Chapter 08

Project Quality Management

erga

Project Management

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Erga Academy

PM17 – PMP6 Certification

EPDM & ESM tracks

20 credits

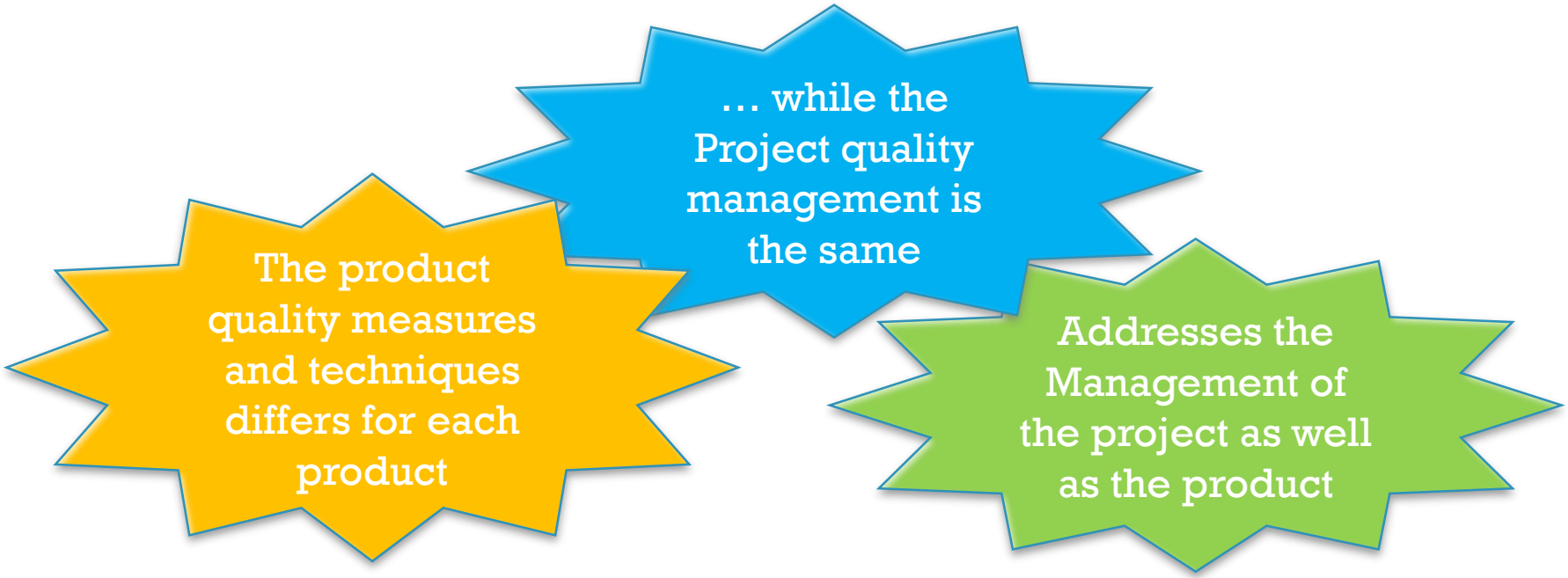
Plan


1. Introduction
2. Environment in which projects operate
3. The role of the Project Manager
4. Project Integration Management
5. Project Scope Management
6. Project Schedule Management
7. Project Cost Management
8. Project Quality Management
9. Project Resource Management
10. Project Communications Management
11. Project Risk Management
12. Project Procurement Management
13. Project Stakeholder Management
14. Professional Responsibility

Plan

- Chapter 08- Project Quality Management

It includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements in order to meet stakeholders' objectives. It also supports continuous process improvement activities as undertaken on behalf of the performing organization.



Plan

- Chapter 08- Project Quality Management

  8.1 Plan Quality Management

  8.2 Manage Quality

  8.3 Control Quality

	Project Management Process Groups				
Knowledge Areas	Initiating	Planning	Executing	Monitoring & Controlling	Closing
8. Project Quality Management		8.1 Plan Quality Management	8.2 Manage Quality	8.3 Control Quality	

Plan

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- **8.1 Plan Quality Management** (*planning*): The process of Identifying which quality requirements /standards for the project and the product, and documenting how the project will demonstrate compliance.

- **8.2 Manage Quality** (*Execution*): The process of auditing the quality requirements and the results from the quality control measurements to ensure appropriate quality standards and operational definitions are used.

- **8.3 Control Quality** (*M&C*): The process of monitoring and recording results of executing the quality activities to assess the performance and recommend necessary actions.

Plan

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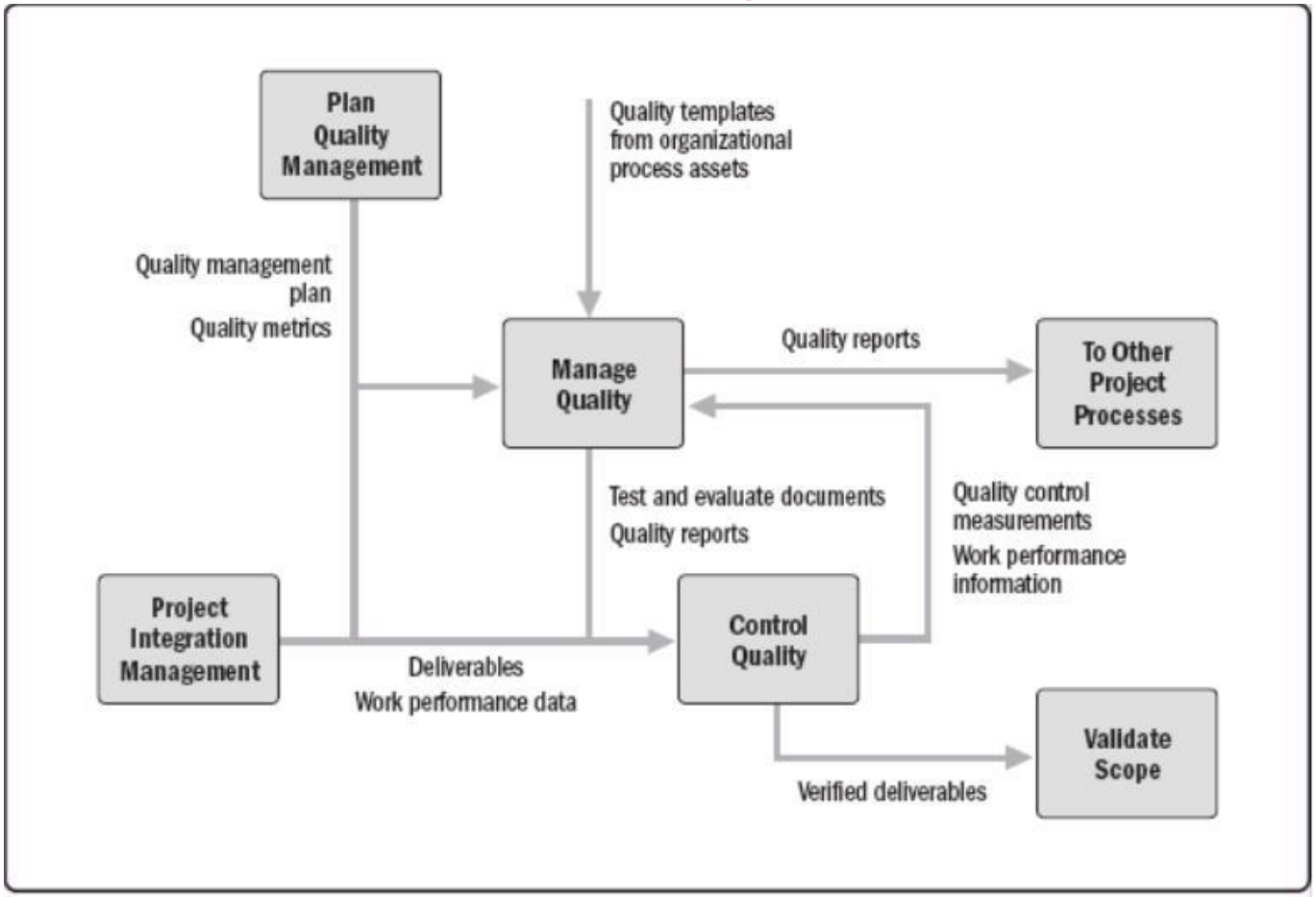


Figure 8-2. Major Project Quality Management Process Interrelations

What is QUALITY?

Definition

"the degree to which the project fulfills requirements"

The International Organization for Standardization (ISO) defines **quality** as "*the degree to which a set of inherent characteristics fulfills requirements*" (ISO9000:2000)

QUALITY versus GRADE

Grade (*degree of functionality*)

- Grade is a category assigned to products or services having the same functional use but different technical characteristics.
- Low Quality is always a problem; low grade may not be.

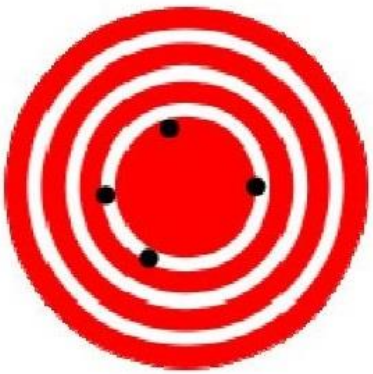
Product A		
Features	Performance	
Camera	Bad	High grade but low quality
Games	Bad	
Internet	Bad	
Video call	Bad	
MMS	Bad	

Product B		
Features	Performance	
Camera	Good	Low grade but high quality
Games	Good	

Precision versus Accuracy

Precision and Accuracy are not equivalent.

- "**Precision**" is consistency that the value of repeated measurements are clustered and have little scatter.
- "**Accuracy**" is correctness 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 PMT must determine how much accuracy or precision or both are required.



High accuracy, but low precision

High precision, but low accuracy

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Why Quality Matters?

The fundamental reason for focusing on quality issues is the potential for an increased profitability of the project.

- Customer Satisfaction (Understanding, Evaluating, Defining and Managing).
- Conformance to requirements: The project must produce what it said it would produce.
- Fitness for use: The product /service must satisfy real needs.
- Prevention is preferred over inspection. It is better to design quality into deliverables, rather than to find quality issues during inspection. The cost of preventing mistakes is generally much less than the cost of correcting mistakes when they are found by inspection or during usage..
- Less Rework.
- Increased Productivity.

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Why Quality Matters? (cont'd)

There are five levels of increasingly effective QM as follows:

1. Usually, the most expensive approach is to let the customer find the defects. This approach can lead to warranty issues, recalls, loss of reputation, and rework costs.
2. Detect and correct the defects before the deliverables are sent to the customer as part of the quality control process. The control quality process has related costs, which are mainly the appraisal costs and internal failure costs.
3. Use quality assurance to examine and correct the process itself and not just special defects.
4. Incorporate quality into the planning and designing of the project and product.
5. Create a culture throughout the organization that is aware and committed to quality in processes and products.

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Cost of Quality

Cost of Conformance (COC) + Cost of Non-Conformance (CONC)

➢ Cost of Conformance (COC)

A component of the "Cost Of Quality" for a work product.

COC is the total cost of ensuring that a product is of good quality. It includes costs of "Quality Assurance" activities such as standards, training and audit processes; and costs of "Quality Control" activities such as inspections, and testing.

➢ Cost of Non-Conformance (CONC)

The element of the "Cost Of Quality" representing the total cost (to the organization) of failure to achieve a good "Quality" product.

CONC includes both in-process costs generated by quality failures, particularly the cost of "Rework" and post-delivery costs including further "Rework", re-performance of lost work (for products used internally), possible loss of business, possible legal redress and other potential costs.

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Cost of Quality (cont'd)

Cost of Conformance

Prevention Cost
(build a quality)
- Quality training
- Document Processes
- Equipment
- Time to do it right
- Efforts to ensure everyone knows the processes to use to complete their work

Appraisal Costs
(Assess the Quality)
- Testing
- Inspection

Money spent during the project to avoid failures

Cost of Non-Conformance

Internal Failure costs
(Failure found by the project)
- Rework
- Scrap

External Failure Costs
(Failure found by the customer)
- Liabilities
- Inventory cost
- Lost business

Money spent during and after the project because of failures

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General Quality terms

- **Gold Plating** refers to giving the customer extras.
- **Prevention Over Inspection** Quality must be planned in, not inspected in!
- **Continuous Improvement** (or Kaizen) Small improvements in products or processes to reduce costs and ensure consistency in improving performance of products or services.
- **Prevention** is keeping errors out of the process.
- **Inspection** is catching errors when they have occurred, or keeping errors out of the hands of the customer.
- **Tolerances** (specified range of acceptable results) and **control limits** (that identify the boundaries of common variation in a statistically stable process or process performance).
- **Marginal Analysis** is the point where the benefits or revenue to be received from improving quality equals the incremental cost to achieve the quality.

General Quality terms (cont'd)

- **Attribute Sampling**

The result either confirms or does not confirm.

Example : If the height of the person is above 170cm, he is eligible to join the army, else he is not eligible.

Yes or No.

- **Variable Sampling**

The result is rated on a continuous scale that measures the degree of conformity.

Example: If the age of the person is between 19 to 30 years, he is eligible for gun shooting, and after 30 years he is not considered as eligible resource and moved to other job.

"how much" or "how bad" or "how good".

General Quality terms (cont'd)

➢ **Just in Time (JIT)**

Many companies are finding that holding raw materials in inventory is too expensive and un-necessary. Instead, they have their suppliers deliver raw materials just when they are needed or just before they are needed, thus decreasing inventory close to ZERO.

- A JIT system forces attention on quality.

➢ **Total Quality Management (TQM)**

A philosophy that encourages companies and their employees to focus on finding ways to continuously improve the quality of their business practices and products.

➢ **Impact of poor quality**

- Increased Cost
- Low Morale
- Low Customer Satisfaction
- Increased Risk
- Rework and Schedule delays

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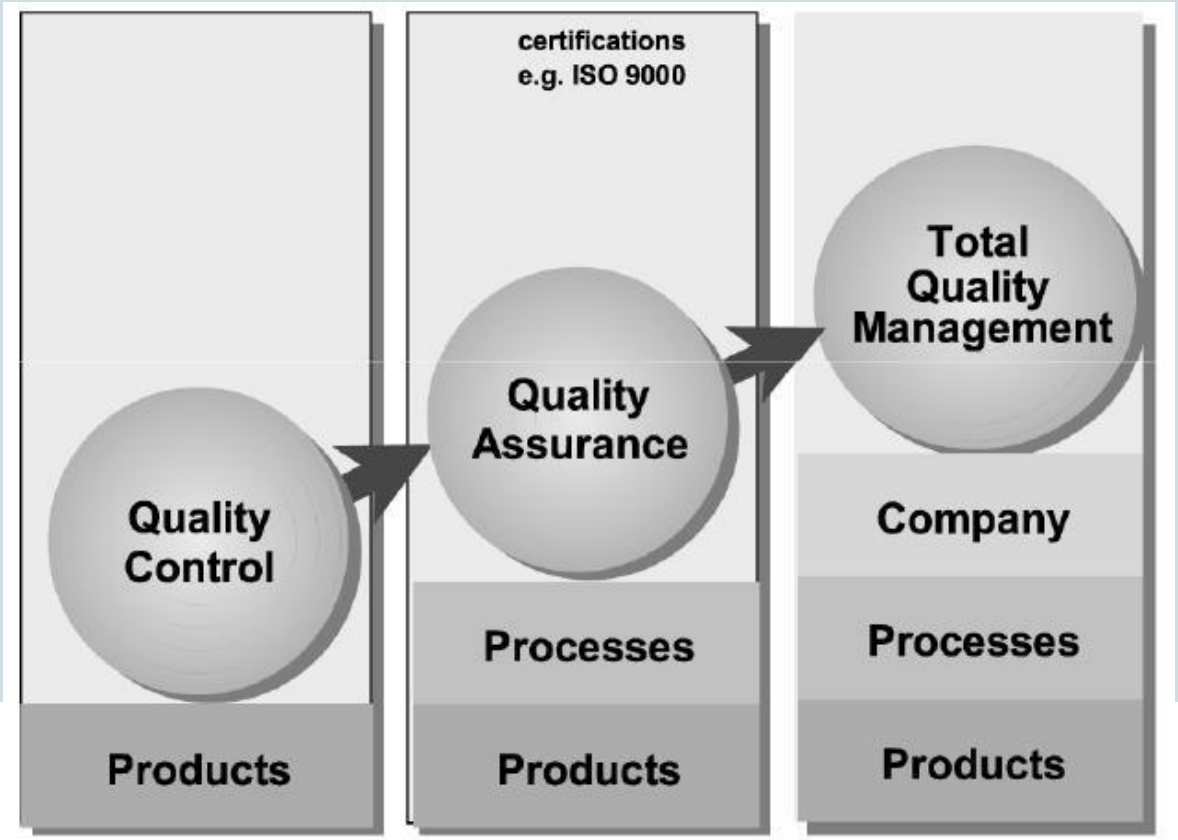
Quality management Evolution



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Quality management Evolution

FAST FACTS

Key differences between traditional Total Quality Management (TQM) and Six Sigma

TQM		Six Sigma
Typically grass roots driven	→	Top down implementation
Incremental improvement, ie 10–15%	→	Breakthrough improvement, 50–100%
Focus is ongoing	→	Focus is short-term projects
Goal is "more with more" (ie inspection)	→	Goal is "more with less"
Consensus driven	→	Data driven; statistical analysis

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Quality Theorists

Joseph Juran:

- Developed 80/20 principle.
- Advocated top management involvement.
- Defined quality as "fitness for use".

W. Edward Deming:

- Developed 14 Steps of Total Quality Management.
- Advocated the Plan-Do-Check-Act cycle as the basis for quality improvement.

Philip Crosby:

- Popularized the concept of the "cost of poor quality".
- Advocated "prevention over inspection".
- "Zero Defects". Crosby suggest that organizations strive for zero defects.
- He believed that quality is "Conformance to requirements."

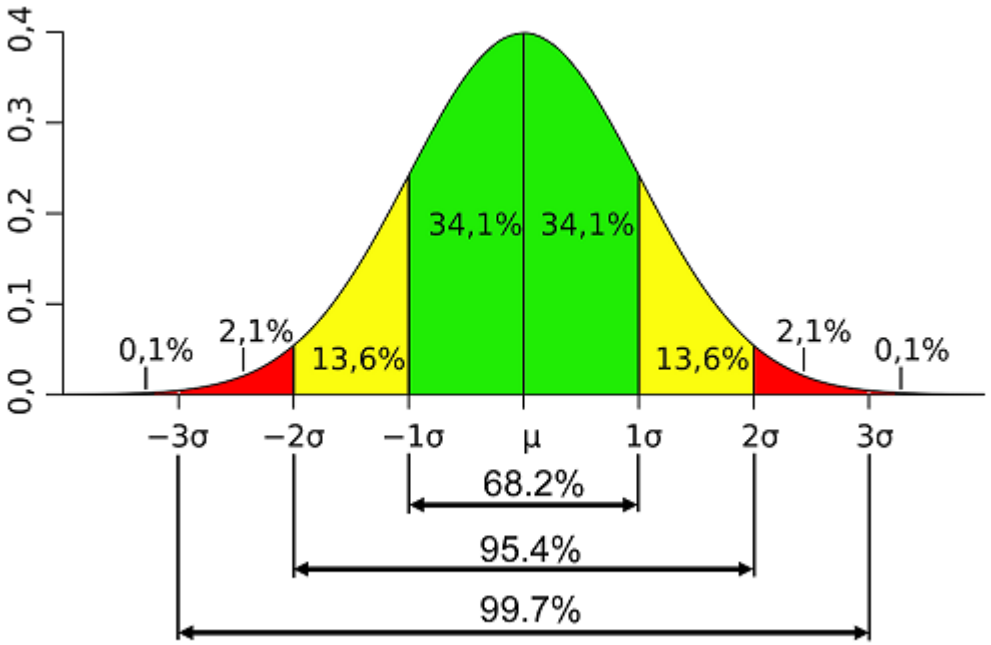
Standard Deviation Definition

It shows how much variation or dispersion there is from the average (mean, or expected value).

Remember that:

- Sigma is considered on both sides of the mean.

±1 Sigma corresponds to 68.27% of the expected results to fall between the control limits.
±2 Sigma corresponds to 94.45%.
±3 Sigma corresponds to 99.7%.
±6 Sigma corresponds to 99.9999998%.



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Modern quality management approaches seek to minimize variation and to deliver results that meet defined stakeholder requirements. Trends in Project Quality Management include:

- **Customer satisfaction**. Understand, evaluate, define, and manage requirements so that customer expectations 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 needs to satisfy the real needs). In agile environments, stakeholder engagement with the team ensures customer satisfaction is maintained throughout the project.
- **Continual improvement**. The plan-do-check-act (PDCA) cycle is the basis for quality improvement as defined by Shewhart and modified by Deming. In addition, quality improvement initiatives such as total quality management (TQM), Six Sigma, and Lean Six Sigma may improve both the quality of project management, as well as the quality of the end product, service, or result.
- …

Chapter 08- Project Quality Management

- …
- **Management responsibility**. Success requires the participation of all members of the project team. Management retains, within its responsibility for quality, a related responsibility to provide suitable resources at adequate capacities.
- **Mutually beneficial partnership with suppliers**. An organization and its suppliers are interdependent. Relationships based on partnership and cooperation with the supplier are more beneficial to the organization and to the suppliers than traditional supplier management. The organization should prefer long-term relationships over short-term gains. A mutually beneficial relationship enhances the ability for both the organization and the suppliers to create value for each other, enhances the joint responses to customer needs and expectations, and optimizes costs and resources.

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Each project is unique; therefore, the project manager will need to tailor the way Project Quality Management processes are applied. Considerations for tailoring include:

- **Policy compliance and auditing**. What quality policies and procedures exist in the organization? What quality tools, techniques, and templates are used in the organization?
- **Standards and regulatory compliance**. Are there any specific quality standards in the industry that need to be applied? Are there any specific governmental, legal, or regulatory constraints that need to be taken into consideration?
- **Continuous improvement**. How will quality improvement be managed in the project? Is it managed at the organizational level or at the level of each project?
- **Stakeholder engagement**. Is there a collaborative environment for stakeholders and suppliers?

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- In order to navigate changes, agile methods call for frequent quality and review steps built in throughout the project rather than toward the end of the project.
- Recurring retrospectives regularly check on the effectiveness of the quality processes. They look for the root cause of issues then suggest trials of new approaches to improve quality. Subsequent retrospectives evaluate any trial processes to determine if they are working and should be continued or new adjusting or should be dropped from use.
- In order to facilitate frequent, incremental delivery, agile methods focus on small batches of work, incorporating as many elements of project deliverables as possible. Small batch systems aim to uncover inconsistencies and quality issues earlier in the project life cycle when the overall costs of change are lower.

8.1 Plan Quality Management

Identify quality requirements and/or standards for the project and its deliverables, and documenting how the project will demonstrate compliance with quality requirements and/or standards.

- Implies the ability to anticipate situations and prepare actions to bring about the desired outcome.
- It is one of the key processes during development of the PMP.
- Important to prevent defects by:
  - Selecting proper Quality materials, standards etc.
  - Providing quality oriented training.
  - Planning a process that ensures the appropriate outcome.

8.1 Plan Quality Management

Inputs

1. Project charter
2. Project management plan
   - Requirements management plan
   - Risk management plan
   - Stakeholder engagement plan
   - Scope baseline
3. Project documents
4. Enterprise environmental factors
5. Organizational process assets

Tools & Techniques

1. Expert judgment
2. **Data gathering**
   - Benchmarking
   - Brainstorming
   - Interviews
3. **Data analysis**
4. Decision making
   - Multicriteria decision analysis
5. **Data representation**
   - Flowcharts
   - Logical data model
   - Matrix diagrams
   - Mind mapping
6. **Test and inspection planning**
7. Meetings

Outputs

1. **Quality management plan**
2. **Quality metrics**
3. Project management plan updates
4. Project documents updates
   - Lessons learned register
   - Requirements traceability matrix
   - Risk register
   - Stakeholder register

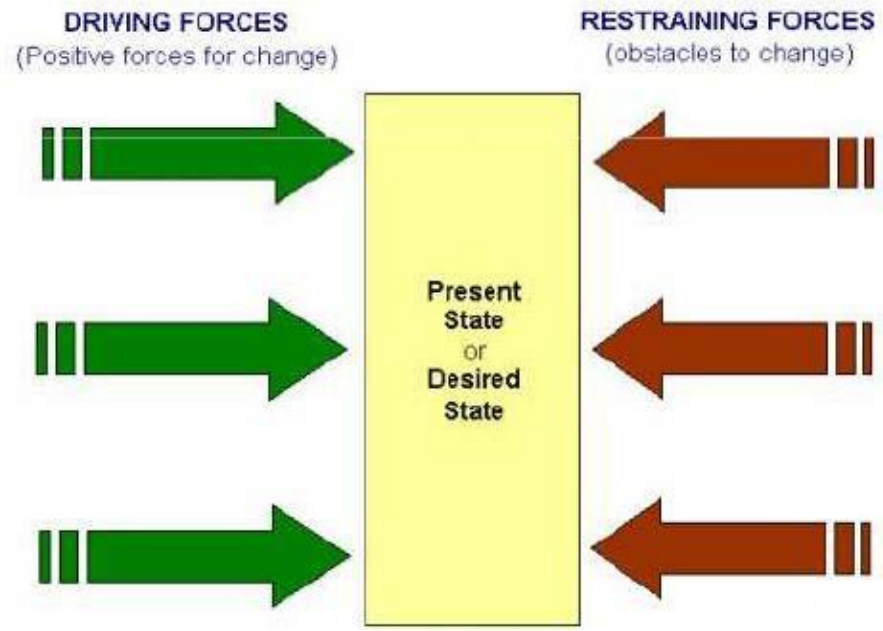
8.1 Plan Quality Management

Input → **Tools & Techniques** → Output

2. Data gathering

❖ **Brainstorming**

Force field analysis – which are diagrams of the forces for and against change.



By Kurt Lewin
1890-1947

8.1 Plan Quality Management

3. Data analysis

Data analysis techniques that can be used for this process include:

- **Cost-benefit analysis.** A cost-benefit analysis is a financial analysis tool used to estimate the strengths and weaknesses of alternatives in order to determine the best alternative in terms of benefits provided. A cost-benefit analysis will help the PM determine if the planned quality activities are cost effective.
- **Cost of quality**. The cost of quality (COQ) associated with a project consists of one or more of the following costs:
  - **Prevention costs**. Costs related to the prevention of poor quality in the products, deliverables, or services of the specific project.
  - **Appraisal costs**. Costs related to evaluating, measuring, auditing, and testing the products, deliverables, or services of the specific project.
  - **Failure costs** (internal/external). Costs related to nonconformance of the products, deliverables, or services to the needs or expectations of the stakeholders.

8.1 Plan Quality Management

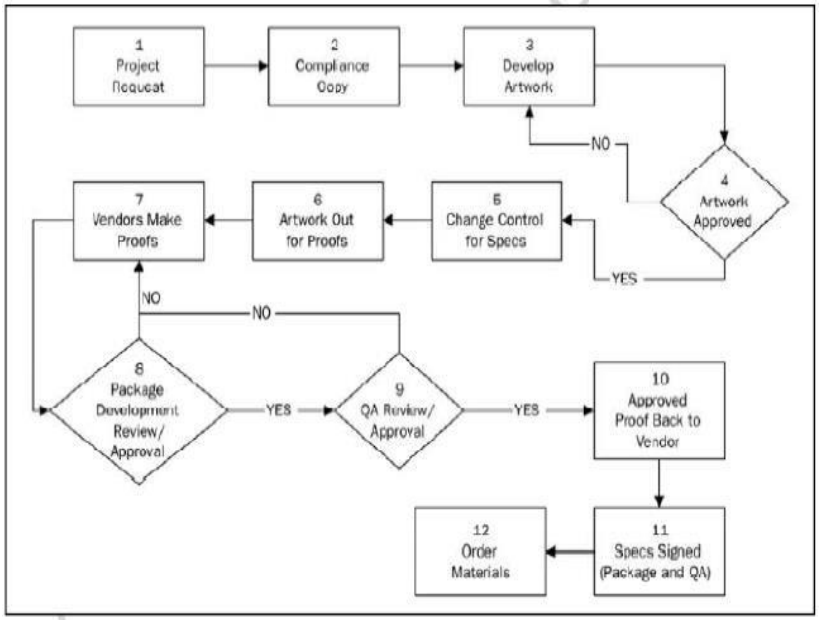
Input → **Tools & Techniques** → Output

5. Data representation

❖ Flowcharting

A flowchart is a graphical representation of a process showing the relationships among the process steps.

- 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 the test procedures or approaches for dealing with them.



8.1 Plan Quality Management

Input → **Tools & Techniques** → Output

5. Data representation (cont'd)

❖ Matrix Diagrams

Also called: matrix, matrix chart

The matrix diagram shows the relationship between two, three or four groups of information. It also can give information about the relationship, such as its strength, the roles played by various individuals or measurements.

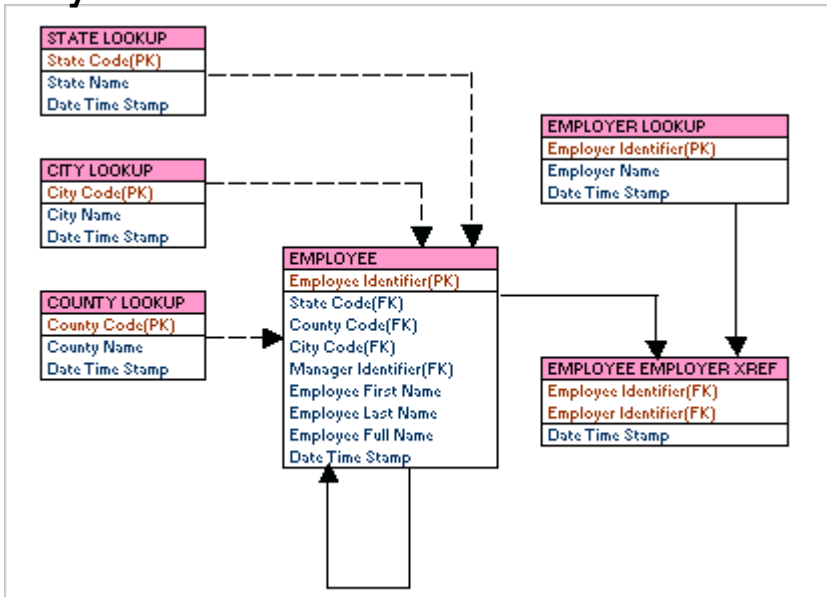
8.1 Plan Quality Management

Input → **Tools & Techniques** → Output

5. Data representation (cont'd)

❖ Logical data model

Logical data models are a visual representation of an organization's data, described in business language and independent of any specific technology. The logical data model can be used to identify where data integrity or other quality issues can arise.



8.1 Plan Quality Management

6. Test and inspection planning

During the planning phase, the PM and the PT determine how to test or inspect the product, deliverable, or service to meet the stakeholders' needs and expectations, as well as how to meet the goal for the product's performance and reliability.

- The tests and inspections are industry dependent and can include, for example, alpha and beta tests in software projects, strength tests in construction projects, inspection in manufacturing, and field tests and nondestructive tests in engineering.

8.1 Plan Quality Management

1. Quality Management Plan

It describes how the PMT will implement the performing organization's quality policy.

- The quality management plan is a component or a subsidiary plan of the PMP.
- The quality management plan provides inputs to the overall PMP and must address quality control (QC), quality assurance (QA) and continuous process improvement for the project.

8.1 Plan Quality Management

1. Quality Management Plan (cont'd)

The quality management plan may include:

- ✓ Quality standards that will be used by the project;
- ✓ Quality objectives of the project;
- ✓ Quality roles and responsibilities;
- ✓ Project deliverables and processes subject to quality review;
- ✓ Quality control and quality management activities planned for the project;
- ✓ Quality tools that will be used for the project;
- ✓ Major procedures relevant for the project, such as dealing with nonconformance, corrective actions procedures, and continuous improvement procedures.

8.1 Plan Quality Management

2. Quality Metrics

A quality metric specifically describes a project or product attribute and how the *Control Quality* process will verify compliance to it.

Some examples of quality metrics include:

- Percentage of tasks completed on time,
- Cost performance measured by CPI,
- Failure rate,
- Number of defects identified per day,
- Total downtime per month,
- Errors found per line of code,
- Customer satisfaction scores,
- Percentage of requirements covered by the test plan as a measure of test coverage.

8.1 Plan Quality Management

2. Quality Metrics - Sample

Project Quality Metrics					
Project		Project #			
Project Manager		Sponsor			0
Project Artifacts		Updated			
ID	Critical Success Criteria	Potential Quality Metric	Priority	Metric Target	Action Plan

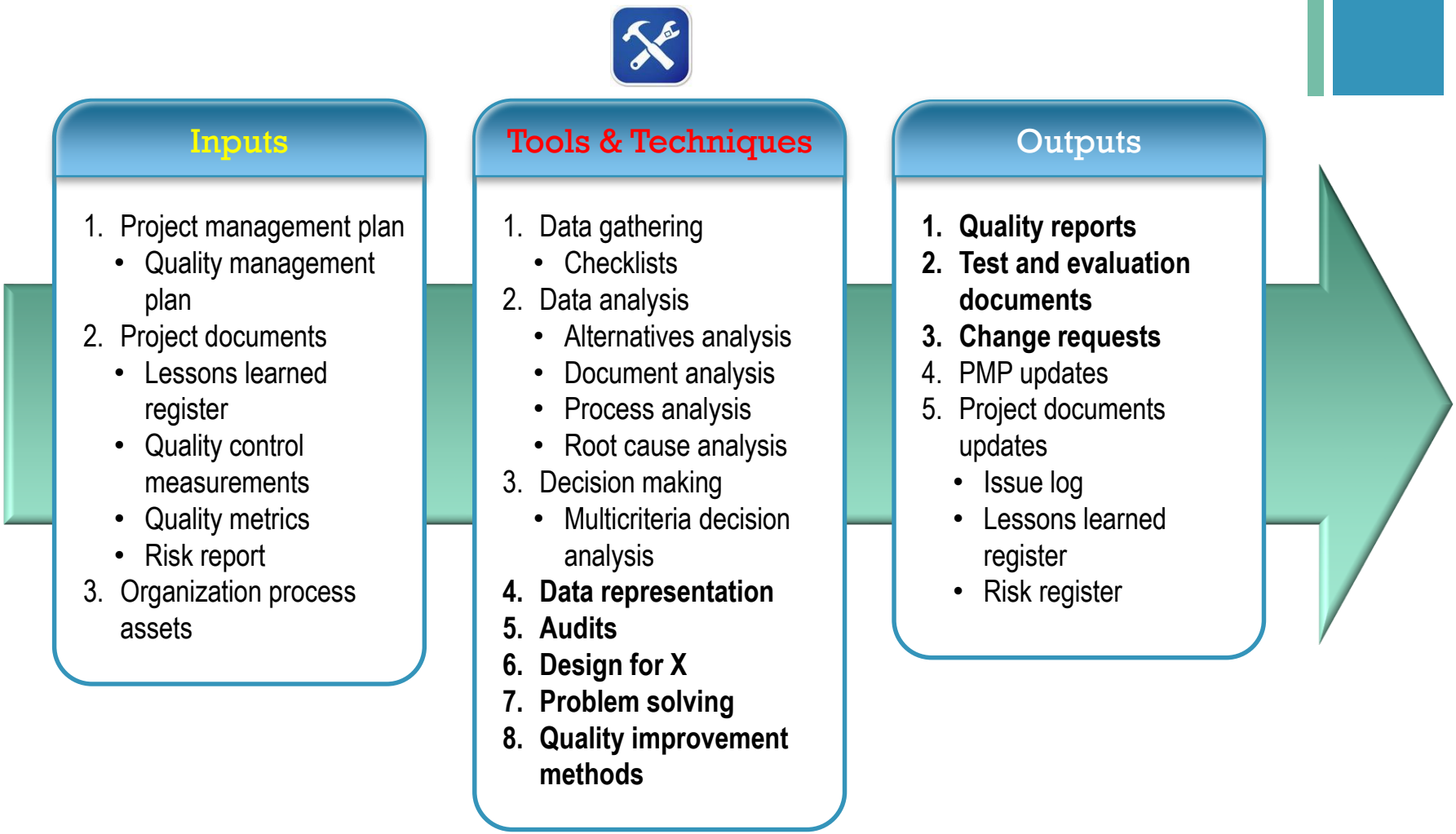
8.2 Manage Quality

Translating the quality management plan into executable quality activities that incorporate the organization's quality policies into the project.

- Quality assurance includes all the activities related to satisfying the relevant quality standards for a project.
- Manage Quality includes all the quality assurance activities, and is also concerned with the product design aspects and process improvements.

Project team members, the PM, and the stakeholders are responsible for the quality assurance of the project.

8.2 Manage Quality



8.2 Manage Quality

4. Data representation

Data representation techniques that can be used include:

- **Affinity diagrams**. Affinity diagrams can organize potential causes of defects into groups showing areas that should be focused on the most.
- **Cause-and-effect diagrams**.
- **Flowcharts**. Flowcharts show a series of steps that lead to a defect.
- **Histograms**.
- **Matrix diagrams**. The matrix diagram seeks to show the strength of relationships among factors, causes, and objectives that exist between the rows and columns that form the matrix.
- **Scatter diagrams**.

8.2 Manage Quality

Input → **Tools & Techniques** → Output

4. Data representation (cont'd)

❖ Affinity diagrams

Affinity diagrams allow large numbers of ideas to be classified into groups for review and analysis.

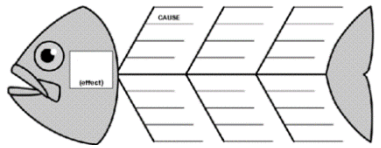
8.2 Manage Quality

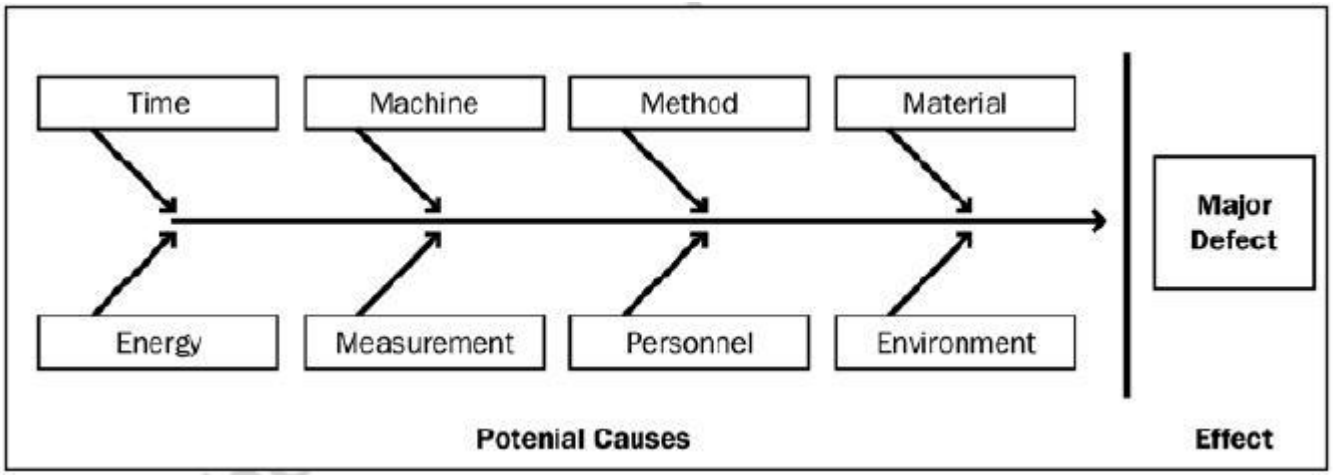
Input → **Tools & Techniques** → Output

4. Data representation (cont'd)

❖ **Cause and Effect Diagrams**

Also called Ishikawa diagrams, fishbone diagrams, or why-why diagrams. This type of diagram breaks down the causes of the problem statement identified into discrete branches, helping to identify the main or root cause of the problem.





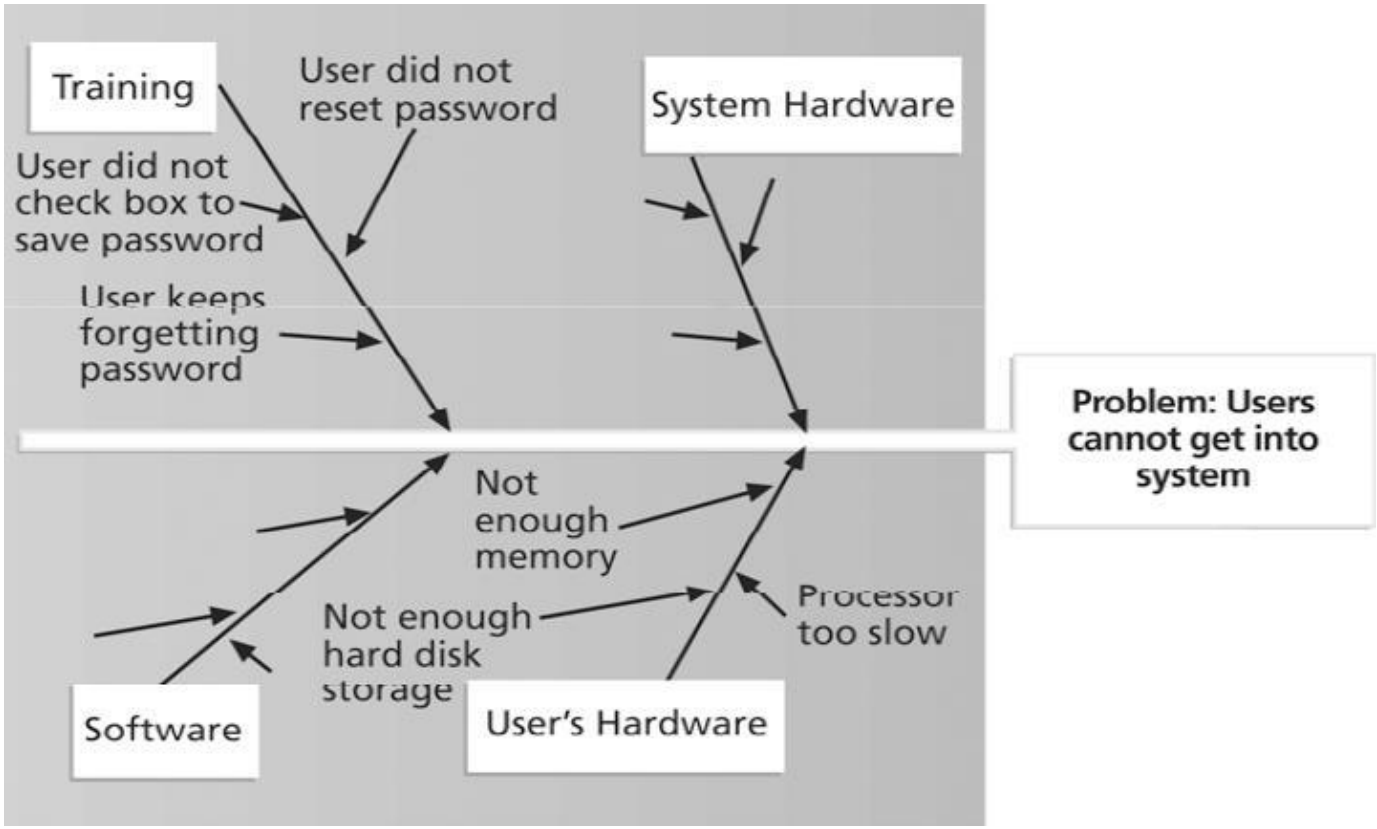
Kaoru Ishikawa

8.2 Manage Quality

Input → **Tools & Techniques** → Output

4. Data representation (cont'd)

❖ Cause and Effect Diagram - Sample



8.2 Manage Quality

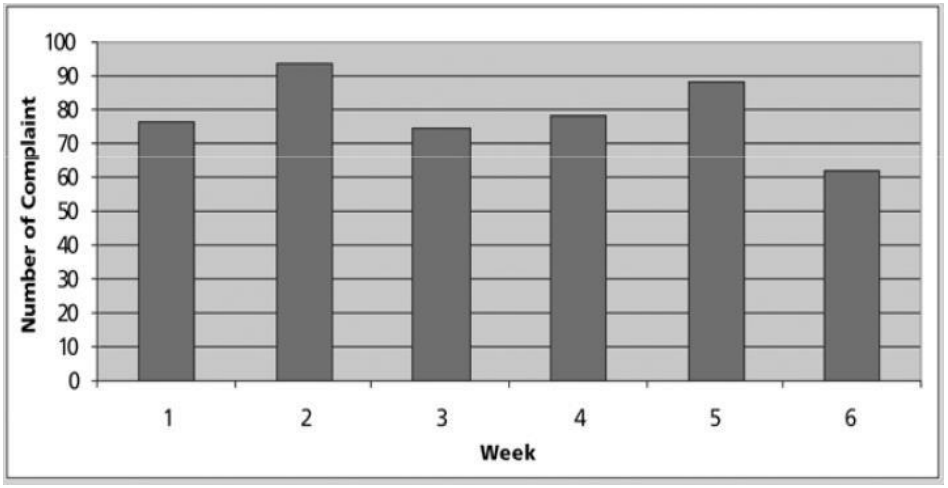
Input → **Tools & Techniques** → Output

4. Data representation (cont'd)

❖ **Histogram**

It is a bar chart showing the distribution of variables. Each column represents an attribute or characteristics of a problem or situation.

- The height of each column represents the relative frequency of the characteristics.
- Histogram helps identify the cause of the problem in a process by the shape and width of the distribution.



8.2 Manage Quality

4. Data representation (cont'd)

❖ **Histogram (cont'd)**

Pareto Chart (80/20 Principles)

Pareto chart is a specific type of histogram ordered by frequency of occurrences.

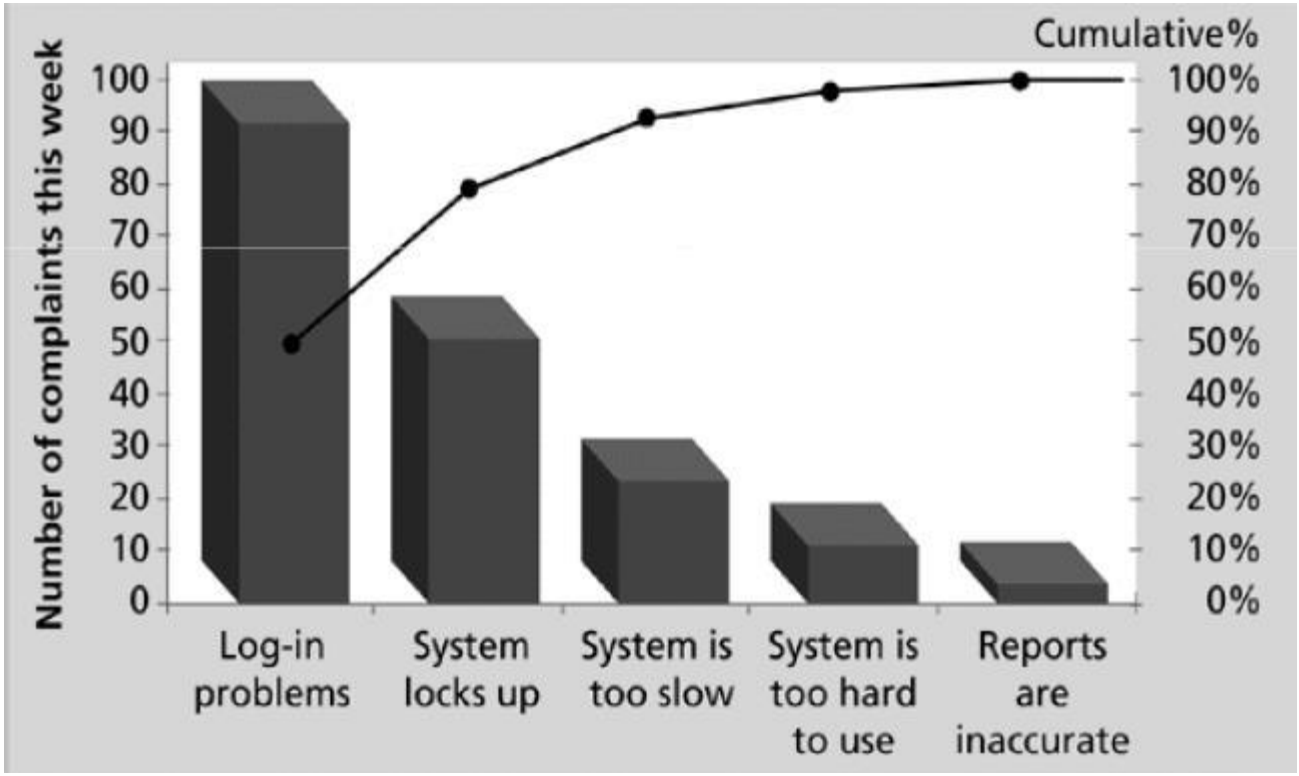
- It can help you identify and prioritize problem areas.
- Pareto analysis is also called the ***80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes.***
- It shows how many defects were generated by type or category of identified cause.
- The Pareto technique is used primarily to identify & evaluate non-conformances.
- The PT should take actions to fix the problems that are causing the greatest number of defects first.
- **Advantages**:
  - helps focus attention on most critical issues.
  - prioritizes potential causes of the problems.
  - separates the critical few from the uncritical many.

8.2 Manage Quality

Input → **Tools & Techniques** → Output

4. Data representation (cont'd)

Pareto Chart Diagram



Wilfredo Pareto

8.2 Manage Quality

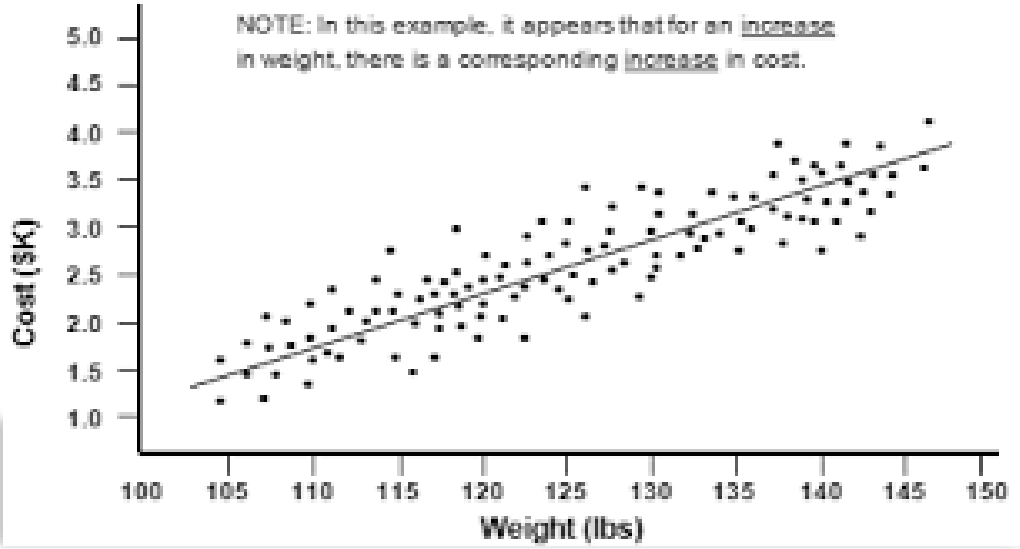
Input → **Tools & Techniques** → Output

4. Data representation (cont'd)

❖ **Scatter Diagram**

It allows the Quality team to study and identify the possible relationship between two variables.

- It shows the pattern of relationship between two variables.
- The closer the points are to a diagonal line the more closely they are related.



8.2 Manage Quality

Input → **Tools & Techniques** → Output

5. Audits

Audit is a structured, independent review to determine if project activities comply with Quality expectation.

Objectives:

- Identifying all good and best practices being implemented;
- Identifying all nonconformity, gaps, and shortcomings;
- Sharing good practices introduced or implemented in similar projects in the organization and/or industry;
- Proactively offering assistance in a positive manner to improve the implementation of processes to help raise team productivity;
- Highlighting contributions of each audit in the lessons learned repository of the organization.
- …

8.2 Manage Quality

Input → Tools & Techniques → Output

5. Audits (cont'd)

- …
- The subsequent (Successive) effort to correct these deficiencies should result in:
  - Reduced cost of quality.
  - Increase in the percentage of acceptance of the product or service by the customer or sponsor within the performing organization.
- Quality audits confirm the implementation of approved change requests, corrective actions, defect repairs, and preventive actions.

8.2 Manage Quality

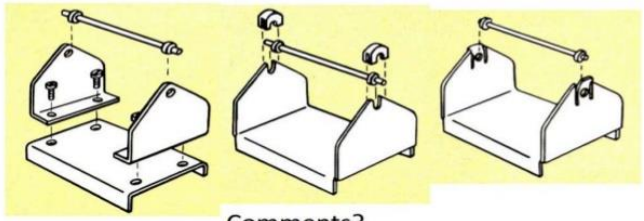
Input → **Tools & Techniques** → Output

6. Design for X

Design for X (DfX) is a set of technical guidelines that may be applied during the design of a product for the optimization of a specific aspect of the design.

- DfX can control or even improve the product's final characteristics.
- The X in DfX can be different aspects of product development, such as reliability, deployment, assembly, manufacturing, cost, service, usability, safety, and quality.
- Using the DfX may result in cost reduction, quality improvement, better performance, and customer satisfaction.

Three solutions to the same design issue.



Comments?
Which do you prefer?
Why?

8.2 Manage Quality

7. Problem solving

Problem solving entails finding solutions for issues or challenges. It can include gathering additional information, critical thinking, creative, quantitative and/or logical approaches.

- Effective and systematic problem solving is a fundamental element in QA and quality improvement. Problems can arise as a result of the *Control Quality* process or from quality audits and can be associated with a process or deliverable.
- Using a structured problem-solving method will help eliminate the problem and develop a long-lasting solution.
- Problem-solving methods generally include:
  - Defining the problem,
  - Identifying the root-cause,
  - Generating possible solutions,
  - Choosing the best solution,
  - Implementing the solution, and
  - Verifying solution effectiveness.

8.2 Manage Quality

8. Quality improvement methods

Quality improvements can occur based on findings and recommendations from quality control processes, the findings of the quality audits, or problem solving in the *Manage Quality* process.

- Plan-do-check-act and Six Sigma are two of the most common quality improvement tools used to analyze and evaluate opportunities for improvement.

8.2 Manage Quality

1. Quality reports

The quality reports can be graphical, numerical, or qualitative. The information provided can be used by other processes and departments to take corrective actions in order to achieve the project quality expectations.

The information presented in the quality reports may include:

- ✓ All quality management issues escalated by the team;
- ✓ Recommendations for process, project, and product improvements;
- ✓ Corrective actions recommendations (including rework, defect/bugs repair, 100% inspection, and more);
- ✓ The summary of findings from the *Control Quality* process.

8.2 Manage Quality

2. Test and evaluation documents

Test and evaluation documents can be created based on industry needs and the organization's templates. They are inputs to the *Control Quality* process and are used to evaluate the achievement of quality objectives. These documents may include dedicated checklists and detailed requirements traceability matrices as part of the document.

3. Change Requests

Quality improvement includes taking action to increase the effectiveness and efficiency of the policies, processes, and procedures of the performing organization which should benefit the stakeholders in the project.

8.3 Control Quality

Monitoring and recording results of executing the quality management activities in order to assess performance ensure the project outputs are complete, correct, and meet customer expectations.

- QC involves monitoring specific project results to determine:
  - Whether they comply with relevant quality standards.
  - Identifying ways to eliminate causes of unsatisfactory results.
- QC standards include project processes and product goals.
- Project results include deliverables and PM results, such as cost and schedule performance.
- QC is often performed by a quality control department.
- QC can include taking actions to eliminate cause of unsatisfactory project performance.

8.3 Control Quality

Inputs

1. Project management plan
   - Quality management plan
2. Project documents
   - Lessons learned register
   - Quality metrics
   - Test and evaluation documents
3. **Approved change requests**
4. Deliverables
5. Work performance data
6. Enterprise environmental factors
7. **Organizational process assets**

Tools & Techniques

1. **Data gathering**
2. Data analysis
   - Performance reviews
   - Root cause analysis
3. **Inspection**
4. **Testing/product evaluations**
5. **Data representation**
   - Cause-effect diagrams
   - Control charts
   - Histogram
   - Scatter diagrams
6. **Meetings**

Outputs

1. **Quality control measurements**
2. **Verified deliverables**
3. **Work performance information**
4. **Change requests**
5. **PMP update**
6. Project documents updates
   - Issue log
   - Lessons learned register
   - Risk register
   - Test and evaluation documents

8.3 Control Quality

3. Approved Change requests

These can include:

- Modifications such as revised work methods and revised schedule.
- The timely corrective implementation of approved changes that needs to be verified.

7. Organizational Process Assets

Include, but are not limited to:

- Quality standards and policies;
- Quality templates, for example, check sheets, checklists, etc.
- Issue and defect reporting procedures and communication policies.

8.3 Control Quality

1. Data gathering

Data-gathering techniques that can be used include:

- **Checklists.** Checklists help in managing the control quality activities in a structured manner.
- **Questionnaires and Surveys.**
- **Statistical sampling.** It is used to choose part of a population of interest for inspection (ex: selecting 10 engineering drawings at random from a list of 75).
  - Appropriate sampling can often reduce the cost of QC.
  - The size of a sample depends on how representative you want the sample to be.
  - Expert judgment will be involved in statistical analysis.
- **Check sheets**. Check sheets are also known as tally sheets and are used to organize facts in a manner that will facilitate the effective collection of useful data about a potential quality problem. They are especially useful for gathering attributes data while performing inspections to identify defects;

8.3 Control Quality

Input → **Tools & Techniques** → Output

1. Data gathering (cont'd)

❖ Check Sheet

A check sheet can be introduced as the most basic tool for quality.

- A check sheet is basically used for gathering and organizing data.
- When this is done with the help of software packages such as Microsoft Excel, you can derive further analysis graphs and automate through available macros.
- Therefore, it is always a good idea to use a software check sheet for information gathering and organizing needs.

Motor Assembly Check Sheet

Name of Data Recorder: Lester B. Rapp
Location: Rochester, New York
Data Collection Dates: 1/17 - 1/23

Defect Types / Event Occurrence	Dates							TOTAL
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Supplied parts rusted		|||||	||||	||			20
Misaligned weld			|||		||		5
Improper test procedure								0
Wrong part issued								3
Film on parts								0
Voids in casting				||||	||		6
Incorrect dimensions						||	2
Adhesive failure								0
Mixing insufficient								1
Spray failure			|||||			5
TOTAL		10	13	10	5	4		

8.3 Control Quality

3. Inspection

An inspection is the examination of a work product to determine if it conforms to documented standards..

- Inspections can be conducted at any level i.e. results of a single activity or the final product can be inspected.
- Inspections are also used to validate Corrective actions, Preventive actions & defect repairs.

4. Testing or product evaluations

Testing is an organized and constructed investigation conducted to provide objective information about the quality of the product or service under test in accordance with the project requirements. The intent of testing is to find errors, defects, bugs, or other nonconformance problems in the product or service.

8.3 Control Quality

5. Data representation (cont'd)

- **Cause-and-effect diagrams**. They are used to identify the possible effects of quality defects and errors.
- **Histograms**. Histograms can demonstrate the number of defects by source or by component.
- **Scatter diagrams**. They can show the planned performance on one axis and the actual performance on the second axis.
- **Control charts** are used to determine whether or not a process is stable or has predictable performance…

8.3 Control Quality

5. Data representation

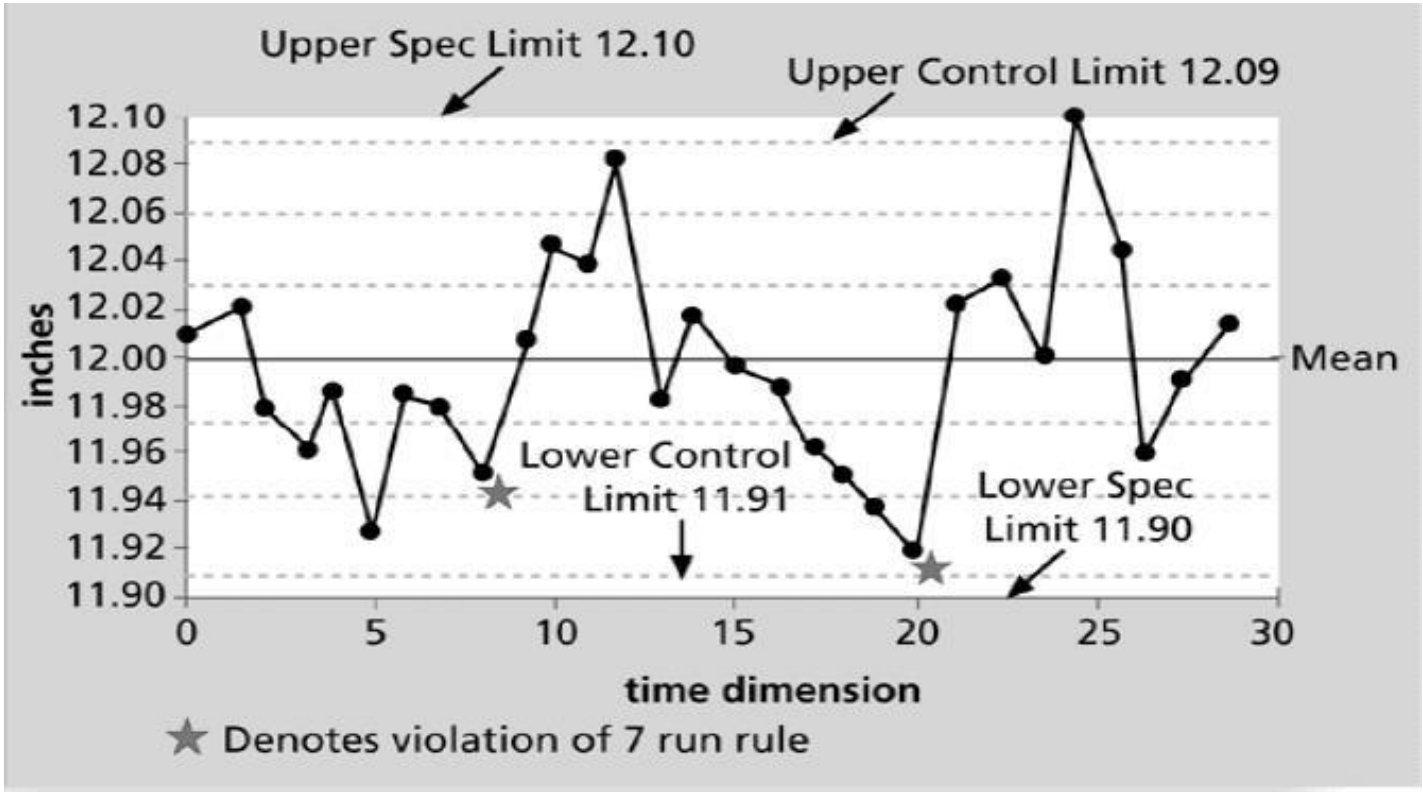
- **Control charts** are used to determine whether or not a process is stable or has predictable performance.
  - *Upper and lower specification limits* are based on the requirements and reflect the maximum and minimum values allowed.
  - *Upper and lower control limits* are different from specification limits. The control limits are determined using standard statistical calculations and principles to ultimately establish the natural capability for a stable process.
- The PM and appropriate stakeholders may use the statistically calculated control limits to identify the points at which corrective action will be taken to prevent performance that remains outside the control limits.
- 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, they may also be used to monitor cost and schedule variances, volume, frequency of scope changes, or other management results to help determine if the project management processes are in control.

8.3 Control Quality

Input → **Tools & Techniques** → Output

5. Data representation (cont'd)

- **Control Chart - Sample**



8.3 Control Quality

5. Data representation (cont'd)

❖ **Control Chart – Rule of Seven**

It refers to non-random data points grouped together in a series that total seven on one side of the mean.

- This indicates that the process may be out of control.
- The rule of seven states that if seven data points in a row are all below the mean, above the mean, or are all increasing or decreasing, then the process needs to be examined for non-random problems

A **run chart** can help you spot upward and downward trends and it can show you a general picture of a process. A **control chart** also plots a single line of data over time. However, control charts include upper and lower control limit lines with a centerline. … Run charts lack the benefit of statistical control limits.

8.3 Control Quality

6. Meetings

The following meetings may be used as part of the *Control Quality* process:

- **Approved change requests review**. All approved change requests should be reviewed to verify that they were implemented as approved. This review should also check that partial changes are completed and all parts have been properly implemented, tested, completed, and certified.
- **Retrospectives/lesson learned**. A meeting held by a project team to discuss:
  - Successful elements in the project/phase,
  - What could be improved,
  - What to incorporate in the ongoing project and what in future projects,
  - What to add to the OPA.

8.3 Control Quality

1. Quality control measurements

These measurements are the documented results of *Control Quality* activities. They should be captured in the format that was specified in the quality management plan..

2. Verified Deliverables

QC aims to determine the correctness of deliverables.
The result of the *Control Quality* process is 'verified deliverables'.

3. Work Performance Information

WPI includes information on project requirements fulfillment, causes for rejections, rework required, recommendations for corrective actions, lists of verified deliverables, status of the quality metrics, and the need for process adjustments.

8.3 Control Quality

4. Change Requests

If the recommended corrective or preventive actions or a defect repair requires a change to the PMP, a change request should be initiated in accordance with the defined *Perform Integrated Change Control* process.

5. Project management plan updates

The PMP is updated to reflect changes to the quality management plan.

- All requested changes (addition, modification, or deletions) to the PMP and its subsidiary plans are processed by review and disposition through the *Perform Integrated Change Control* process.
- Elements of the PMP that may get updated include:
  - Quality management plan,
  - Process improvement plan

8.3 Control Quality

Quality Assurance VS Quality Control

Quality Assurance	Quality Control
• Identifies weaknesses in processes and improve them. • QA is the responsibility of the entire team. • Prevents the introduction of issues or defects. • QA evaluates whether or not quality control is working for the primary purpose of determining whether or not there is a weakness in the process. • QA improves the process that is applied to multiple products that will ever be produced by a process. • QA personnel should not perform quality control unless doing it to validate quality control is working.	• Identifies defects for the primary purpose of correcting defects. • QC is the responsibility of the tester. • Detects, reports and corrects defects. • QC evaluates if the application is working for the primary purpose of determining if there is a flaw / defect in the functionalities. • QC improves the development of a specific product or service. • QC personnel may perform quality assurance tasks if and when required.

Thank you

Knowledge area

- You can find the whole Project Management Professional course on Z:\eLibraries\eBooks\Management\PMP 6 Course
- You can also visit www.pmi.org for more information

Please call us for any support