product with minimum functionality (for instance, an inexpensive nail gun that can only apply one level of pressure).

A high-quality product is designed and constructed for dependability and efficiency. It functions in accordance with customer requirements, is reasonably sturdy, and, if necessary, has clear and effective instructions. Any product that does not do this is lacking in quality.

13.8.3. Accuracy vs. Precision

It is also important to understand the difference between accuracy and precision.

Understand the differences between precision and accuracy.

Accuracy refers to the **alignment of a value with its target value.** For example, if the targeted output of a process is 300 milliliters, accuracy is determined by calculating how close the actual output is to the 300 milliliters target.

Precision refers to the **consistency of the output**. If a process has a targeted output of 300 milliliters, precision is determined by calculating the percentage of tests with an output of 300 milliliters in relation to the total number of tests.

13.8.4. Prevention vs. Inspection

Prevention, a proactive approach to quality, entails **eliminating defects and potential defects** from the process.

Inspection, a reactive approach to quality, entails discovering **errors or defects after the work is complete**.

13.8.5. Attribute Sampling vs. Variable Sampling

Attribute sampling entails **checking that the actual result conforms** to the expected result.

Variable sampling entails **rating the result on a continuous scale that determines the degree of conformity** to the expected result.

13.8.6. Tolerances vs. Control Limits

Understand the differences between prevention and inspection.

Tolerances are a **specified range of acceptable results**.

Control limits are **identified boundaries of common variation in a statistically stable process** or process performances.

13.8.7. Cost of Quality

The cost of quality is equal to the **cost of conformance and the cost of nonconformance**.

Conformance to quality is a proactive approach that typically requires paying for quality upfront by investing in initiatives that plan quality into the work. Examples of proactive investments are additional planning, testing throughout development (adjusting processes as needed to improve quality), and providing quality training to the team. Conformance to quality typically has a positive effect on team morale, customer perception, and product cost.

Nonconformance to quality is a reactive approach that typically requires paying for quality after the work is complete by investing in rework. Examples of reactive investments are the costs associated with rework in terms of salaries and materials. Nonconformance typically has a negative impact on team morale, customer perception, and product cost in the form of excessive inventory, waste, and warranty support.

Understand the cost of conformance and nonconformance.

Cost of Conformance and Cost of Nonconformance

Cost Item	Conformance (Prevention)	Nonconformance (Inspection)
Proactive analysis of process improvement	X	
Company training relating to quality and continuous improvement	X	
Reduced inventory	X	
Reduced warranty support	X	
Excessive inventory		X
Throwing away defective products		X
Warranty support		X
Reacting to problems after they occur		X

13.8.8. Design of Experiments

Know the definition and application of Design of Experiments (DOE).

Design of Experiments (DOE) is a statistical process used to determine the factors that can influence variables associated with a process or product. DOE should be applied during the Plan Quality Management process to determine the overall impact on the cost of quality based on testing types and number. It is useful when optimizing products or processes.

13.8.9. Just-in-Time (JIT)

Just-in-Time (JIT) is an inventory management process that results in little to no inventory, other than what is required to fulfill existing orders. Ideally, **zero inventory** is stocked and supplies arrive only when needed for product fulfillment. JIT reduces overall costs by lowering or eliminating the costs associated with unnecessary inventory.

Know the basics of Just-in-Time (JIT) inventory and that the amount of inventory needed is 0%.

13.8.10. Normal Distribution

Normal distribution is typically depicted as a bell shaped curve that represents a typical outcome from project activity with no abnormalities, that is a curve with an equal mean, medium, and mode. A variance in the bell shape (the curve is tighter or the "hill" is steeper) is still normal; the data is just much closer in the measurement. Other examples of distribution formats include **beta** and **triangular** distributions.

13.8.11. Sigma (σ)

Memorize the percentages of 1, 2, 3, and 6 sigma.

Sigma (σ), also known as standard deviation, is often used as a quality measure. **The formula for standard deviation is (P - O) / 6** where **P** represents Pessimistic and **O** represents Optimistic.

It is not necessary to become a statistician to understand the concept of sigma in relation to quality. Instead, apply the concept of "**Realistics™.**" Realistics™ was developed by Crosswind as a sensible way to approach sigma. While Six Sigma expresses sigma as +/- (for example 68.26% is +/- 1 sigma), Realistics™ would express 68.26% as 1 sigma.

The following diagram represents **68.26% as 1 sigma,** which is the typical quality standard used in the workplace. To meet the quality standard when producing 100 units, 68.26 or more units must work and 31.74 units or less (100% of 100 - 68.26% of 100) may fail. That failure rate leads to rework/waste costs.

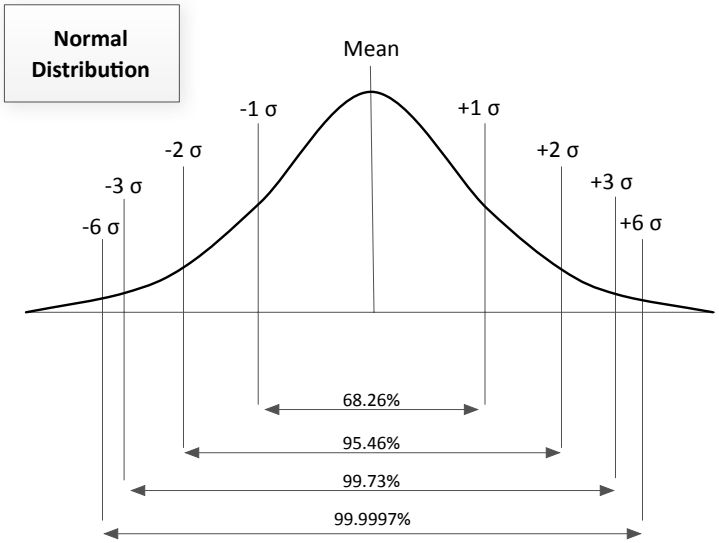

Figure 13-4: Normal Distribution Sample

By increasing the standard to **2 sigma** (**95.46%**), the quantity of expected passing measurement or product must be increased to 95.46 units out of 100 units (no more than 4.54 units can fail). While this decreases the cost of rework and waste, costs associated with achieving the standard (quality training and other proactive activities) must be considered. The precision used to calculate these values will result in slightly different answers (e.g., 68.26%, 68.27%, 68.28% etc.). Note that the exam might use percentages that vary slightly (68.2%, 95.0%, 99.7%, 99.999%) .

13.8.12. Probabilities

Understand the basics of probabilities and that the sum of all probabilities must equal 1.0 (100%).

A probability is the likelihood that something will occur. It can be expressed in a percentage (1%, 75%, 100%) or as a decimal (0.01, 0.75, 1.0). For the exam, it is key to understand that the sum of all probabilities equals 100% or 1.0.

13.8.13. Proprietary Quality Management Methodologies

Understand the more recognizable proprietary quality management methodologies and know when to apply them.

There are many proprietary quality management methodologies. Among the more recognizable are:

- CMMI
- Six Sigma
- Lean Six Sigma
- Quality Function Deployment

13.8.14. Six Sigma

Six Sigma is a modern quality philosophy made popular by Motorola and other companies in the late 80s. It involves setting a very high standard of 6 sigma for the products or processes that the company produces. In essence, this philosophy states that at least **99.9997%** of everything created, or processes executed, are virtually error-free.

13.8.15. ISO 9000 (International Organization for Standardization)

The International Organization for Standardization (ISO) standard is associated with companies that wish to document and adhere to their processes. While quality improvement is not always a result of this standard, the repeatability associated with it typically shows a positive benefit. A company can also use this standard as a requirement for its partners to ensure they have defined repeatable processes.

Generally ISO involves:

- Documenting what is done
- Doing what is documented
- Documenting any variance (from the normal processes)

13.8.16. Quality Responsibility

It is very important to know the level of responsibility for quality by role.

This knowledge:

- May be required to correctly answer some question on the exam
- May ensure that project quality will not slip as a result of a misunderstanding regarding which role is responsible for quality

The following table details three roles, their levels of responsibility, and an example.

Role	Level of Responsibility	Example
Team member or worker	Responsible for the quality of their own work	The electrician is accountable for doing satisfactory work on the job.
Project Manager	Responsible for the quality standards on the project	The project manager is responsible for the quality of the networking project.
Senior/Executive Management	Responsible for the quality standards at the organization	The CEO and senior management are responsible for quality at the organization.

Know at what point the worker, the project manager, and senior management are responsible for quality.

The source for the above text is the Project Management Institute, *A Guide to the Project Management Body of Knowledge*, (*PMBOK® Guide*) – Sixth Edition, Project Management Institute Inc., 2017, Pages 277-287

13.9. Manage Quality (Executing Process Group)

Know the Key Inputs, Tools & Techniques, and Outputs for Manage Quality.

Manage Quality is the process of executing the project quality management plan and verifying/validating that the quality standards defined for the project will meet the desired standards. This process **validates the quality process, not the product,** by taking a random sampling of items created in order to verify a desired level of acceptability.

During Manage Quality, the quality management plan is executed.

For the situational questions on the exam, the Project Management Institute, Inc. assumes that the environment has a quality assurance initiative and a quality assurance/audit system in place.