CHAPTER 8

PROJECT QUALITY MANAGEMENT

Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. It implements the quality management system through policy and procedures with continuous process improvement activities conducted throughout, as appropriate.

Figure 8-1 provides an overview of the Project Quality Management processes which include the following:

8.1 Plan Quality—The process of identifying quality requirements and/or standards for the project and product, and documenting how the project will demonstrate compliance.

8.2 Perform Quality Assurance—The process of auditing the quality requirements and the results from quality control measurements to ensure appropriate quality standards and operational definitions are used.

8.3 Perform Quality Control—The process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes.

These processes interact with each other and with the processes in the other Knowledge Areas. Each process can involve effort from one or more persons or groups based on the project requirements. Each process occurs at least once in every project and occurs in one or more of the project phases, if the project is divided into phases. Although the processes are presented here as discrete elements with well-defined interfaces, in practice they may overlap and interact in ways not detailed here. Process interactions are discussed in detail in Chapter 3.

Project Quality Management addresses the management of the project and the product of the project. It applies to all projects, regardless of the nature of their product. Product quality measures and techniques are specific to the type of product produced by the project. While quality management of software products uses different approaches and measures than building a nuclear power plant, Project Quality Management approaches apply to both. In either case, failure to meet product or project quality requirements can have serious negative consequences for any or all of the project stakeholders. For example:

- Meeting customer requirements by overworking the project team may result in increased employee attrition, errors, or rework.
- Meeting project schedule objectives by rushing planned quality inspections may result in undetected errors.

Quality and grade are not the same. Quality is "the degree to which a set of inherent characteristics fulfill requirements [**4**]." Grade is a category assigned to products or services having the same functional use but different technical characteristics [**5**]. While a quality level that fails to meet quality requirements is always a problem, low grade may not be. For example, a software product can be of high quality (no obvious defects, readable manual) and low grade (a limited number of features), or of low quality (many defects, poorly organized user documentation) and high grade (numerous features). The project manager and the project management team are responsible for managing the tradeoffs involved to deliver the required levels of both quality and grade.

Precision and accuracy are not equivalent. Precision means the values of repeated measurements are clustered and have little scatter. Accuracy means that the measured value is very close to the true value. Precise measurements are not necessarily accurate. A very accurate measurement is not necessarily precise. The project management team must determine appropriate levels of accuracy and precision.

The basic approach to quality management described in this section is intended to be compatible with that of the International Organization for Standardization (ISO). This is compatible with proprietary approaches to quality management such as those recommended by Deming, Juran, Crosby, and others, and non-proprietary approaches such as Total Quality Management (TQM), Six Sigma, failure mode and effect analysis (FMEA), design reviews, voice of the customer, cost of quality (COQ), and continuous improvement.

Modern quality management complements project management. Both disciplines recognize the importance of:

- **Customer satisfaction.** Understanding, evaluating, defining, and managing expectations so that customer requirements are met. This requires a combination of conformance to requirements (to ensure the project produces what it was created to produce) and fitness for use (the product or service must satisfy real needs).
- **Prevention over inspection.** One of the fundamental tenets of modern quality management states that quality is planned, designed, and built in—not inspected in. The cost of preventing mistakes is generally much less than the cost of correcting them when they are found by inspection.

- **Continuous improvement.** The plan-do-check-act cycle is the basis for quality improvement as defined by Shewhart and modified by Deming. In addition, quality improvement initiatives undertaken by the performing organization, such as TQM and Six Sigma, should improve the quality of the project's management as well as the quality of the project's product. Process improvement models include Malcolm Baldrige, Organizational Project Management Maturity Model (OPM3®), and Capability Maturity Model Integrated (CMMI®).
- **Management Responsibility.** Success requires the participation of all members of the project team, but remains the responsibility of management to provide the resources needed to succeed.

Cost of quality (COQ) refers to the total cost of all efforts related to quality throughout the product life cycle. Project decisions can impact operational costs of quality as a result of product returns, warranty claims, and recall campaigns. Therefore, due to the temporary nature of a project, the sponsoring organization may choose to invest in product quality improvement, especially defect prevention and appraisal, to reduce the external cost of quality.

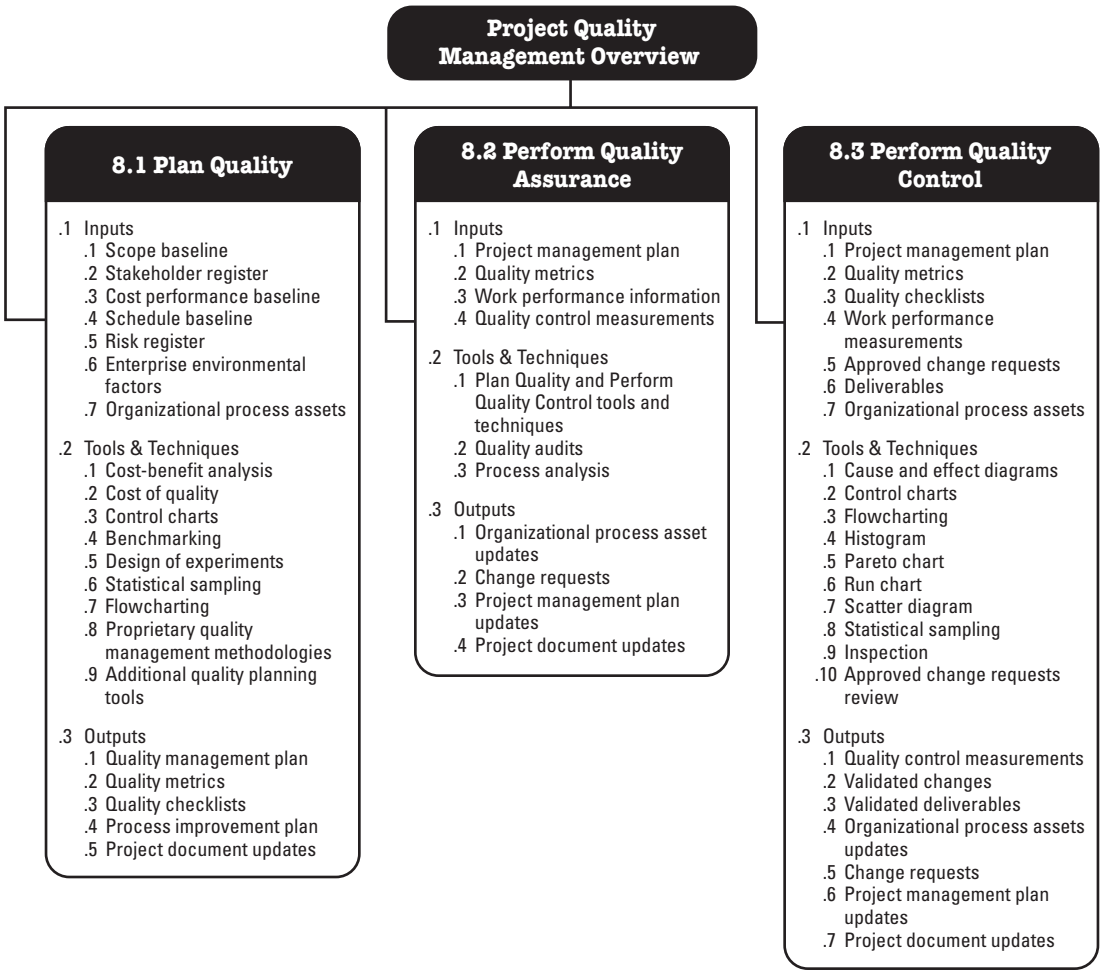

Figure 8-1. Project Quality Management Overview

8.1 Plan Quality

Plan Quality is the process of identifying quality requirements and/or standards for the project and product, and documenting how the project will demonstrate compliance. See Figures 8-2 and 8-3.

Quality planning should be performed in parallel with the other project planning processes. For example, proposed changes in the product to meet identified quality standards may require cost or schedule adjustments and a detailed risk analysis of the impact to plans.

The quality planning techniques discussed here are those most frequently used on projects. There are many others that may be useful on certain projects or in some application areas.

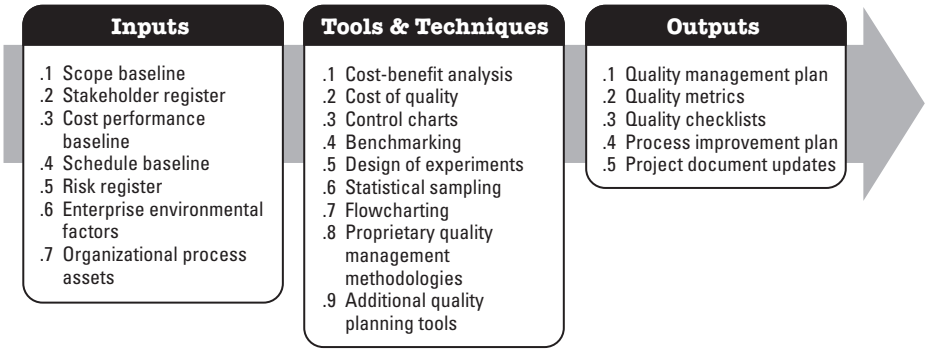

Figure 8-2. Plan Quality Inputs, Tools & Techniques, and Outputs

8.1.1 Plan Quality: Inputs

.1 Scope Baseline

- **Scope statement.** The scope statement contains the project description, major project deliverables, and acceptance criteria. The product scope description will often contain details of technical issues and other concerns that can affect quality planning. The definition of acceptance criteria can significantly increase or decrease project costs and quality costs. Satisfying all acceptance criteria implies the needs of the customer have been met.
- **WBS.** The WBS identifies the deliverables, the work packages and the control accounts used to measure project performance.
- **WBS Dictionary.** The WBS dictionary defines technical information for WBS elements.

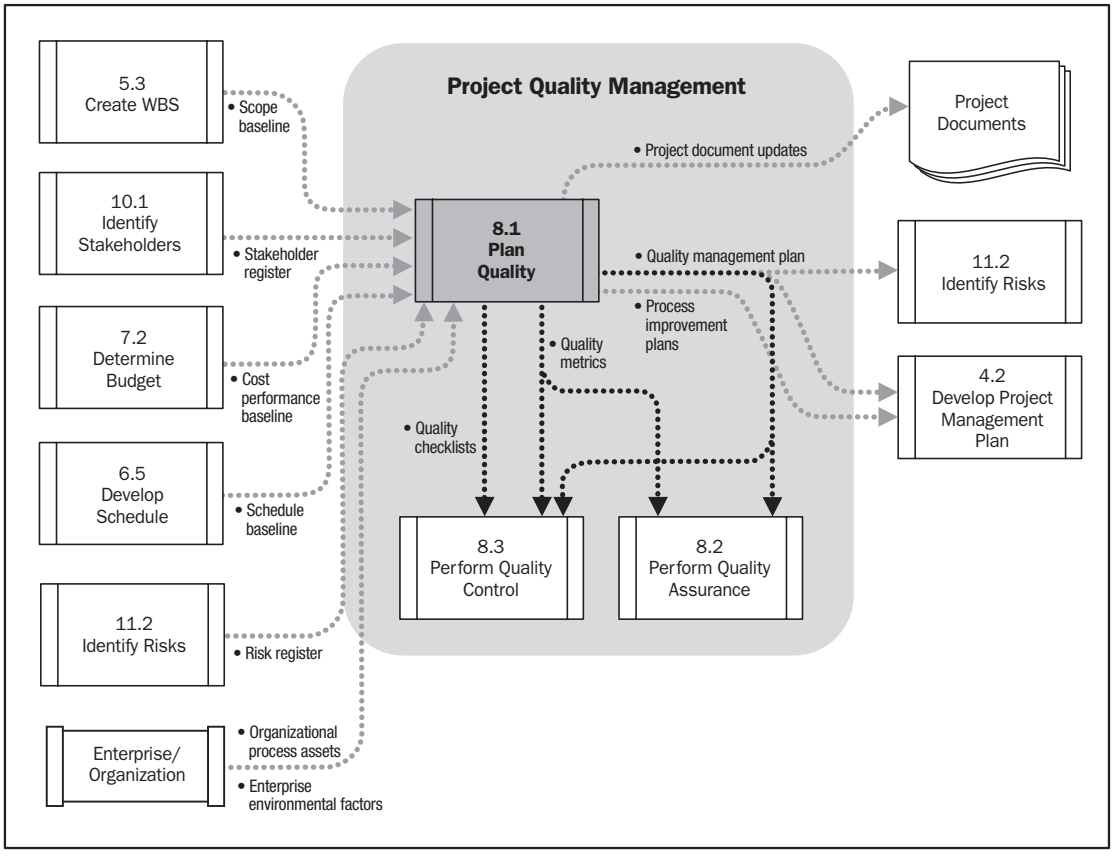

Figure 8-3. Plan Quality Data Flow Diagram

.2 Stakeholder Register

The stakeholder register identifies stakeholders with a particular interest in, or impact on, quality.

.3 Cost Performance Baseline

The cost performance baseline documents the accepted time phase used to measure cost performance (Section 7.2.3.1).

.4 Schedule Baseline

The schedule baseline documents the accepted schedule performance measures including start and finish dates (Section 6.5.3.2).

.5 Risk Register

The risk register contains information on threats and opportunities that may impact quality requirements (Section 11.2.3.1).

.6 Enterprise Environmental Factors

The enterprise environmental factors that influence the Plan Quality process include, but are not limited to:

- Governmental agency regulations,
- Rules, standards, and guidelines specific to the application area, and
- Working/operating conditions of the project/product which may affect project quality.

.7 Organizational Process Assets

The organizational process assets that influence the Plan Quality process include, but are not limited to:

- Organizational quality policies, procedures, and guidelines,
- Historical databases,
- Lessons learned from previous projects, and
- Quality policy, as endorsed by senior management, which sets the intended direction of a performing organization with regard to quality. The quality policy of the performing organization for their products often can be adopted "as is" for use by the project. If the performing organization lacks a formal quality policy, or if the project involves multiple performing organizations (as with a joint venture), the project management team will need to develop a quality policy for the project. Regardless of the origin of the quality policy, the project management team must ensure that the project stakeholders are fully aware of the policy used for the project through the appropriate distribution of information.

8.1.2 Plan Quality: Tools and Techniques

.1 Cost-Benefit Analysis

The primary benefits of meeting quality requirements can include less rework, higher productivity, lower costs, and increased stakeholder satisfaction. A business case for each quality activity compares the cost of the quality step to the expected benefit.

.2 Cost of Quality (COQ)

Cost of quality includes all costs incurred over the life of the product by investment in preventing nonconformance to requirements, appraising the product or service for conformance to requirements, and failing to meet requirements (rework). Failure costs are often categorized into internal (found by the project) and external (found by the customer). Failure costs are also called cost of poor quality. Figure 8-4 provides some examples to consider in each area.

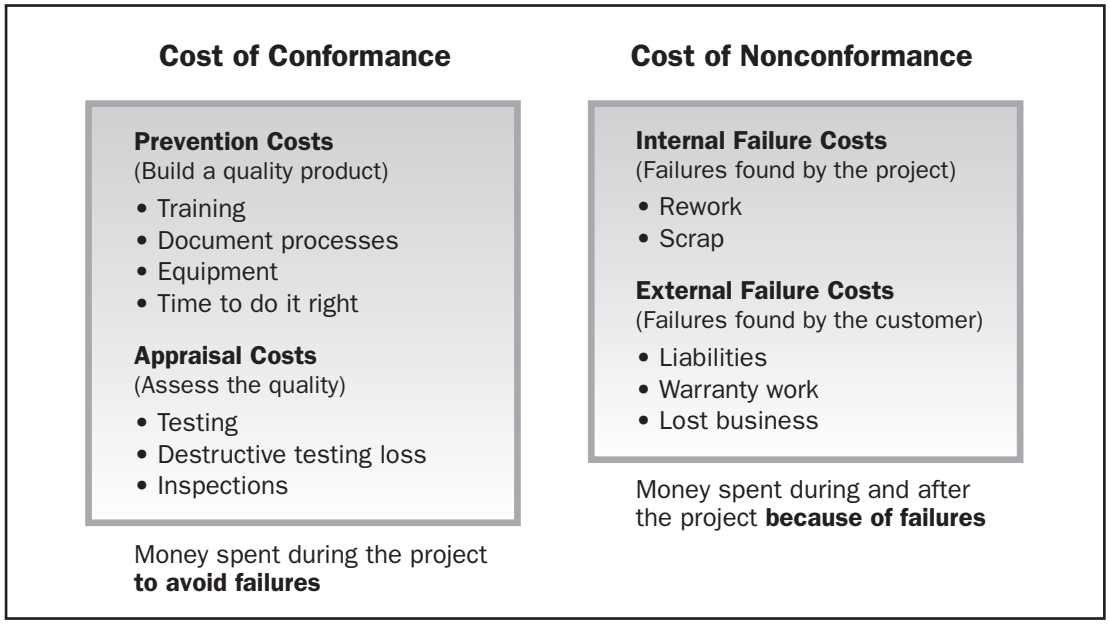

Figure 8-4. Cost of Quality

.3 Control Charts

Control charts are used to determine whether or not a process is stable or has predictable performance. Upper and lower specification limits are based on requirements of the contract. They reflect the maximum and minimum values allowed. There may be penalties associated with exceeding the specification limits. Upper and lower control limits are set by the project manager and appropriate stakeholders to reflect the points at which corrective action will be taken to prevent exceeding specification limits. For repetitive processes, the control limits are generally $\pm 3\sigma$. A process is considered out of control when a data point exceeds a control limit or if seven consecutive points are above or below the mean.

Control charts can be used to monitor various types of output variables. Although used most frequently to track repetitive activities required for producing manufactured lots, control charts may also be used to monitor cost and schedule variances, volume, and frequency of scope changes, or other management results to help determine if the project management processes are in control. Figure 8-5 shows a control chart that tracks recorded project hours. Figure 8-6 shows measured product defects compared to fixed limits.

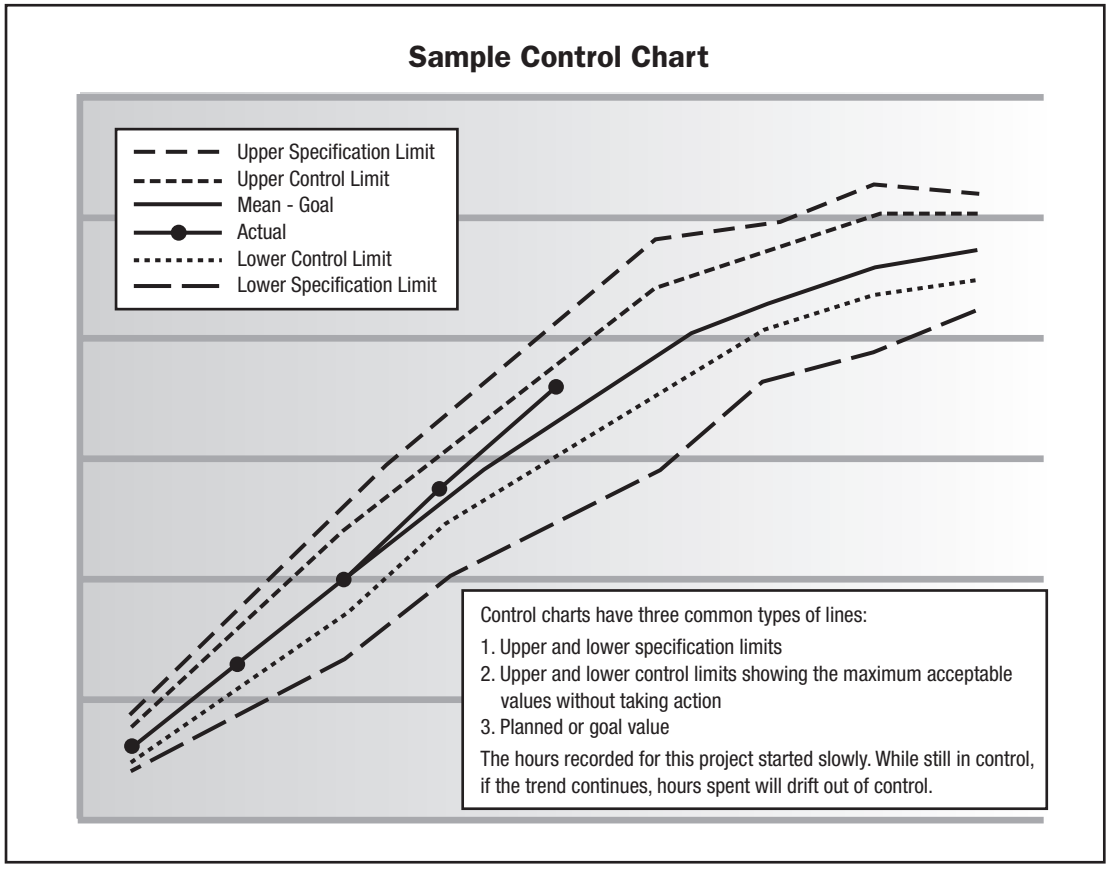

Figure 8-5. Sample Control Chart

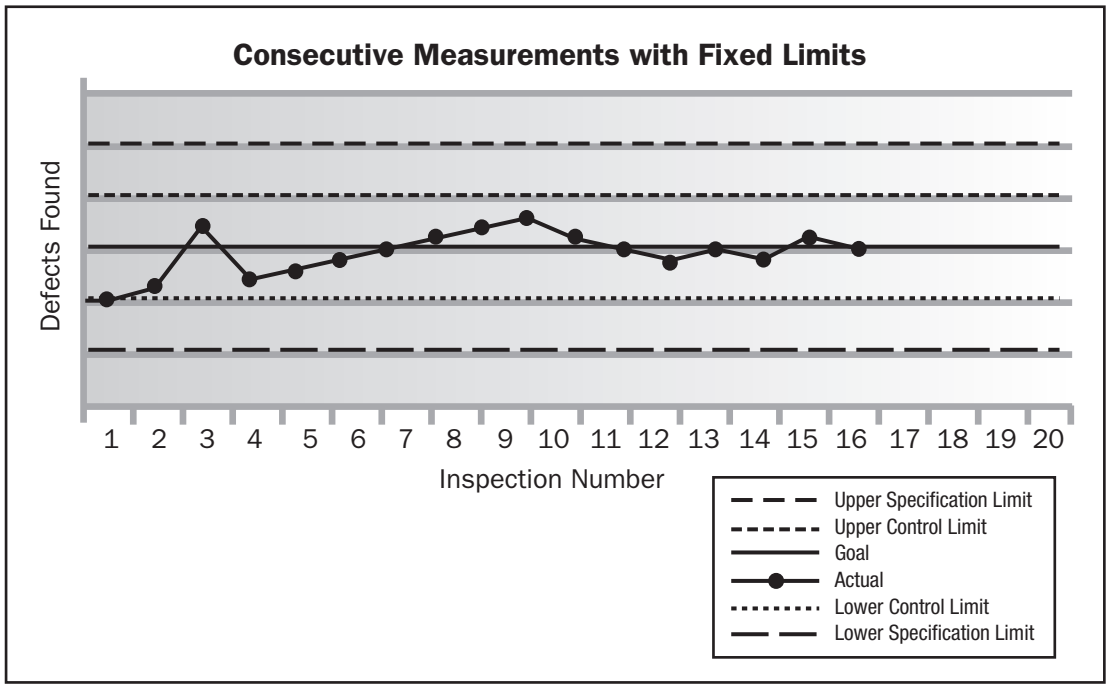

Figure 8-6. Control Chart of Consecutive Measurements with Fixed Limits

.4 Benchmarking

Benchmarking involves comparing actual or planned project practices to those of comparable projects to identify best practices, generate ideas for improvement, and provide a basis for measuring performance. These other projects can be within the performing organization or outside of it and can be within the same or in another application area.

.5 Design of Experiments

Design of experiments (DOE) is a statistical method for identifying which factors may influence specific variables of a product or process under development or in production. DOE should be used during the Plan Quality process to determine the number and type of tests and their impact on cost of quality.

DOE also plays a role in the optimization of products or processes. DOE can be used to reduce the sensitivity of product performance to sources of variations caused by environmental or manufacturing differences. One important aspect of this technique is that it provides a statistical framework for systematically changing all of the important factors, rather than changing the factors one at a time. Analysis of the experimental data should provide the optimal conditions for the product or process, highlight the factors that influence the results, and reveal the presence of interactions and synergy among the factors. For example, automotive designers use this technique to determine which combination of suspension and tires will produce the most desirable ride characteristics at a reasonable cost.

.6 Statistical Sampling

Statistical sampling involves choosing part of a population of interest for inspection (for example, selecting ten engineering drawings at random from a list of seventy-five). Sample frequency and sizes should be determined during the Plan Quality process so the cost of quality will include the number of tests, expected scrap, etc.

There is a substantial body of knowledge on statistical sampling. In some application areas it may be necessary for the project management team to be familiar with a variety of sampling techniques to assure the sample selected actually represents the population of interest.

.7 Flowcharting

A flowchart is a graphical representation of a process showing the relationships among process steps. There are many styles, but all process flowcharts show activities, decision points, and the order of processing. During quality planning, flowcharting can help the project team anticipate quality problems that might occur. An awareness of potential problems can result in the development of test procedures or approaches for dealing with them. Figure 8-7 is an example of a process flowchart for design reviews.

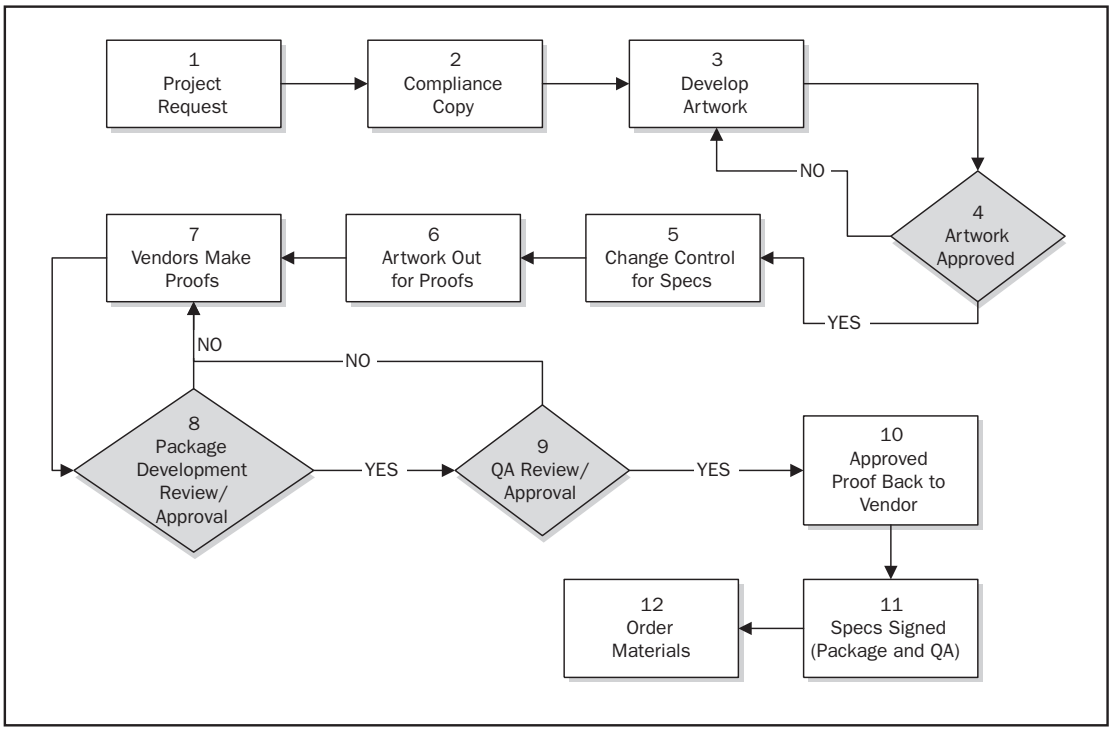

Figure 8-7. Process Flowchart

.8 Proprietary Quality Management Methodologies

These include Six Sigma, Lean Six Sigma, Quality Function Deployment, CMMI®, etc. Many other methodologies exist—this is not intended to be a recommended or complete list of examples.

.9 Additional Quality Planning Tools

Other quality planning tools are often used to better define the quality requirements and plan effective quality management activities. These include, but are not limited to:

- **Brainstorming** (defined in Section 11.2.2.2).
- **Affinity diagrams,** used to visually identify logical groupings based on natural relationships.
- **Force field analysis,** which are diagrams of the forces for and against change.
- **Nominal group techniques,** to allow ideas to be brainstormed in small groups and then reviewed by a larger group.

- **Matrix diagrams,** which include two, three, or four groups of information and show relationships between factors, causes, and objectives. Data in a matrix is organized in rows and columns with intersecting cells that can be filled with information that describes the demonstrated relationship between the items located in the row and column.
- **Prioritization matrices,** which provide a way of ranking a diverse set of problems and/or issues (usually generated through brainstorming) by their importance.

8.1.3 Plan Quality: Outputs

.1 Quality Management Plan

The quality management plan describes how the project management team will implement the performing organization's quality policy. It is a component or a subsidiary plan of the project management plan (Section 4.2.3.1).

The quality management plan provides input to the overall project management plan and includes quality control, quality assurance, and continuous process improvement approaches for the project.

The quality management plan may be formal or informal, highly detailed, or broadly framed. The style and detail is determined by the requirements of the project. The quality management plan should be reviewed early in the project to ensure that decisions are based on accurate information. The benefits of this review can include reduction of cost and schedule overruns caused by rework.

.2 Quality Metrics

A quality metric is an operational definition that describes, in very specific terms, a project or product attribute and how the quality control process will measure it. A measurement is an actual value. The tolerance defines the allowable variations on the metrics. For example, a metric related to the quality objective of staying within the approved budget by ± 10% could be to measure the cost of every deliverable and determine the percent variance from the approved budget for that deliverable. Quality metrics are used in the quality assurance and quality control processes. Some examples of quality metrics include on-time performance, budget control, defect frequency, failure rate, availability, reliability, and test coverage.

.3 Quality Checklists

A checklist is a structured tool, usually component-specific, used to verify that a set of required steps has been performed. Checklists range from simple to complex based on project requirements and practices. Many organizations have standardized checklists available to ensure consistency in frequently performed tasks. In some application areas, checklists are also available from professional associations or commercial service providers. Quality checklists are used in the quality control process.

.4 Process Improvement Plan

The process improvement plan is a subsidiary of the project management plan (Section 4.2.3.1). The process improvement plan details the steps for analyzing processes to identify activities which enhance their value. Areas to consider include:

- **Process boundaries.** Describes the purpose of processes, their start and end, their inputs/outputs, the data required, the owner, and the stakeholders.
- **Process configuration.** A graphic depiction of processes, with interfaces identified, used to facilitate analysis.
- **Process metrics.** Along with control limits, allows analysis of process efficiency.
- **Targets for improved performance.** Guides the process improvement activities.

.5 Project Document Updates

Project documents that may be updated include, but are not limited to:

- Stakeholder register, and
- Responsibility Assignment Matrix (Section 9.1.2.1).

8.2 Perform Quality Assurance

Perform Quality Assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure appropriate quality standards and operational definitions are used. See Figures 8-8 and 8-9. Perform Quality Assurance is an execution process that uses data created during Perform Quality Control (Section 8.3).

A quality assurance department, or similar organization, often oversees quality assurance activities. Quality assurance support, regardless of the unit's title, may be provided to the project team, the management of the performing organization, the customer or sponsor, as well as other stakeholders not actively involved in the work of the project.

Perform Quality Assurance also provides an umbrella for continuous process improvement, which is an iterative means for improving the quality of all processes. Continuous process improvement reduces waste and eliminates activities that do not add value. This allows processes to operate at increased levels of efficiency and effectiveness.

Figure 8-8. Perform Quality Assurance: Inputs, Tools & Techniques, and Outputs

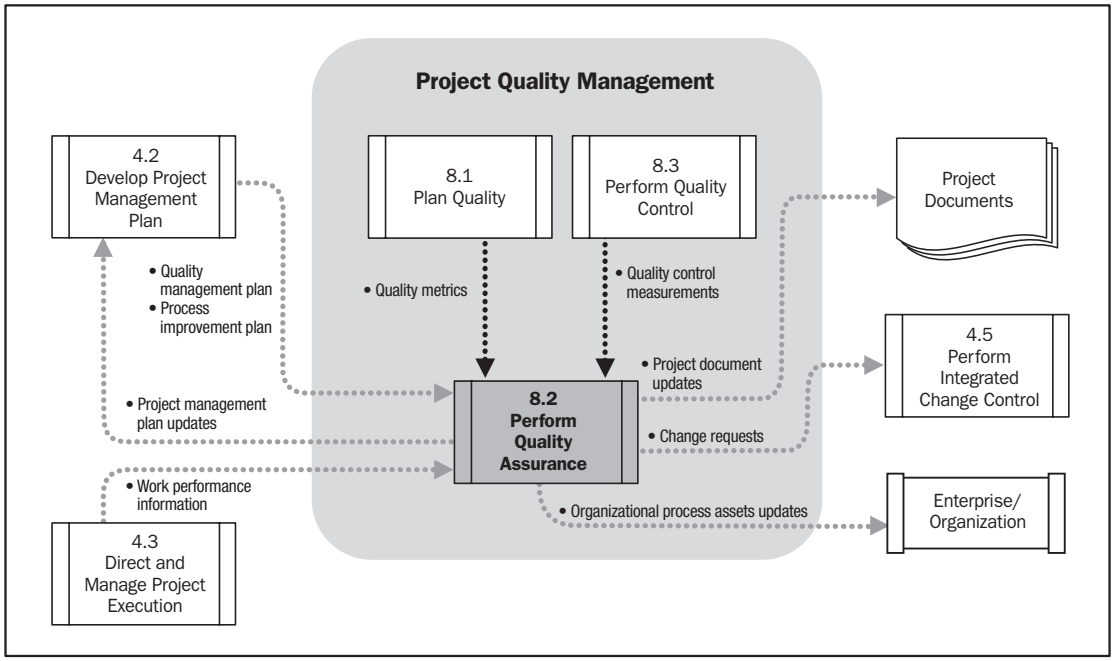

Figure 8-9. Perform Quality Assurance Data Flow Diagram

8.2.1 Perform Quality Assurance: Inputs

.1 Project Management Plan

The project management plan described in Section 4.2.3.1 contains the following information that is used to assure quality:

- **Quality management plan.** The quality management plan describes how quality assurance will be performed within the project.
- **Process improvement plan.** The process improvement plan details the steps for analyzing processes to identify activities which enhance their value.

.2 Quality Metrics

Described in Section 8.1.3.2.

.3 Work Performance Information

Performance information from project activities is routinely collected as the project progresses. Performance results which may support the audit process include, but are not limited to:

- Technical performance measures,
- Project deliverables status,
- Schedule progress, and
- Costs incurred.

.4 Quality Control Measurements

Quality control measurements are the results of quality control activities. They are used to analyze and evaluate the quality standards and processes of the performing organization (Section 8.3.3.1).

8.2.2 Perform Quality Assurance: Tools and Techniques

.1 Plan Quality and Perform Quality Control Tools and Techniques

Tools and techniques from Plan Quality and Perform Quality Control, are discussed in Section 8.1.2. Section 8.3.2 can also be used for quality assurance activities.

.2 Quality Audits

A quality audit is a structured, independent review to determine whether project activities comply with organizational and project policies, processes, and procedures. The objectives of a quality audit are:

- Identify all the good/best practices being implemented,
- Identify all the gaps/shortcomings,
- Share the good practices introduced or implemented in similar projects in the organization and/or industry,
- Proactively offer assistance in a positive manner to improve implementation of processes to help the team raise productivity, and
- Highlight contributions of each audit in the lessons learned repository of the organization.

The subsequent effort to correct any deficiencies should result in a reduced cost of quality and an increase in sponsor or customer acceptance of the project's product. Quality audits may be scheduled or random and may be conducted by internal or external auditors.

Quality audits can confirm the implementation of approved change requests including corrective actions, defect repairs, and preventive actions.

.3 Process Analysis

Process analysis follows the steps outlined in the process improvement plan to identify needed improvements. This analysis also examines problems experienced, constraints experienced, and non-value-added activities identified during process operation. Process analysis includes root cause analysis—a specific technique to identify a problem, discover the underlying causes that lead to it, and develop preventive actions.

8.2.3 Perform Quality Assurance: Outputs

.1 Organizational Process Assets Updates

Elements of the organizational process assets that may be updated include, but are not limited to, the quality standards.

.2 Change Requests

Quality improvement includes taking action to increase the effectiveness and/or efficiency of the policies, processes, and procedures of the performing organization. Change requests are created and used as input into the Perform Integrated Change Control (Section 4.5) process to allow full consideration of the recommended improvements. Change requests can be used to take corrective action or preventive action or to perform defect repair.

.3 Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to:

- Quality management plan,
- Schedule management plan, and
- Cost management plan.

.4 Project Document Updates

Project documents that may be updated include, but are not limited to:

- Quality audits reports,
- Training plans, and
- Process documentation.

8.3 Perform Quality Control

Perform Quality Control is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes. Quality control is performed throughout the project. Quality standards include project processes and product goals. Project results include deliverables and project management results, such as cost and schedule performance. Quality control is often performed by a quality control department or similarly titled organizational unit. Quality control activities identify causes of poor process or product quality and recommend and/or take action to eliminate them. See Figures 8-10 and 8-11.

The project management team should have a working knowledge of statistical quality control, especially sampling and probability, to help evaluate quality control outputs. Among other subjects, the team may find it useful to know the differences between the following pairs of terms:

- Prevention (keeping errors out of the process) and inspection (keeping errors out of the hands of the customer).
- Attribute sampling (the result either conforms or does not conform) and variables sampling (the result is rated on a continuous scale that measures the degree of conformity).
- Tolerances (specified range of acceptable results) and control limits (thresholds, which can indicate whether the process is out of control).

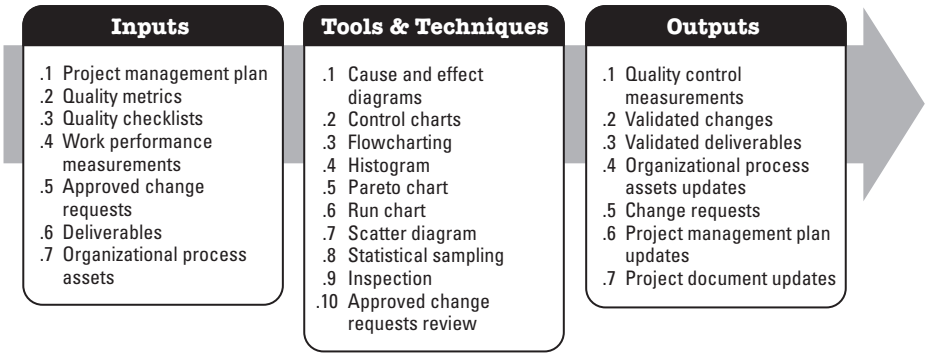

Figure 8-10. Perform Quality Control: Inputs, Tools & Techniques, and Outputs

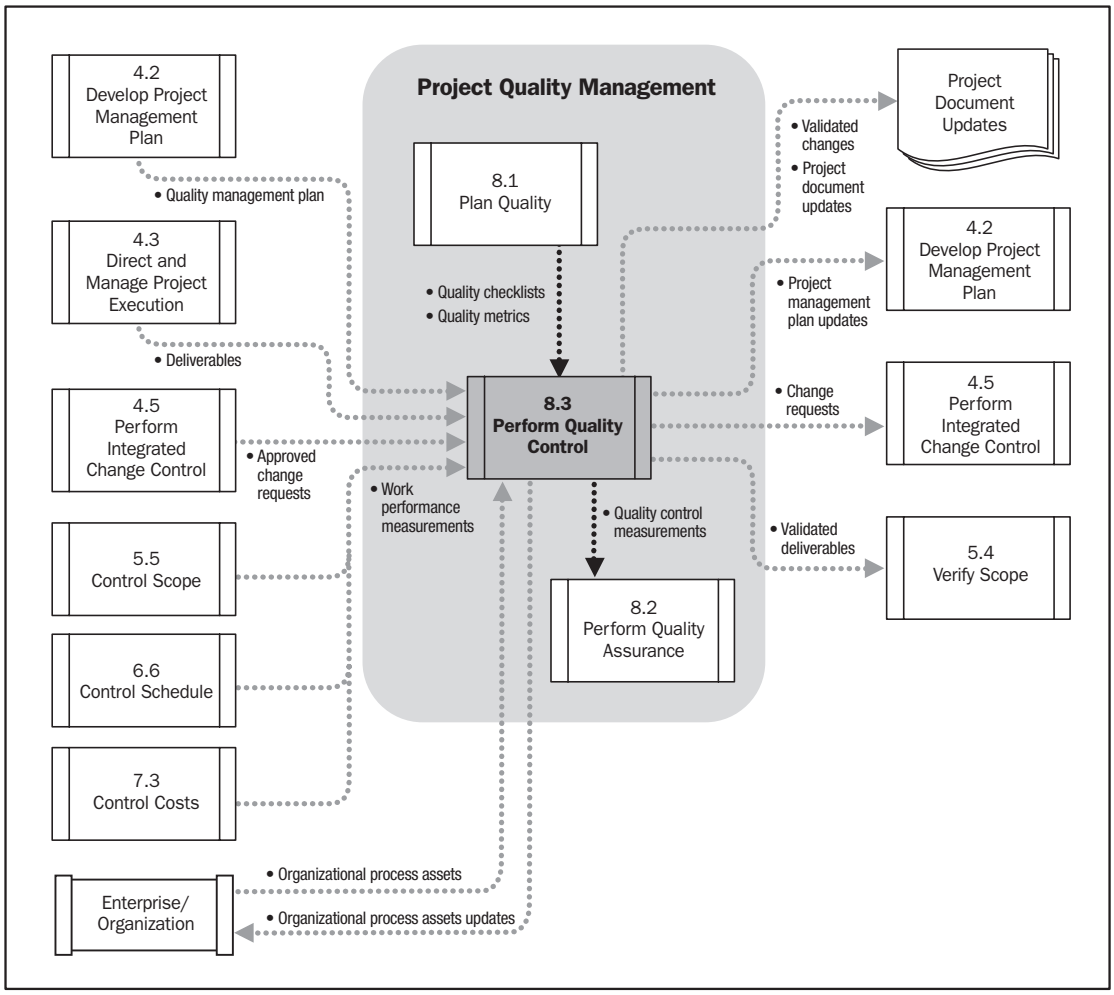

Figure 8-11. Perform Quality Control Data Flow Diagram

8.3.1 Perform Quality Control: Inputs

.1 Project Management Plan

The project management plan described in Section 4.2.3.1 contains the quality management plan, which is used to control quality. The quality management plan describes how quality control will be performed within the project.

.2 Quality Metrics

Described in Section 8.1.3.2.

.3 Quality Checklists

Described in Section 8.1.3.3.

.4 Work Performance Measurements

Work performance measurements are used to produce project activity metrics to evaluate actual progress as compared to planned progress. These metrics include, but are not limited to:

- Planned vs. actual technical performance,
- Planned vs. actual schedule performance, and
- Planned vs. actual cost performance.

.5 Approved Change Requests

As part of the Perform Integrated Change Control process a change control status update will indicate that some changes are approved and some are not. Approved change requests can include modifications such as defect repairs, revised work methods and revised schedule. The timely implementation of approved changes needs to be verified.

.6 Deliverables

Described in Section 4.3.3.1.

.7 Organizational Process Assets

The organizational process assets that can influence the Perform Quality Control process include, but are not limited to:

- Quality standards and policies,
- Standard work guidelines, and
- Issue and defect reporting procedures and communication policies.

8.3.2 Perform Quality Control: Tools and Techniques

The first seven of these tools and techniques are known as Ishikawa's seven basic tools of quality.

.1 Cause and Effect Diagrams

Cause and effect diagrams, also called Ishikawa diagrams or fishbone diagrams, illustrate how various factors might be linked to potential problems or effects. Figures 8-12 and 8-13 are examples of cause and effect diagrams. A possible root cause can be uncovered by continuing to ask "why" or "how" along one of the lines. "Why-Why" and "How-How" diagrams may be used in root cause analysis. Cause and effect diagrams are also used in risk analysis (Section 11.2.2.5).

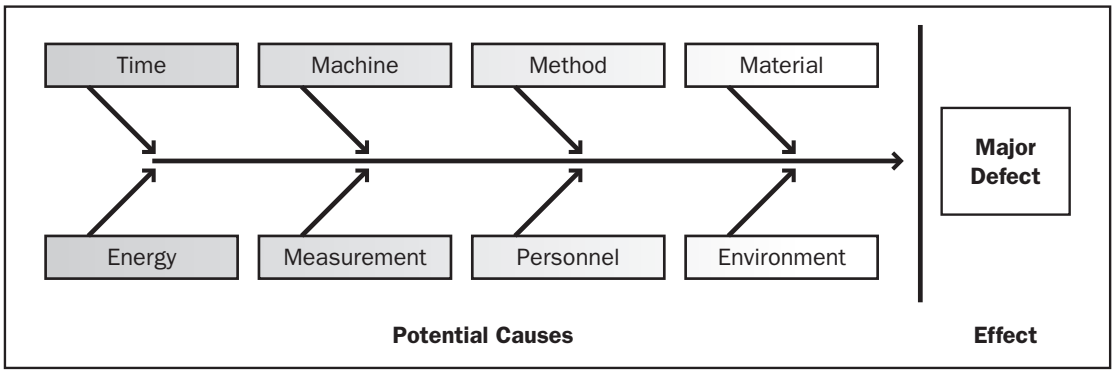

Figure 8-12. Classic Sources of Problems to Consider

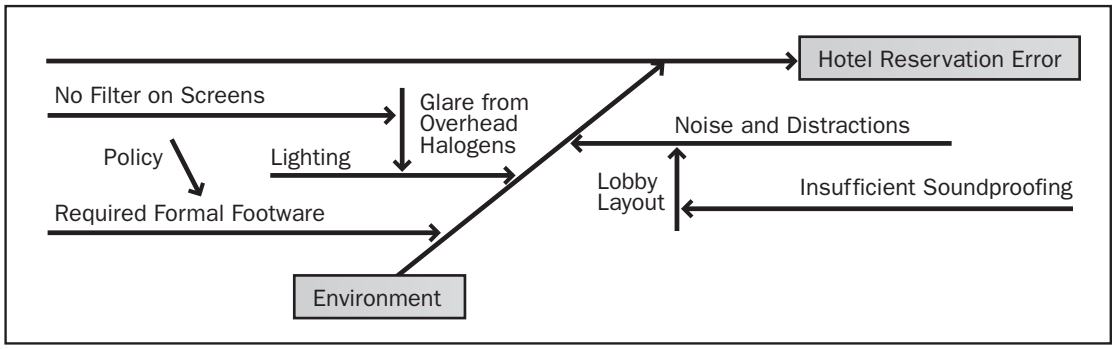

Figure 8-13. Environment Bone Expanded by Brainstorming

.2 Control Charts

Control charts are described in Section 8.1.2.3. In this tool, the appropriate data is collected and analyzed to indicate the quality status of project processes and products. Control charts illustrate how a process behaves over time and when a process is subject to special cause variation, resulting in an out-of-control condition. They graphically answer the question: "Is this process variance within acceptable limits?" The pattern of data points on a control chart may reveal random fluctuating values, sudden process jumps, or a gradual trend in increased variation. By monitoring the output of a process over time, a control chart can help assess whether the application of process changes resulted in the desired improvements.

When a process is within acceptable limits it is in control and does not need to be adjusted. Conversely, when a process is outside acceptable limits, the process should be adjusted. Seven consecutive points above or below the central line indicate a process that is out of control. The upper control limit and lower control limit are usually set at $\pm 3\sigma$, where 1σ is one standard deviation.

.3 Flowcharting

Described in Section 8.1.2.7, flowcharting is used during Perform Quality Control to determine a failing process step(s) and identify potential process improvement opportunities. Flowcharting is also used in risk analysis (Section 11.2.2.5).

.4 Histogram

A histogram is a vertical bar chart showing how often a particular variable state occurred. Each column represents an attribute or characteristic of a problem/situation. The height of each column represents the relative frequency of the characteristic. This tool helps illustrates the most common cause of problems in a process by the number and relative heights of the bars. Figure 8-14 is an example of an unordered histogram showing causes of late time entry by a project team.

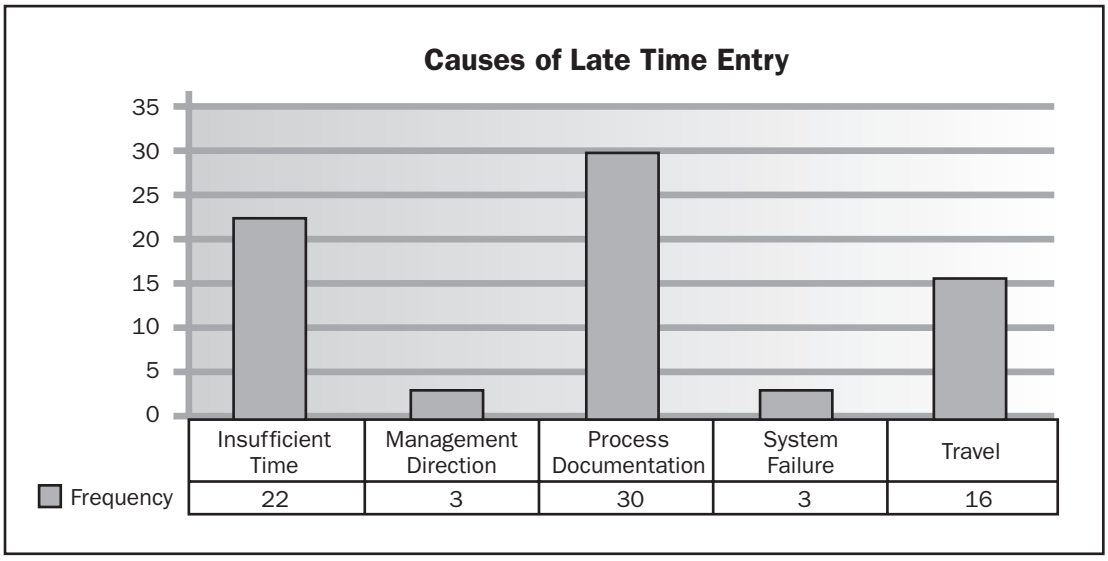

Figure 8-14. Histogram

.5 Pareto Chart

A Pareto chart, also referred to as a Pareto diagram, is a specific type of histogram, ordered by frequency of occurrence. It shows how many defects were generated by type or category of identified cause (Figure 8-15). Rank ordering is used to focus corrective action. The project team should address the causes creating the greatest number of defects first.

Pareto diagrams are conceptually related to Pareto's Law, which holds that a relatively small number of causes will typically produce a majority of the problems or defects. This is commonly referred to as the 80/20 principle, where 80% of the problems are due to 20% of the causes. Pareto diagrams can also be used to summarize various types of data for 80/20 analyses.

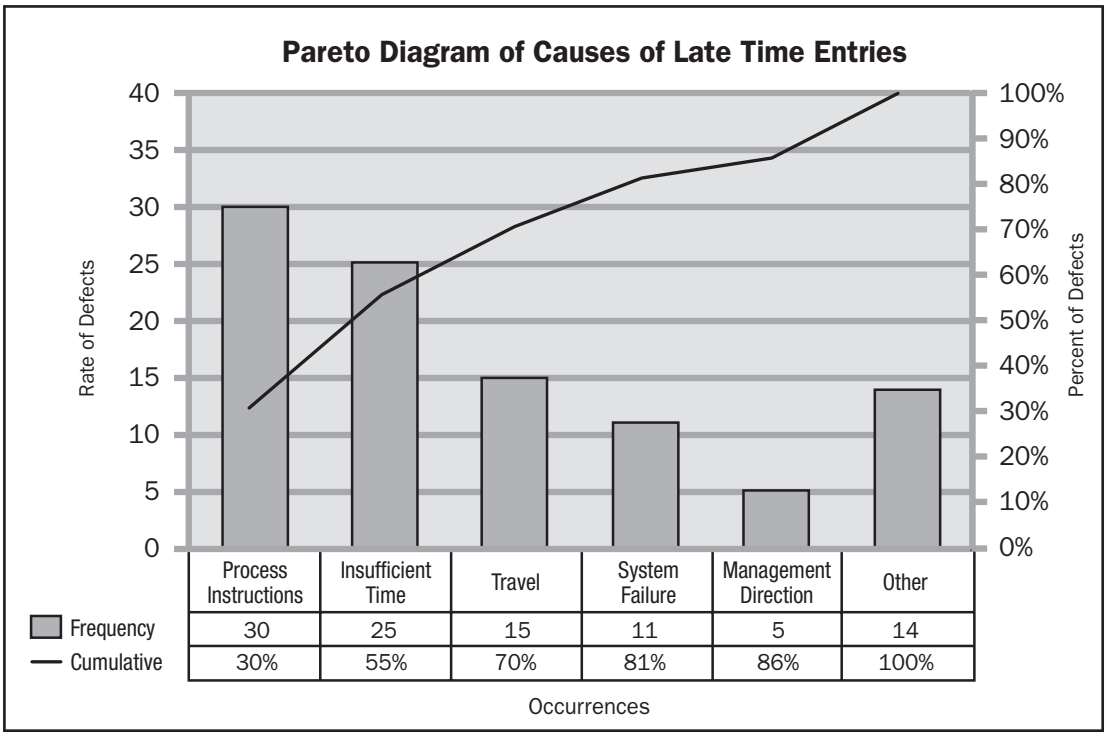

Figure 8-15. Pareto Diagram

.6 Run Chart

Similar to a control chart without displayed limits, a run chart shows the history and pattern of variation. A run chart is a line graph that shows data points plotted in the order in which they occur. Run charts show trends in a process over time, variation over time, or declines or improvements in a process over time. Trend analysis is performed using run charts and involves mathematical techniques to forecast future outcomes based on historical results. Trend analysis is often used to monitor:

- **Technical performance.** How many errors or defects have been identified, and how many remain uncorrected?
- **Cost and schedule performance.** How many activities per period were completed with significant variances?

.7 Scatter Diagram

A scatter diagram (Figure 8-16) shows the relationship between two variables. This tool allows the quality team to study and identify the possible relationship between changes observed in two variables. Dependent variables versus independent variables are plotted. The closer the points are to a diagonal line, the more closely they are related. Figure 8-16 shows the correlation between the timecard submission date and the number of days traveling per month.

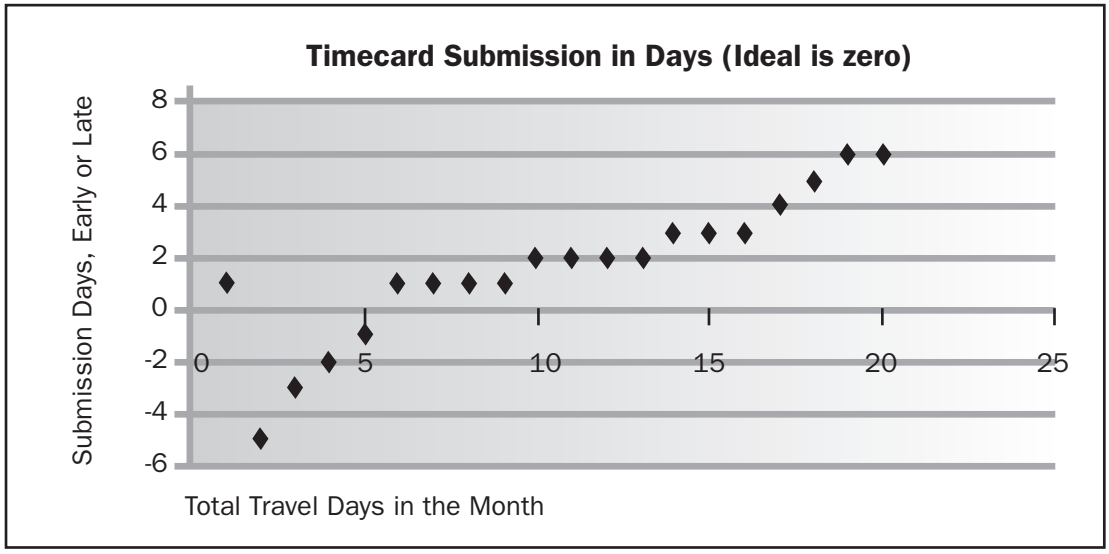

Figure 8-16. Scatter Diagram

.8 Statistical Sampling

Described in Section 8.1.2.6. Samples are selected and tested as defined in the quality plan.

.9 Inspection

An inspection is the examination of a work product to determine whether it conforms to documented standards. The results of an inspection generally include measurements and may be conducted at any level. For example, the results of a single activity can be inspected, or the final product of the project can be inspected. Inspections may be called reviews, peer reviews, audits, or walkthroughs. In some application areas, these terms have narrow and specific meanings. Inspections are also used to validate defect repairs.

.10 Approved Change Requests Review

All approved change requests should be reviewed to verify that they were implemented as approved.

8.3.3 Perform Quality Control: Outputs

.1 Quality Control Measurements

Quality control measurements are the documented results of quality control activities in the format specified during quality planning.

.2 Validated Changes

Any changed or repaired items are inspected and will be either accepted or rejected before notification of the decision is provided. Rejected items may require rework.

.3 Validated Deliverables

A goal of quality control is to determine the correctness of deliverables. The results of the execution quality control processes are validated deliverables. Validated deliverables are an input to Verify Scope (5.4.1.4) for formalized acceptance.

.4 Organizational Process Assets Updates

Elements of the organizational process assets that may be updated include, but are not limited to:

- **Completed checklists.** When checklists are used, the completed checklists become part of the project's records (Section 4.1.1.5).

- **Lessons learned documentation.** The causes of variances, the reasoning behind the corrective action chosen, and other types of lessons learned from quality control are documented so they become part of the historical database for both the project and the performing organization. Lessons learned are documented throughout the project life cycle, but at a minimum, during project closure.

.5 Change Requests

If the recommended corrective or preventive actions or a defect repair requires a change to the project management plan, a change request (Section 4.4.3.1) should be initiated in accordance with the defined Perform Integrated Change Control (4.5) process.

.6 Project Management Plan Updates

Elements of the project management plan that may be updated include, but are not limited to:

- Quality management plan, and
- Process improvement plan.

.7 Project Document Updates

Project documents that may be updated include, but are not limited to, quality standards.