



PROJECT QUALITY MANAGEMENT



WHAT'S PROJECT QUALITY MANAGEMENT?

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

PROJECT QUALITY MANAGEMENT?

WHAT DO THE QUALITY EXPERTS SAY ABOUT QUALITY?

- Quality is "the degree to which a set of characteristics fulfill requirements"
- Quality should be planned, designed & built-in as the integral part of the process.

QUALITY MANAGEMENT APPROACH

PMI's QUALITY MANAGEMENT APPROACH

- 1) Uses standards established by:
 - a) International Organization for Standardization (ISO)
 - b) Total Quality Management (TQM)
 - c) Six Sigma Cost of Quality (COQ)
 - d) Continuous Improvement
- 2) Addresses quality of the project & the product of the project
- 3) Because projects are temporary, the cost for product quality is often borne by the acquiring organization, especially defect prevention & appraisal.

ISO

TQM

COQ

QUALITY MANAGEMENT APPROACH

Modern quality management complements project management. For example, both disciplines recognize the importance of:

- **Customer Satisfaction:** understanding, evaluating, defining, and managing combination of:
 - conformance to requirements (the project must produce what it said it would produce), and
 - fitness for use (the product or service must satisfy real needs)
- **Prevention Over Inspection:** The cost of preventing mistakes is generally much less than the cost of correcting them, as revealed by inspection
- **Management Responsibility:** Management must provide resources needed to meet quality levels and thus succeed
- **Continuous Improvement:** The plan-do-check-act cycle is the basis for quality improvement (as defined by Shewhart and modified by Deming)

QUALITY VS GRADE

QUALITY versus GRADE

- Quality and Grade are not the same.
- Grade is a category (or rank) that distinguishes items having the same functional use but different technical characteristics, e.g. a product with lots of features and benefits is generally considered a high grade product, but still can be of poor quality.
- Quality is a degree measuring fitness for use, e.g. a high quality product will meet the specs and satisfy the real purpose, but may have limited features (or, grade).
- For example, software of high quality has no bugs, but may be low grade because it has limited features (such as Microsoft Calculator).
- Low quality is always a problem, low grade may not be.
- PM and his team are responsible for determining and delivering the required levels of both quality and grade.

QUALITY PHILOSOPHIES

QUALITY PHILOSOPHIES

W. Edwards Deming

- Workers need to be shown “what acceptable Quality is”
- Quality is a Management problem
- Improve Leadership, drive out fear
- Improve constantly and forever (continuous improvement)
- Started the TQM movement

Dr. Joseph Juran

- Fitness to Use/Conformance
- Quality & Grade
- Trilogy: Quality Improvement, Planning & Control

QUALITY PHILOSOPHIES

Phillip Crosby

- Quality is ‘Free’
- ‘Right’ the First Time
- Prevention is the ‘Key’
 - Zero Defects

Kaizen Method or Technologies

- Continuous improvement in small increments (continuous improvement of people first, then products & services
 - Overall improvement, in life at work, the well-being
- Kaizen is a Japanese word that means gradual continuous improvement

ISO

The International Organization for Standardization

- ISO 9001 is a quality standard that checks on the systems used by an organization
- Quality Management System (QMS) is a systematic approach used to plan, manage and continually improve the quality of an organization's products or services. It's a framework that directs and ensures that controls are in place to achieve success in management of a business.
- See www.iso.org
ISO 14001 defines Environment standard
OHSAS 18001 defines Health & Safety standard

QUALITY PROCESSES

QUALITY PROCESS DEFINITIONS

8.1 Plan Quality

- The process of identifying quality requirements and/or standards for the project & 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.

See Figure 8-3, p.193 for plan quality data flow diagram

QUALITY PROCESSES

PROCESSES BY PROCESS GROUP

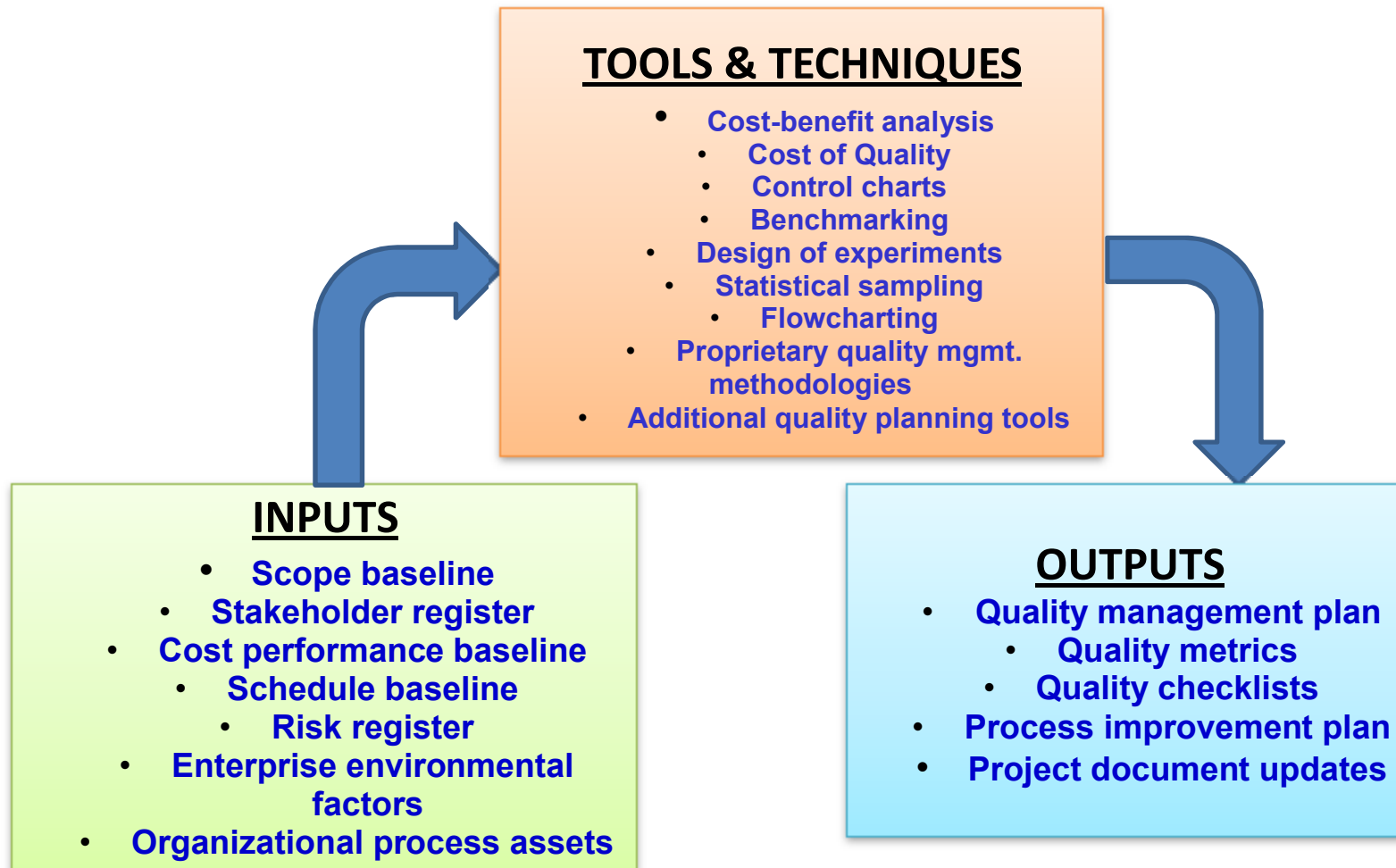
Planning	Executing	Monitoring & Controlling
8.1 Plan Quality	8.2 Perform Quality Assurance	8.3 Perform Quality Control

PLAN QUALITY

WHAT YOU DO IN PLAN QUALITY?

- The process of identifying quality requirements and/or standards for the project & product, and documenting how the project will demonstrate compliance.
- 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.

PLAN QUALITY



PLAN QUALITY - INPUTS

INPUTS

1. Scope Baseline
 - Scope statement
 - WBS
 - WBS Dictionary
2. Stakeholder Register
 - It identifies stakeholders with a particular interest in, or impact on, quality.
3. Cost Performance Baseline
 - It documents the accepted schedule performance measures including start and finish dates.
4. Schedule Baseline
 - It documents the accepted schedule performance measures including start and finish dates

PLAN QUALITY-INPUTS

INPUTS

5. Risk Register

The risk register contains information on threats and opportunities that may impact quality requirements

6. Enterprise Environmental Factors

Governmental agency regulations, rules, standards, and guidelines specific to the application area may affect the project

7. Organizational Process Assets

Organizational quality policies, procedures and guidelines, historical databases and lessons learned from previous projects specific to the application area may affect the project

PLAN QUALITY – T&T

TOOLS & TECHNIQUES

- **Cost-Benefit Analysis**
 - Quality planning must consider cost-benefit tradeoffs.
 - The primary benefit of meeting quality requirements is less rework, which means higher productivity, lower costs, and increased stakeholder satisfaction.
 - The primary cost of meeting quality requirements is the expense associated with Project Quality Management activities.

PLAN QUALITY – T&T

- **Cost of Quality (COQ)**

- Quality costs are the total costs incurred by investment in *preventing* non-conformance to requirements, *appraising* the product or service for conformance to requirements, and *failing* to meet requirements (rework). Failure cost are categorized into internal or external (Failure costs are also called cost of poor quality).

- **Examples of :**

- **Cost of Conformance**

- *Prevention* - training, surveys, using a quality system, planning, recruiting quality staff, etc.

- *Appraisal* - testing, inspecting, auditing, etc.

- **Cost of non-conformance**

- Internal - rework, rejects, etc.

- External - warranty, recall, repairs, handling complaints, legal issues, loss of goodwill, etc.

PLAN QUALITY – T&T

Control Charts

- Control charts are used to determine whether or not a process is stable or has predictable performance.
- They reflect the maximum and minimum values allowed.
- Control charts are used to monitor various types of output variables
- See Fig. 8-5 & Fig. 8-6(Page 196-197) – Read thoroughly

PLAN QUALITY – T&T

•Benchmarking

- Comparing actual or planned project practices to those of other projects to generate ideas for improvement and to provide a basis by which to measure performance
- **Design of Experiments**
- Statistical method that helps identify which factors may influence specific variables of a product or process under development or production.
- The most important aspect of this technique is that it provides a statistical framework for systematically *changing all of the important factors*
- For example, automotive designers use this technique to determine which combinations of suspensions and tires will produce the most desirable ride characteristics at a reasonable cost

PLAN QUALITY – T&T

Statistical Sampling

- Statistical sampling involves choosing part of a population of interest for inspection
- There is a substantial body of knowledge on statistical sampling. In some application areas it may be necessary for the PM team to be familiar with a variety of sampling techniques to assure the sample selected actually represents the population of interest.

Flowcharting

- Graphical representation of a process showing the relationships among process steps. Flowcharts show activities, decision points, and the order of processing
- See Fig. 8-7 in Page 199.

PLAN QUALITY – T&T

Proprietary Quality Mgmt. Methodologies

- These include Six Sigma, Lean Six Sigma, Quality Function Deployment, CMMI, etc.

Additional Quality Planning Tools

- These include brainstorming, affinity diagrams, force field analysis*, nominal group techniques, matrix diagrams, and prioritization matrices.

*Identifies forces and factors, both restraining and driving, effecting the solution of an issue so that the positives can be reinforced and negatives reduced or eliminated.

PLAN QUALITY – T&T

Quality Management Plan

- Describes how the PM team will implement the performing organization's quality policy (Quality management plan is a component or a subsidiary plan of the project management plan).
- Provides input to the overall Project Management Plan and must address quality assurance, quality control and continuous process improvement for the project.
- Quality management plan may be formal or informal, highly detailed or broadly framed, based on the requirement of the project.
- Should include efforts at the front end of the project to ensure that earlier decisions (e.g. on concepts, designs, and tests) are correct. These efforts should be performed through an independent peer review and not include persons that worked on the material being reviewed.

PLAN QUALITY – OUTPUTS

Quality Metrics

- A metric is an operational definition that describes, in very specific terms, what something is and how the quality control process measures it.
- Very specific (actual) measurable values to be met by a process, activity or work result.
- For example, *it is not enough to say* that meeting the planned schedule dates is a measurement of management quality. The PM team must also indicate whether every activity must start on time or only finish on time and whether individual activities will be measured, or only certain deliverables and if so, which ones.
- Quality metrics are *used both in QA & QC* processes.

Quality Checklists

- Structured tool used by both QA and QC to verify a set of required steps have been performed (usually component specific)

PLAN QUALITY – T&T

Process Improvement Plan

- It is subsidiary of the project management plan.
- Details the steps for analyzing processes that will facilitate the identification of waste, error & non-value added activity, thus increasing customer value.
- Examples of such steps are:
 - *Process boundaries*: describes the purpose, start, and end of processes, their inputs & outputs, data required and the owner and stakeholder of the processes.
 - *Process configuration*: a flowchart of processes to facilitate analysis with interfaces identified
 - *Process metrics*
 - *Targets for improved performance*

PLAN QUALITY – T&T

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)

QUALITY PROCESSES

PROCESSES BY PROCESS GROUP

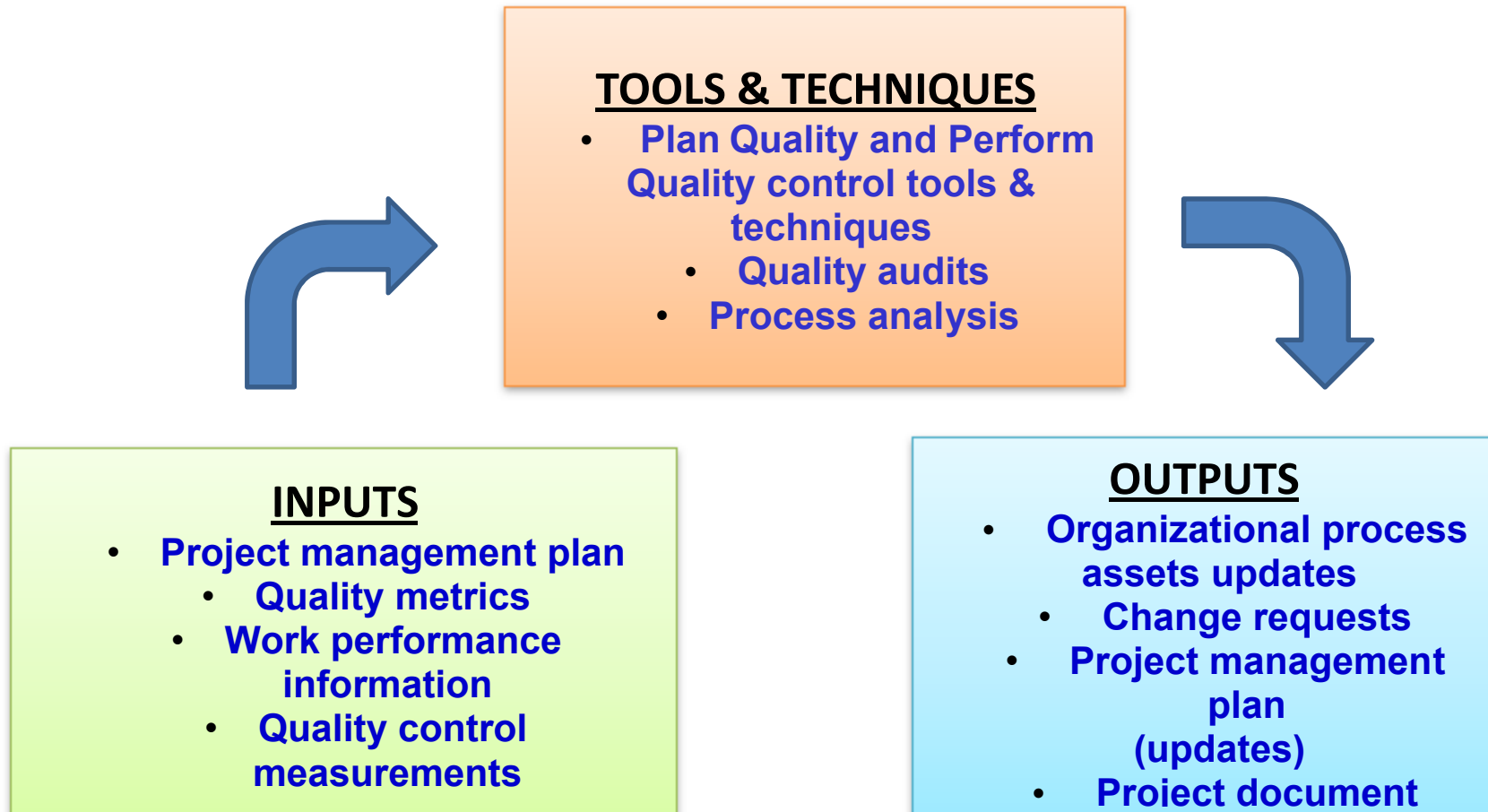
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PERFORM QUALITY ASSURANCE

HOW SHOULD YOU PERFORM QUALITY ASSURANCE?

- Quality assurance (QA) is application of planned, systematic quality activities to ensure the project will employ all processes needed to meet requirements
- QA uses the Process Improvement Plan to make project processes better
- A quality assurance department, or similar organization, often oversees quality assurance activities.
- QA also provides an umbrella for another important quality activity, continuous process improvement (CPI). CPI provides an iterative means for improving the quality of all processes (improves in small steps over time)

PERFORM QUALITY ASSURANCE





PERFORM QUALITY ASSURANCE- INPUTS

INPUTS

- **Project Management Plan**
- **Quality Metrics**
- **Work performance information**
- **Quality Control Measurements**

QC measurements are the results of quality control activities that is fed back to the QA process for use in re-evaluating and analyzing the quality standards and processes of the performing organization



PERFORM QUALITY ASSURANCE-T&T

TOOLS & TECHNIQUES

- **Plan Quality and Perform Quality Control tools and techniques**

Tools & techniques from Plan Quality and Perform Quality Control, discussed in Section 8.1.2 and Section 8.3.2 (can also be used for that Quality Assurance activities).

- **Quality Audits**

- A structured, independent review to determine whether project activities comply with organizational & project policies, processes, & procedures
- The objective of a quality audit is to identify inefficient and ineffective policies, processes, and procedures in use on the project.
- May be scheduled or at random
- May be carried out by properly trained in-house auditors or third parties
- Quality audits confirm that approved change requests, corrective actions, defect repairs & preventive actions are being implemented



PERFORM QUALITY ASSURANCE-T&T

• Process Analysis

- Follows the steps outlined in the Process Improvement Plan to identify needed improvements from an organizational and technical standpoint
- Examines problems & constraints experienced and non-value-added activities identified during process operation
- Uses root cause analysis, a specific technique to analyze a problem/situation, determine the underlying causes that lead to it, and create preventive actions for similar problems

PERFORM QUALITY ASSURANCE-OUTPUTS

OUTPUTS

- **Organizational Process Assets Updates**
e.g. quality standards
- **Change Requests**
- **Project Management Plan Updates**
 - Quality mgmt. plan
 - Schedule mgmt. plan
 - Cost mgmt. plan
- **Project Document Updates**
 - Quality audit reports
 - Training plans
 - Process documentation

QUALITY PROCESSES

PROCESSES BY PROCESS GROUP

Planning	Executing	Monitoring & Controlling
8.1 Quality Planning	8.2 Perform Quality Assurance	8.3 Perform Quality Control

PERFORM QUALITY CONTROL

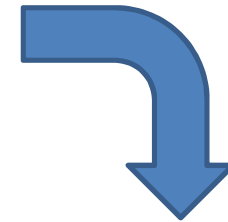
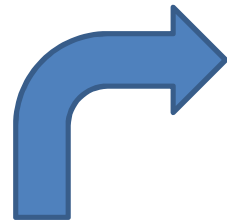
HOW DO YOU PERFORM QUALITY CONTROL?

- Use the Quality Management Plan to monitor specific project results to determine whether they comply with relevant quality standards (metrics) for both project & product quality
- Identify ways to eliminate causes of unsatisfactory results.
- It should be performed throughout the project
- QC is performed by a Quality Control Department
- The PM team should have a working knowledge of statistical quality control, especially sampling & probability

PERFORM QUALITY CONTROL

TOOLS & TECHNIQUES

- Cause and effect diagram
 - Control charts
 - Flowcharting
 - Histogram
 - Pareto chart
 - Run chart
- Scatter diagram
- Statistical sampling
 - Inspection
- Approved change requests review



INPUTS

- Project management plan
 - Quality metrics
 - Quality checklists
 - Work performance measurements
- Approved change requests
 - Deliverables
- Organizational process assets

OUTPUTS

- Quality control measurements
 - Validated changes
 - Validated deliverables
- Organization process assets updates
 - Change Requests
- Project management plan updates
 - Project document updates

PERFORM QUALITY CONTROL

Know the difference between:

Prevention (keeping errors out of the process); **Inspection** (keeping errors out of the hands of the customer)

Attribute sampling (result conforms, or it doesn't); **Variables sampling** (the result is rated on a continuous scale that measures the degree of conformity); **Statistical sampling** (measures only a percentage of items, e.g. 5 out of every 100)

Special causes (unusual events); **Common or random causes** (normal process variation)

Tolerances (the result is acceptable if it falls within range specified by tolerance); **Control limits** (the process is in control if the result falls within the control limits)



PERFORM QUALITY CONTROL-INPUTS

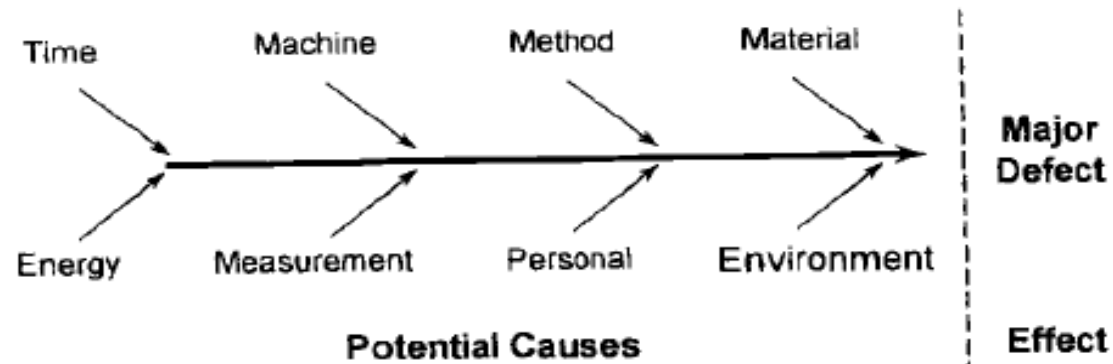
INPUTS

- **Project Management Plan**
- **Quality Metrics**
- **Quality Checklists**
- **Work Performance Information**
- **Approved Change Requests**
- **Deliverables**
- **Organizational Process Assets**

PERFORM QUALITY CONTROL-T&T

TOOLS & TECHNIQUES

- **Cause and Effect Diagram**
- Also called *Ishikawa* (inventor) or fishbone diagrams
- Below is an example to show how various factors might be linked to potential problems or effects



PERFORM QUALITY CONTROL-T&T

- **Control Charts (See Figure 8-5 & 8-6, p.196-7)**
 - Shows whether or not a process is *stable or has predictable performance* over a period of time
 - Stable or Predictable – normal (no action required)
 - Out of control – process is subject to special cause variation and (needs to be fixed)
 - used for repetitive activities like manufacturing
 - a graphic display of the interaction of process variables on a process (Are the process variables within acceptable limits?)

PERFORM QUALITY CONTROL-T&T

- **A process is out of control if the values are:**
 - widely fluctuating values (outside the control limits set)
 - suddenly jumps or shifts
 - gradually increasing variation (trend)

‘Rule of Seven’ which is when 7 values in a row are all below or all above the mean or increase/decrease in direction
- For processes outside acceptable limits, the process should be adjusted (the upper & lower limits are usually set at ± 3 sigma, where sigma is standard deviation)

PERFORM QUALITY CONTROL-T&T

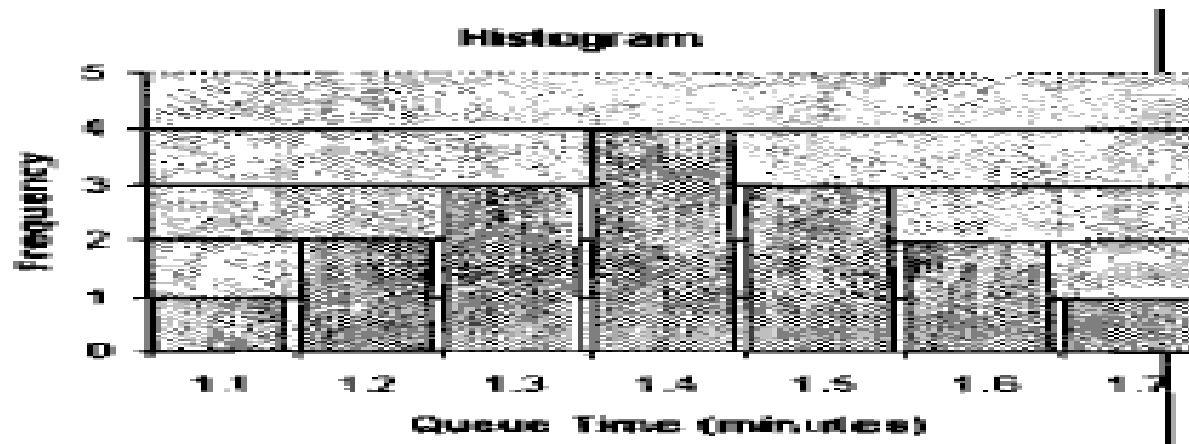
- **Flowcharting**

- Helps to analyze how problem occur
- A flowchart is a graphical representation of a process
- There are many styles, but all flowcharts activities, decision points, and the order of processing
- See Figure 8-8, an example of a process flowchart for design reviews

PERFORM QUALITY CONTROL-T&T

• Histogram

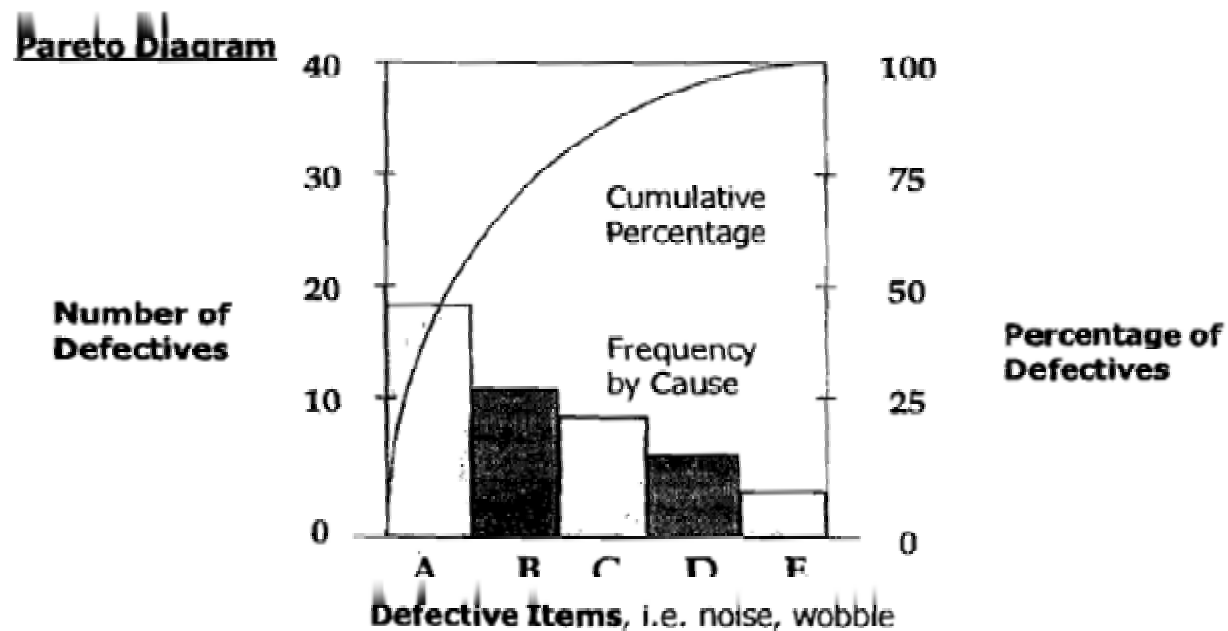
- A bar chart showing a distribution of variables
- Each column represents an attribute or characteristic so that one can compare two or more things
- Height of each column represents the frequency (or amount) of a characteristic



Pareto Chart

- A Pareto chart is a specific type of histogram, ordered by frequency of occurrence
- The Pareto technique is used primarily to identify and evaluate nonconformities
- In Pareto diagrams, rank ordering is used to guide corrective action
- The project team should take action to fix that problem first, which are causing the greatest number of defects
- Pareto diagrams are conceptually related to Pareto's Law, which holds that a small number of causes will typically produce a large majority of the problems or defects
- Pareto's Law is commonly referred as the 80/20 principle, where 80 percent of the problems are due to 20 percent of the causes

PERFORM QUALITY CONTROL-T&T



PERFORM QUALITY CONTROL-T&T

Run Chart

- A run chart shows the history and pattern of variation
- A run chart is a line graph that shows data points plotted in order in which they occur (over time)
- 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
- Trend analysis is using mathematical techniques to forecast future outcomes based on historical results
- Trend analysis is often used to monitor technical performance; project cost & schedule performance.

Scatter Diagram

- Shows the pattern of relationship between two variables
- This tool allows the quality team to study and identify the possible relationships between changes observed in two variables
- The closer the points are to a diagonal line, the more closely they're related

PERFORM QUALITY CONTROL-T&T

- **Statistical Sampling**
 - Involves choosing part of a population of interest for inspection (For example, select 10 widgets at random out of 100)
- **Inspection**
 - Examination of a work product to determine if it conforms to standards
 - Generally, the results of an inspection include measurements
 - Inspection can be conducted at any level, for example, the results of a single activity can be inspected, or final product of the project can be inspected
 - Inspections are also called reviews, peer reviews, audits, and walkthroughs
- **Approved Change Requests Review**
 - All approved change requests should be reviewed to verify that they were implemented as approved.

PERFORM QUALITY CONTROL-OUTPUTS

OUTPUTS

- **Quality Control Measurements**
 - Quality control measurements are documented results of quality control activities in the format specified during quality planning.
- **Validated Changes**
 - Any changed or repaired items are inspected & will be either accepted or rejected before notification of the decision is provided. The rejected items may require rework.



PERFORM QUALITY CONTROL-OUTPUTS

- **Validated Deliverables**
- **Organizational Process Assets Updates**
 - Completed checklists
 - Lessons learned documentation, i.e. causes of variances, reasoning behind the corrective action chosen
- **Change Requests**
- **Project Mgmt. Plan Updates**
- **Project Document Updates**