



Version 6.1 Updated for the 2021
Project Management Professional (PMP)[®] Exam



Crosswind Success Series: PMP[®] Exam Bootcamp Manual

www.crosswindpm.com

Tony Johnson, MBA, CAPM, PMP, PgMP, PfMP

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

PMP, PMI and PMBOK are registered marks of the Project Management Institute, Inc.

13.10. Control Quality (Monitoring and Controlling Process Group)

Control Quality is the process area in which the **product, or the output of the process, is measured against the specifications.**

During Control Quality, project results are measured against the approved standard.

There are a number of tools/techniques and outputs that are key to Control Quality, but their usefulness depends on the type of work being done.

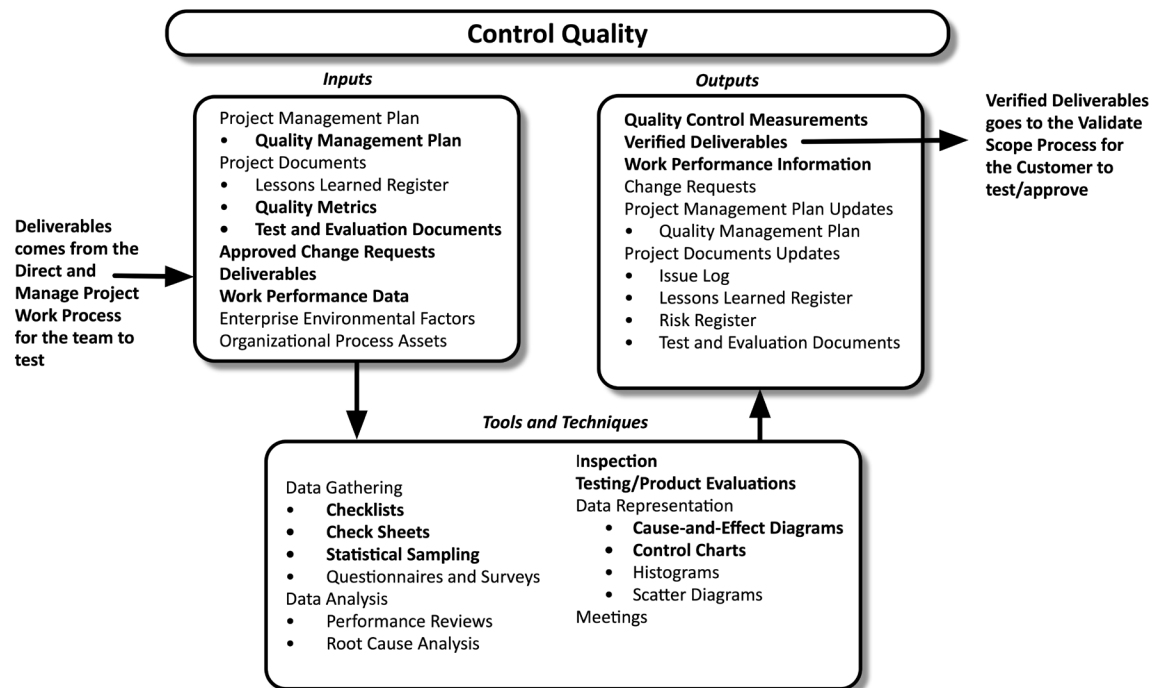


Figure 13-6: Control Quality Data Flow Diagram

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 8-10, Page 298

Control Quality (Monitoring and Controlling)

| | | |
|-------------------|-------------------------------|--|
| Key Inputs | 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 delineates the expected level of quality for the project and product, details the manner in which this level will be achieved, and provides instructions for the disposition of nonconforming products and related corrective action. The plan details activities and necessary resources to accomplish quality goals. Typically it addresses quality criteria, roles and responsibilities, tools, objectives, control and quality management activities, and procedures (including those for continuous improvement). Note that modification of the agreed-upon approach may be required due to actual results. |
| | Quality Metrics | Quality metrics delineate the manner in which the determination is made that a project or product conforms to its defined attributes. Quality metrics include cost performance, failure rate, defect frequency, maintainability, test coverage, and reliability among other metrics. |
| | Test and Evaluation Documents | Test and evaluation documents are used to assess the realization of quality goals. The documents can be generated based on industry needs and organizational templates. Dedicated checklists and a detailed requirements traceability matrix can be included in the documentation. |
| | Approved Change Requests | Approved change requests are requests for modification that have been approved by authorized personnel during the formal change control process. The changes can expand or contract the scope of the project and modify policies, procedures, the project management plan, budgets, and schedules. Approved change requests include such items as correction of defects, revised approaches to the work of the project, and revised schedules. An approved change implementation should be verified, its completeness confirmed, retested, and then certified for correctness. Any change to the status of a change request must be updated in the change request log. |
| | Deliverables | Deliverables are singular and verifiable products, results, or capabilities that result in a verifiable deliverable required by the project. |

| Control Quality (Continued) | | |
|------------------------------------|-----------------------------|--|
| Key Inputs (Cont.) | Work Performance Data | Work performance data represents the raw metrics and observations identified during the performance of project work activities. It contains information about product status, including observations, quality metrics, technical performance measurements, and quality-related schedule performance and cost performance data. |
| Key Tools & Techniques | Checklists | Checklists are utilized to ensure that quality activities are managed in a structural manner. Standardized checklists developed by the organization or the industry are often used. |
| | Check Sheets | Check sheets, also known as tally sheets, are utilized to organize facts in a manner that will make data regarding a potential quality problem easier to collect. A check sheet used to gather attributes data while performing an inspection is very effective for identifying the frequency with which defects occur. |
| | Statistical Sampling | Statistical sampling selects a portion of a defined population, such as 100 of the 2000 product population, for examination. Controls are measured and quality is authenticated against the sampling. Sampling frequency and extent are typically resolved during planning. |
| | Inspection | An inspection is used to analyze the item under review in order to identify any nonconformance to the quality standards for the item or to verify defect corrections. Inspection results typically include metrics. |
| | Testing/Product Evaluations | Testing/product evaluations are used to identify errors, defects, bugs, and nonconformance issues in the product or service as documented in the requirements. The quality management plan dictates the type, frequency, and limits of the testing in accordance with the nature, schedule, and budget of the project. |
| | Cause-and-effect Diagrams | Cause-and-effect diagrams, also known as fishbone, Ishikawa, or why-why diagrams, are used to decompose the identified causes of a problem statement into separate branches in order to determine the root cause of a problem. They are also used to forecast possible effects of quality defects and inaccuracies. |

| Control Quality (Continued) | | |
|---|------------------------------|---|
| Key Tools & Techniques (Cont.) | Control Charts | Control charts are utilized to decide if a process is stable or performs predictably. Upper and lower specification limits are applied in accordance with the requirements of the agreement. Control charts can be used to determine the points at which action should be taken to avert performance that falls outside control limits. |
| Key Outputs | Quality Control Measurements | Quality control measurements are results of activities performed during the Control Quality process. They are acquired and recorded in the format set forth in the quality management plan. |
| | Verified Deliverables | Verified deliverables are deliverables that have been subjected to the Control Quality process, but not yet formally accepted. They are subject to customer acceptance as a result of the Validate Scope process. |
| | Work Performance Information | Work performance information is performance data gathered from control processes and subsequently evaluated in comparison with the components of the project management plan and other applicable artifacts. It includes information about the fulfillment of the project requirements, reasons for any rejections, required rework, list of verified deliverables, suggested corrective actions, metrics status, and required adaptation of processes. |

Situational Question and Real World Application

Failure to effectively perform or fully implement the Control Quality process can result in excessive rework of the product being created and/or product returns by the customer.

13.10.1. Testing

Control Quality **tests the process output**. There are many items to consider when testing. Typically, these items are addressed in Plan Quality Management, but applied in Control Quality.

13.10.2. Sample Testing vs. Population Testing

It is very important to establish the optimal rate of testing for the project to avoid both over-testing, which may result in increased cost, and under-testing, which may result in decreased quality.

There are two types of testing: **population testing** and **sample testing**.

Population testing tests every item created (for example, every airplane built). It is used if the confidence level needs to be 100%, such as with an election or with medical manufacturing.

Sample testing tests a predetermined percentage of every item created. The optimum percentage ensures the discovery of defects, while keeping testing costs to a reasonable level. The percentage may start with an educated guess (one of every ten items), then evolve to a more reasonable percentage if the Manage Quality process indicates that the percentage is too low (little or no failures) or too high (some failures, but not enough to justify the costs of additional testing). Obviously, the higher the percentage tested, the higher the confidence level.



Understand the principles of measuring a sample compared to measuring the entire population.

13.10.3. Variable

A variable is a generic characteristic, such as capacity or height, measured during the Control Quality process.

13.10.4. Attribute

An attribute is a **specific measurement that is typically recorded**. For example, **square feet, inches, or meters**.

A variable must be defined **before** an attribute can be defined.



Know what variables and attributes are as they relate to quality.

13.10.5. Statistical Independence

Statistical independence is the state in which the **outcomes of processes are separate from one another**. As an example, buying a lottery ticket last week doesn't increase the odds of winning the lottery this week.



Understand statistical independence and mutual exclusivity.

13.10.6. Mutual Exclusivity

Mutual exclusivity is a principal that states that selecting an attribute for a single instance excludes all other attribute choices. For instance, if the capacity of the elevator is 500 pounds, the capacity of that same elevator cannot also be 100 pounds.

13.10.7. Heuristic

A heuristic is an aid to problem solving or learning that may not be perfect, but will serve to meet immediate goals.

For example, to quickly determine if \$100 is sufficient to pay for five items, round and approximate to the nearest \$10 increment. Instead of trying to add \$12.13, \$19.99, \$5.76, \$3.47, and \$10.42, add \$10, \$20, \$10, \$10, and \$10. Without rounding and approximation, the answer is \$51.77. With rounding and approximation, the answer is \$60.00.

13.10.8. Special Causes vs. Common Causes

Special causes, sometimes called **unusual events**, are activities or results that typically do not occur during a process. **Common causes**, sometimes called **random causes** or **normal process variations**, are variations that can occur within a process or random events.

13.10.9. Rolled Throughput Yield (RTY)

Rolled Throughput Yield (RTY) is a term used in Six Sigma to describe the probability that a unit can pass through a process without defects. It is the product of the first pass yields (Y) at each step:

$$RTY = Y_1 \times Y_2 \times Y_3 \times \dots \times Y_n$$

In the following example, there are three stages to the process performed on 100 units. In stage one, the 100 units have 10 defects resulting in a 90% (0.9) RTY. In stage two, the remaining 90 units have 18 defects, resulting in an 80% (0.8) RTY. In stage three, the remaining 72 units have seven defects, resulting in a 90% (0.9) RTY. The cumulative affect of the three stages (0.9 x 0.8 x 0.9) is 0.648.

| Process Stage | Units | Defects | RTY |
|----------------|-------|---------|-------|
| 1 | 100 | 10 | 0.9 |
| 2 | 90 | 18 | 0.8 |
| 3 | 72 | 7 | 0.9 |
| Results | 65 | 35 | 0.648 |

13.11. The Basic Tools of Quality

The basic quality tools are used to resolve quality issues. They include check sheets and checklists, flowcharts, histograms, Pareto diagrams, scatter diagrams, control (run) charts, cause-and-effect diagrams, and the Five WHYS.

13.11.1. Check Sheets and Checklists

Check sheets are tools used to capture and categorize quantitative or qualitative data.

Check sheets can be used for tracking such items as instances of process failure in specific areas over a specific period of time. The example in Figure 13-7: Check Sheet depicts the daily calls received by a business.

| Reason | Mon | Tues | Wed | Thurs | Fri |
|--------------|-----------|-----------|-----------|-----------|-----------|
| Wrong Number | 3 | 5 | 2 | 1 | 3 |
| Info Request | 12 | 10 | 12 | 13 | 16 |
| Sales Order | 15 | 15 | 20 | 18 | 13 |
| Boss | 4 | 4 | 4 | 5 | 8 |
| Total | 34 | 34 | 38 | 37 | 40 |

Figure 13-7: Check Sheet

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 8-12, Page 302

Checklists are tools used to ensure that all process steps have been completed as planned. The use of checklists can improve quality and eliminate defects.