PROJECT MANAGEMENT

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PMP® Certification Training

Lesson10: Project Quality Management

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PROJECT MANAGEMENT

Objectives

- Define quality and quality management
- Differentiate among quality planning, quality assurance, and quality control
- Explain cost of quality and its categories
- Describe the Project Quality Management processes
- Explain the quality tools
- Explain Six Sigma

Quality

In a project, meeting the quality expectation is the responsibility of not only the project manager but everyone involved.

The definition of *Quality is as follows:

> Quality is the degree to which a set of inherent characteristics fulfills requirements (ISO 9000).

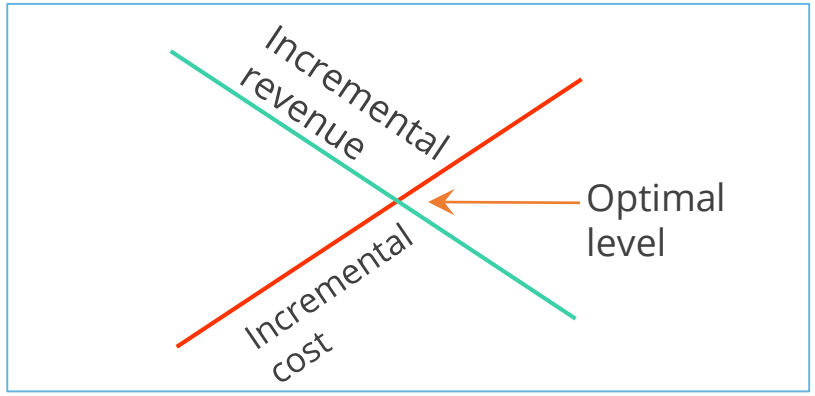
A project is said to meet quality expectations when all the project requirements agreed in the beginning of the project are met and the resulting product is usable.

*Definition taken from the Glossary of the Project Management Institute, *A Guide to the Project Management Body of Knowledge, (PMBOK® Guide)* – Sixth Edition, Project Management Institute, Inc., 2017, Page 274

Optimal Level of Quality

Achieving quality involves cost. Increased efforts and costs can increase the quality of output, but a ceiling on investment on quality has to be fixed.

- The investment on quality is determined by identifying the optimal level of quality of a project.
- Optimal level of quality is achieved when the incremental cost of achieving the quality is equal to the incremental revenue from such improvements.



The sales of a toy manufacturer is at an all-time low because of poor quality. To improve the quality, investments are made on identifying demand, sharing samples, and collecting feedback. Following this, parents are enticed to buy the product. However, the additional investment may increase the cost of the toy, making it prohibitive for the parents to buy. Optimal level of quality is reached at a point where the toy manufacturer gets the maximum number of buyers for the toys manufactured.

Quality Management

Quality management includes creating and following policies and procedures that meet the project's defined quality needs. This is to ensure that the specified approach to quality is implemented on the project. The three key activities of quality management are as follows:

Quality Planning	Quality-related activities of the project are planned
Quality Assurance/ Manage Quality	Manage Quality/Quality Assurance is carried out to ensure that a process is followed per the quality management plan
Quality Control	Periodic checks are conducted to ensure quality improvements

PROJECT MANAGEMENT

Quality Planning vs. Quality Assurance vs. Quality Control

Basis of Comparison	Scope	Activities	Focus Area
Quality Planning	Determines a plan for quality, defining the standards, templates, policies, and procedures	Involves preparation of the quality management plan	Focuses on information on the level of quality and the methods of achieving it
Quality Assurance/ Manage Quality	Determines if the project is complying with the organizational (as well as project) policies and procedures	Involves conducting regular process audits to identify deviations from the quality plan and undertake corrective and preventive actions	Focuses on processes and not products
Quality Control	Measures specific project results (product) against standards	Involves inspecting and verifying the project's product, defect repair, and measuring whether the quality indicators are improving	Focuses on product and data

Quality Planning vs. Quality Assurance vs. Quality Control

A project was planned to be completed within plus or minus 10 percent of the budget. Three months ago, the project was over budget by 20 percent. The most recent measurement done one day ago shows budget overrun by 15 percent.

Since there is an improvement of 5 percent, it is quite likely that over the next 3 months the cost would reduce and the project could get completed within the planned limit. If the cost increases further, corrective and preventive actions have to be taken to bring the project within the agreed limits. This is quality control.

Cost of Quality

"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)." Cost of quality can be categorized as follows:

Cost of Conformance

It is the money spent during the project to avoid failures. This can be divided as follows:

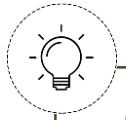
- Prevention Costs: Costs to prevent errors and produce quality products
  Example: training, documentation, equipment, time to do it right
- Appraisal Costs: Costs to assess the quality
  Example: testing, destructive testing loss, and inspections

Cost of Nonconformance

It is the money spent during and after the project because of failures. This can be divided as follows:

- Internal Failure Costs: Costs that occur before the product is released
  Example: rework, scrap
- External Failure Costs: Costs incurred after the product is released to the customer
  Example: liabilities, warranty, and lost business

Figure 8-5. Cost of Quality



Concept-based questions on cost of quality can be expected in the exam.

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Key Concepts

Some of the key concepts are:

- **Prevention over inspection**—Prevention is keeping errors out of the process, and inspection is keeping errors out of the hands of the customer

- **Attribute sampling vs. variable sampling** —In attribute sampling, the result either conforms or does not conform. In variable sampling, the result is rated on a continuous scale that measures the degree of conformity

- **Tolerances and control limits**—Tolerance is the specified range of acceptable results, and control limits identify the boundaries of common variation in a statistically stable process

- **Five levels of effective quality management**
  - Let the customer find the defects, which can lead to warranty issues, recalls, loss of reputation, and rework costs
  - Detect and correct defects during the control quality process
  - Use quality assurance to ensure the correct process is followed
  - Incorporate quality into planning and designing of the project and product
  - Create a culture that helps the organization to be committed to quality in processes and products

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Trends and Emerging Practices

Some of the trends in Project Quality Management are:

- **Customer satisfaction—**A combination of conformance to requirements and fitness for use ensures that the customer requirements are met
- **Continual improvement—**PDCA (Plan-Do-Check-Act) cycle, TQM (Total Quality Management), Six Sigma, Lean Six Sigma, and Kaizen improve both the quality of project management and the quality of the end product, service, or result
- **Management responsibility—**Management should provide suitable resources at adequate capacities
- **Mutually beneficial partnership with suppliers—**Organization should prefer long-term relationships over short-term gains

Kaizen (change for better)

A philosophy that looks for small and continuous improvements in a process

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Tailoring Considerations

Some of the considerations for tailoring are:

- **Policy compliance and auditing—**What quality policies, procedures, tools, techniques, and templates does the organization follow?
- **Standards and regulatory compliance—**What industry quality standards and specific governmental, legal, or regulatory constraints need to be taken into consideration?
- **Continuous improvement—**Is quality improvement 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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Considerations for Agile/Adaptive Environments

- Agile methods involve frequent quality and review steps built in throughout the project rather than toward the end of the project.
- Recurring retrospectives help in finding root causes of issues and suggest approaches for further improvements.
- Agile methods focus on small batches of work to uncover inconsistencies and quality issues earlier in the project life cycle.

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Project Quality Management Processes

Knowledge Areas		Project Integration Management	Project Scope Management	Project Schedule Management	Project Cost Management	Project Quality Management	Projecct Resource Management	Project Communications Management	Project Risk Management	Project Procurement Management	Project Stakeholder Management
Project Management Process Groups	Initiating	4.1 Develop Project Charter									13.1 Identify Stakeholders
	Planning	4.2 Develop Project Management Plan	5.1 Plan Scope 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS	6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule	7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget	8.1 Plan Quality Management	9.1 Plan Resource Management 9.2 Estimate Activity Resources	10.1 Plan Communications Management	11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Response	12.1 Plan Procurement Management	13.2 Plan Stakeholder Engagement
	Executing	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge				8.2 Manage Quality	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	10.2 Manage Communications	11.6 Implement Risk Response	12.2 Conduct Procurements	13.3 Manage Stakeholder Engagement
	Monitoring and Controlling	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	5.5 Validate Scope 5.6 Control Scope	6.6 Control Schedule	7.4 Control Costs	8.3 Control Quality	9.6 Control Resource	10.3 Monitor Communications	11.7 Monitor Risks	12.3 Control Procurements	13.4 Monitor Stakeholder Engagements
	Closing	4.7 Close Project or Phase									

Table 1-4. Project Management Process Group and Knowledge Area Mapping

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Plan Quality Management

"Plan Quality Management is the process of identifying 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." It is part of the Planning Process Group.

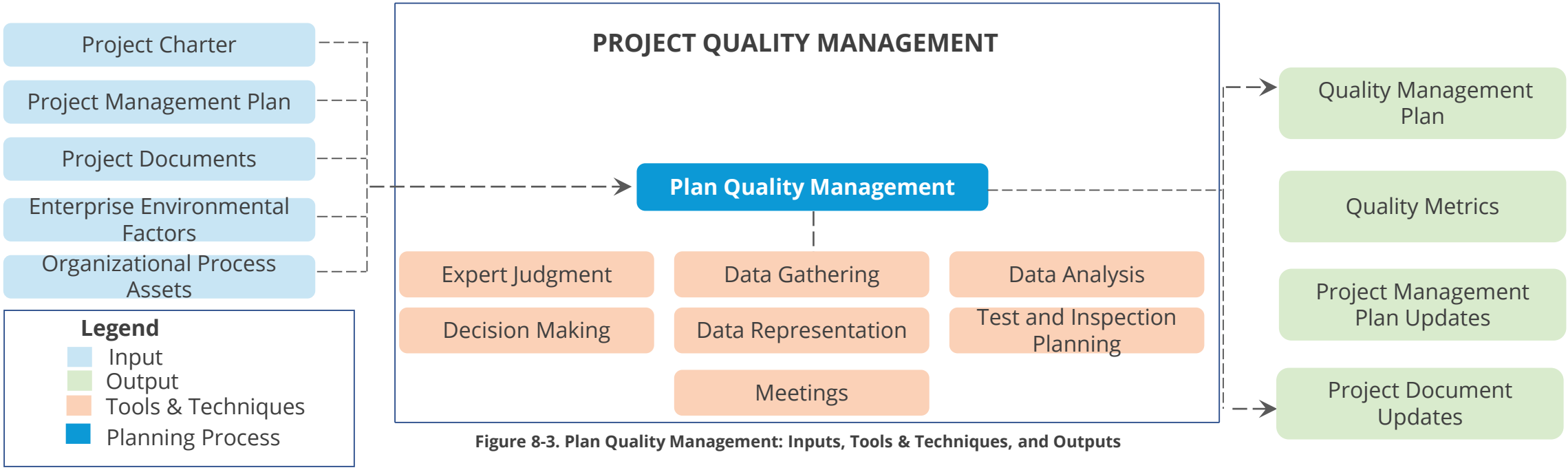

Figure 8-3. Plan Quality Management: Inputs, Tools & Techniques, and Outputs

An understanding of planning quality management may be useful while answering the exam.

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Manage Quality

"Manage Quality is the process of translating the quality management plan into executable quality activities that incorporate the organization's quality policies into the project." It is part of the Executing Process Group.

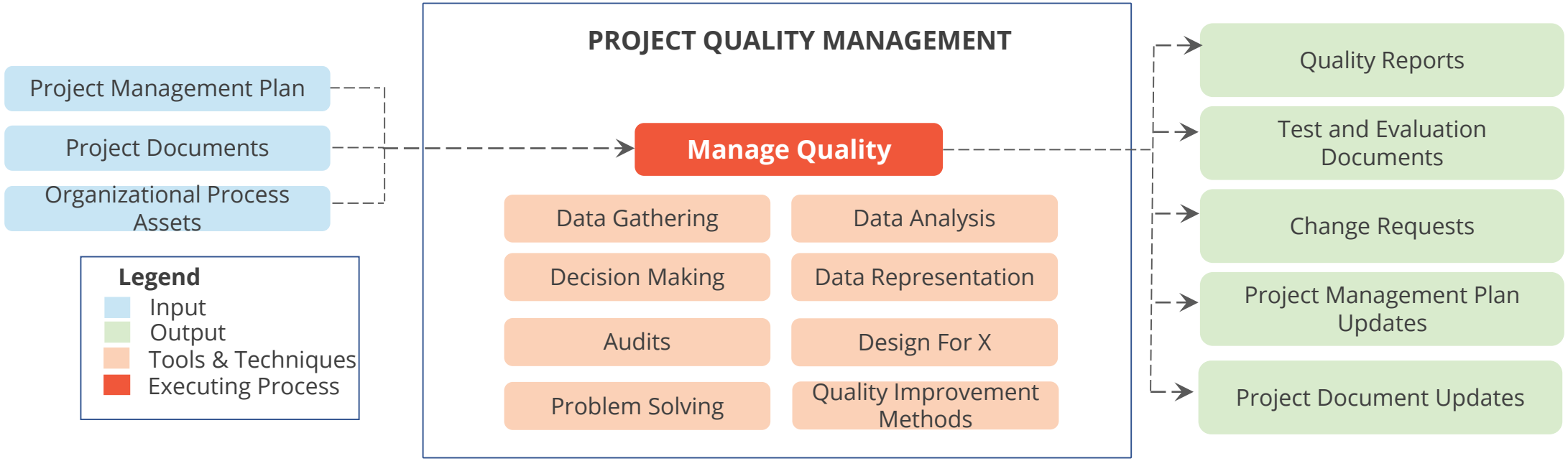

Figure 8-7. Manage Quality: Inputs, Tools & Techniques, and Outputs

Understanding characteristics of quality assurance tools and techniques may be useful while answering the exam.

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Control Quality

"Control Quality is the process of monitoring and recording results of executing the quality management activities to assess performance and ensure the project outputs are complete, correct, and meet customer expectations." It is part of the Monitoring and Controlling Process Group.

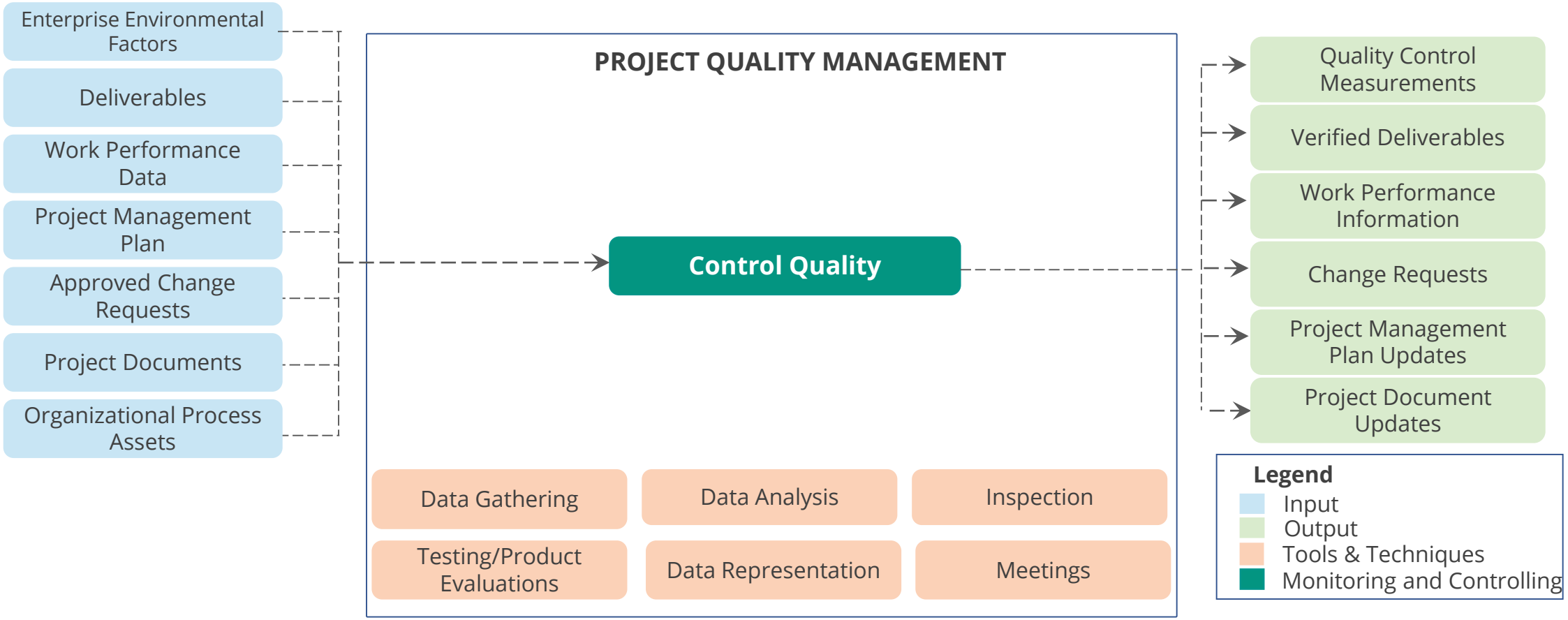

Figure 8-10. Control Quality: Inputs, Tools & Techniques, and Outputs

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Business Scenario

PROBLEM STATEMENT

You are a project manager with Ace Engineering Inc. Four months ago, you wrapped up a project that produced an ignition switch for an automotive company's ignition switch redesign. Managing the project went well because your parts consistently met your quality metrics and fitness for use tests and passed all control charts. There was no indication of issues with quality and grade that would prompt a need for change.

During a post-production quality audit, one of your company's test engineers discovers that a key chain with many keys could pull the key out of the ignition, causing a car to stall as it is driving. This could potentially cause serious injury as air bags would not deploy in an accident. Several hundred thousand cars have been sold with the ignition switch manufactured by the automotive company. What should you do?

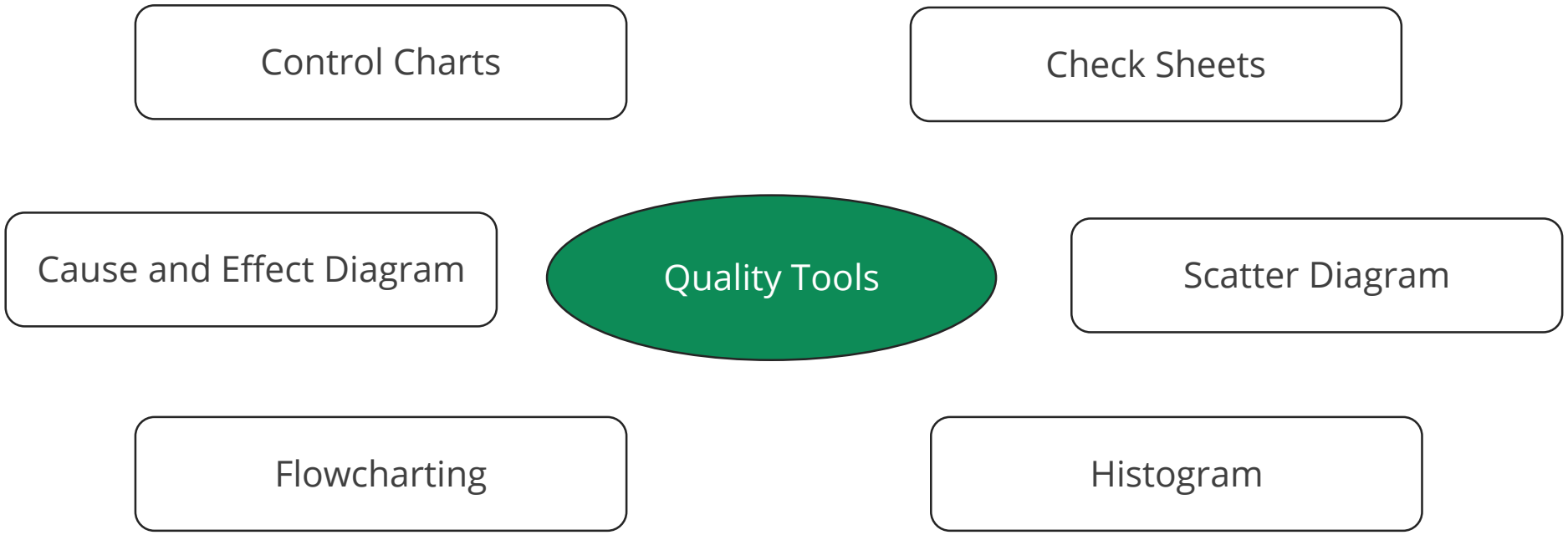
Business Scenario

SOLUTION

Although you are no longer working on the project, you and your company are still responsible for the outcome of the project to the stakeholders. Therefore, first meet with the sponsor of the project so that the customer can be informed.

In an attempt to minimize nonconformance costs and its impact, a recall of all parts needs to be executed. The team needs to be reassembled to evaluate the failed test and find out the root cause of the failure and its effect by using the fishbone diagram. This will help the team determine how to move forward in terms of corrective action.

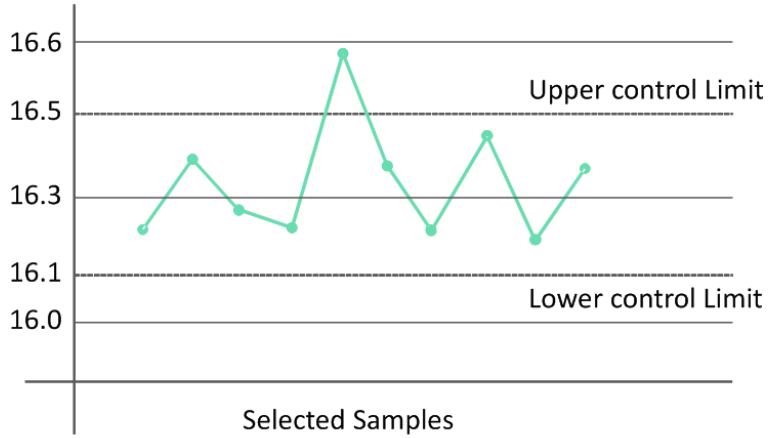
Quality Tools



Control Charts

Control charts help to determine if a process is within acceptable limit.

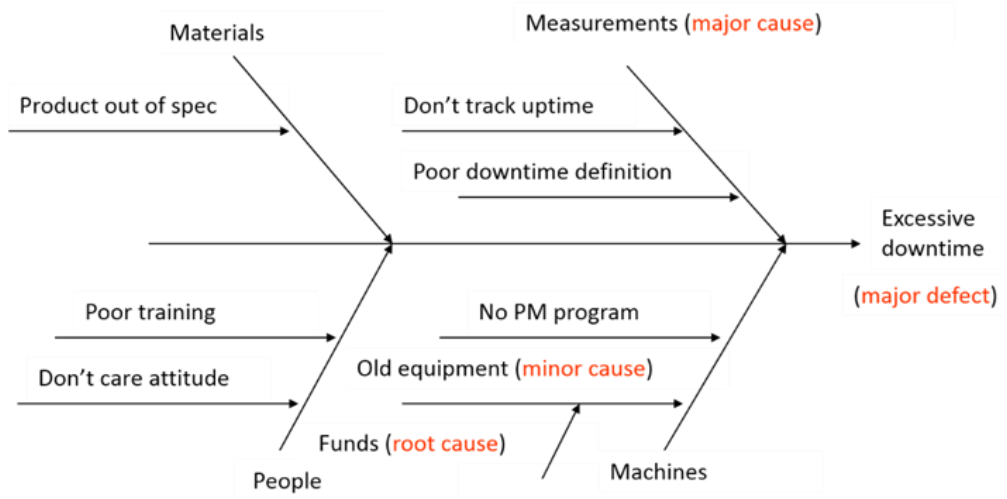
- They are useful to monitor project performance in terms of cost or schedule variance.
- Upper and lower control limits have to be set and the actual schedule variation over time has to be plotted.
- If the values are within the control limits, the project is on track.
- If the schedule variance goes out of these limits, project is out of control and investigations and corrective actions need to be done.



Cause and Effect Diagram

Cause and effect diagram is also called the fishbone or Ishikawa diagram.

- It is used in both quality planning and control.
- It is used to organize thoughts or ideas and to identify the root cause of a problem.
- To draw a fishbone diagram, first identify the reasons at a broad level and then try to find specific reasons under each category.

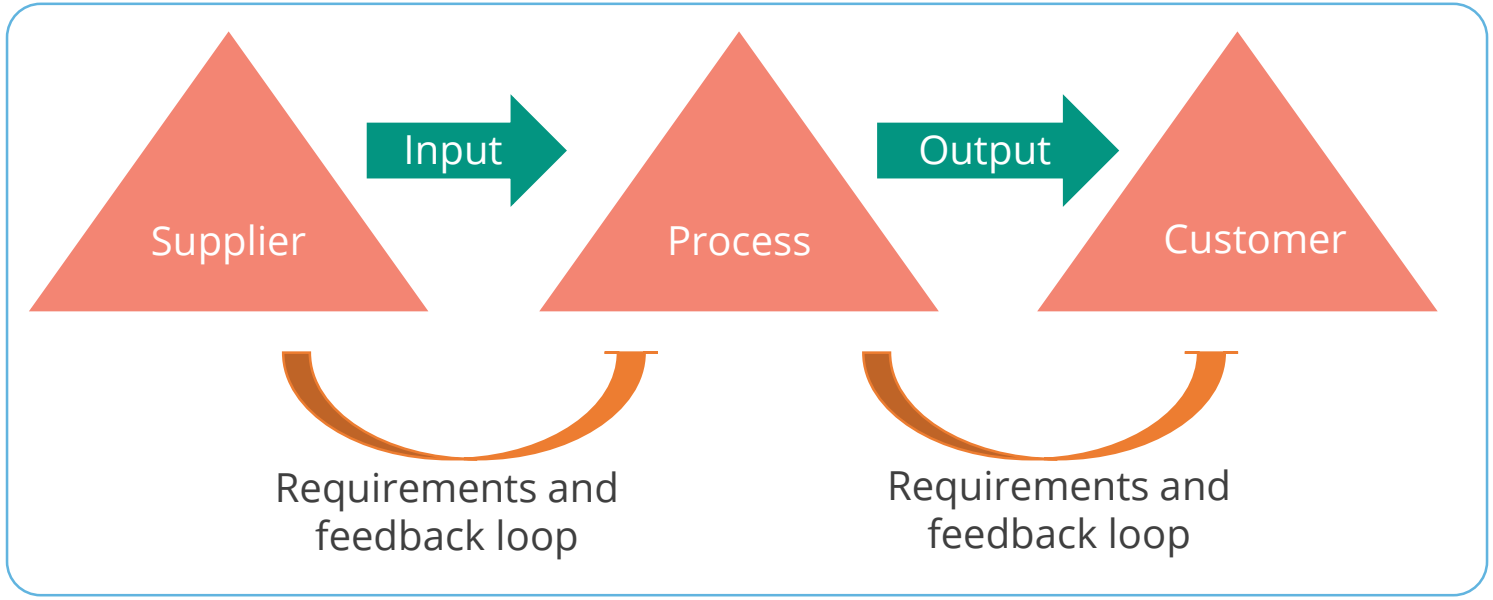


Practice cause and effect diagram for various business scenarios. This will be useful while answering questions based on cause and effect diagram.

Flowcharting

Flowcharts are graphical representations that show how a process or system flows from beginning to end and how the elements interrelate.

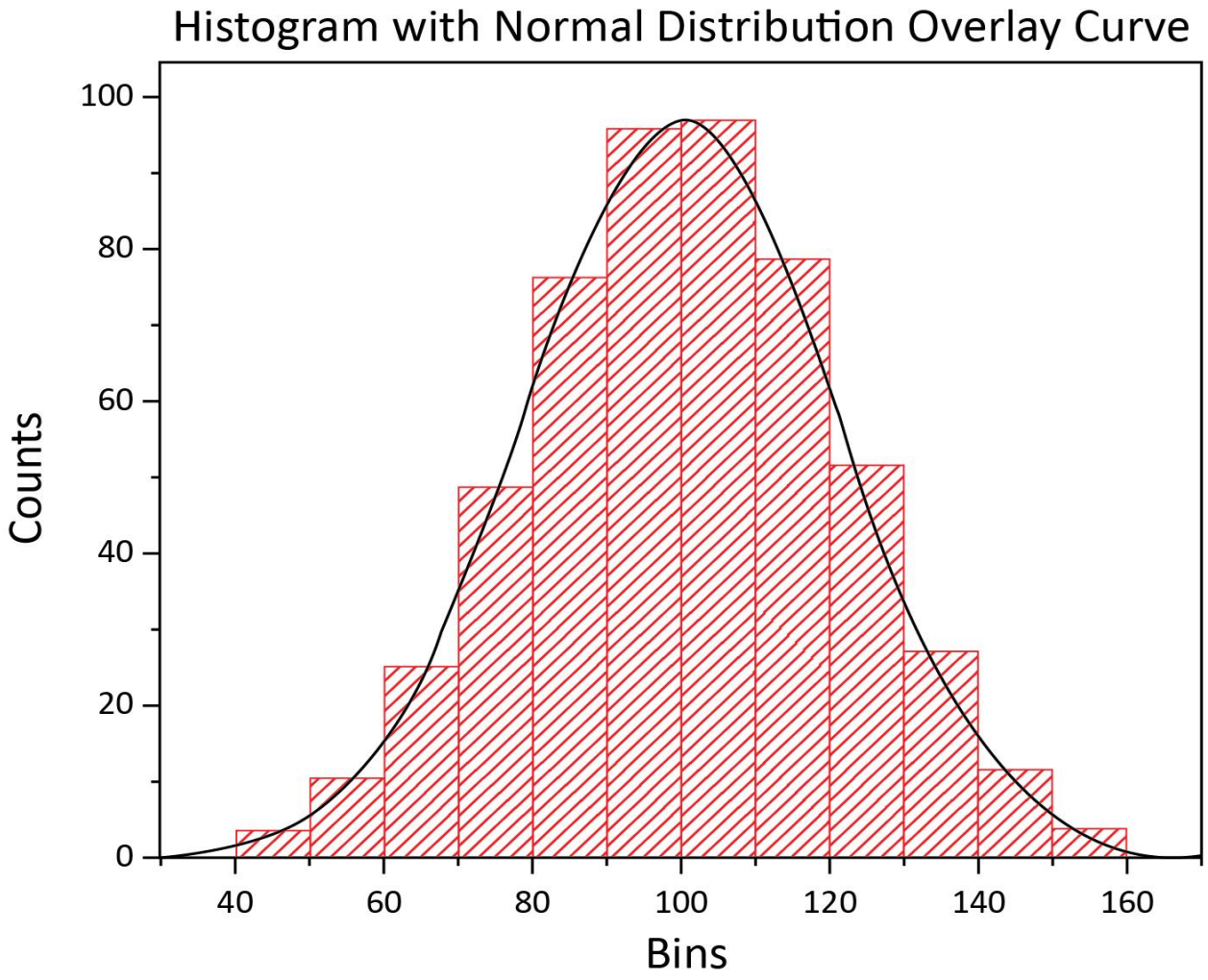
- They represent the process and help analyze where the problems occur.
- They are used to identify redundancies and bottlenecks.



Histogram

Histogram is a vertical bar chart showing the frequency of occurrence of a particular variable.

The height of each column represents the relative frequency of the variable.



Check Sheets

Check sheets, also known as tally sheets, are checklists used for collecting data.

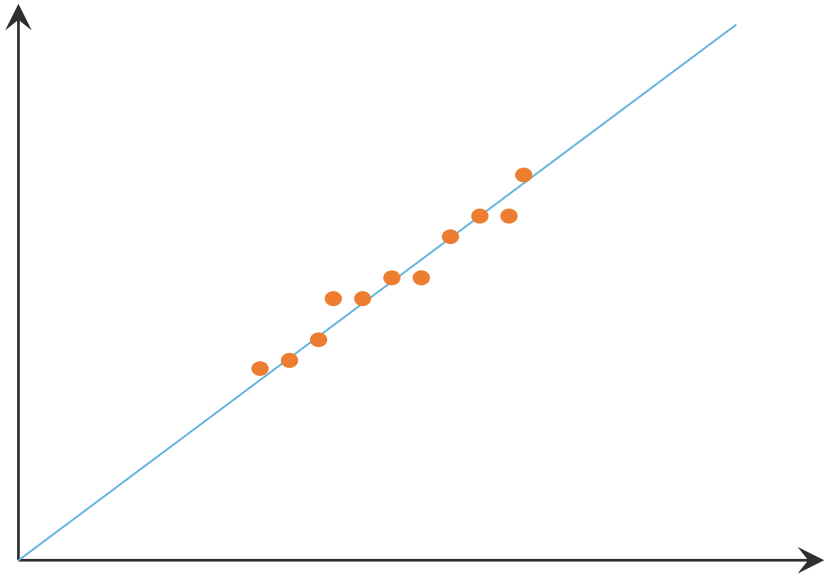
- It ensures that the relevant data or steps of a process are captured and executed.
- It is also useful during inspections.

Defect Description	Frequency of Issues (Tally)				
	Process 1	Process 2	Process 3	Process 4	Total
Defect 1	||||	|	|||	𝍸	13
Defect 2	||	|||	||	||||	11
Defect 3	||	|||	||	||	9
Defect 4	|||	||	||||	|||	12
Total	11	9	11	14	45

Scatter Diagram

Scatter diagram tracks two variables to see if they are correlated or have no relationship.

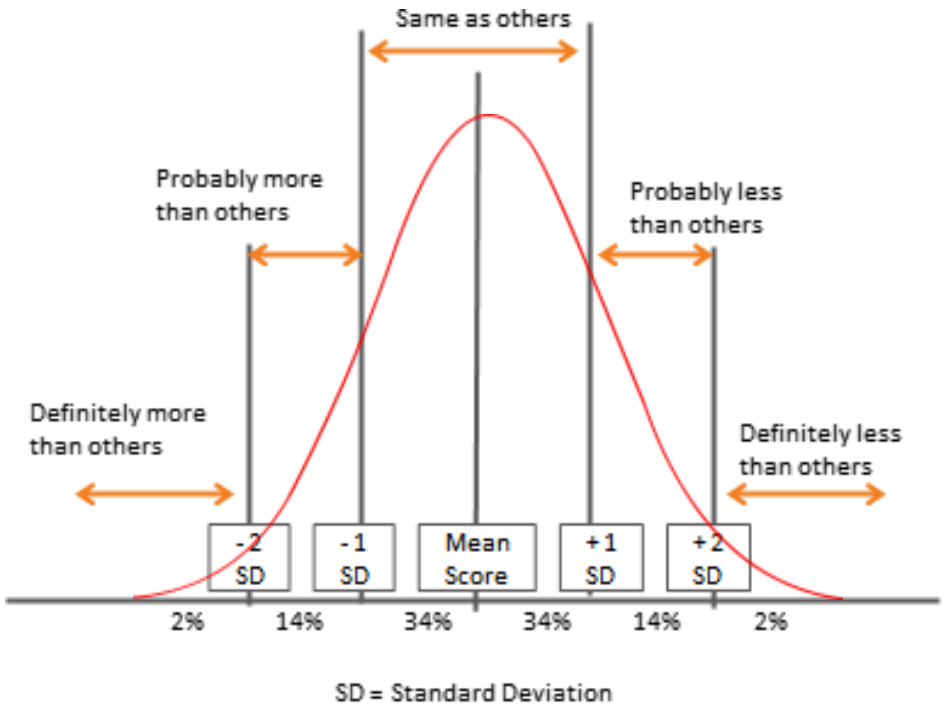
If the two variables are related, scatter diagrams are used to observe the changes in one variable due to a change in the other.



Six Sigma

The concept of Six Sigma is used to produce near-perfect products and services consistently.

- If large volume of data is plotted, the graph takes the form of a bell curve, and such distribution is called normal distribution.
- The line corresponding to the top of the bell curve is the median of the data sample.
- Standard deviation or Sigma is used to measure how far the data is from the mean.
- One standard deviation from the mean covers 68% data.
- At Six Sigma, the distribution covers 99.99966% of the data.



Six Sigma: Example

A tire manufacturing company produces 100,000 units per day. Random samples of these units are verified to ensure they are defect-free.

Thickness of the tires is a parameter to measure defects. A tire with thickness more or less than 10 mm is considered to be defective. If the thicknesses of all the 100,000 tires are plotted on a graph, normal distribution or bell curve is obtained.

One standard deviation from the mean covers 68% of the data, i.e., 68,000 tires lie within one standard deviation of the mean. If the company operates at Six Sigma level, there would be only three defects out of a million tires manufactured as 99.999966% of the data would be covered.

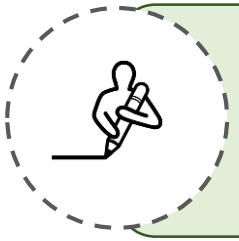
PROJECT MANAGEMENT

Key Takeaways

- A project is said to meet quality expectations when all the project requirements agreed in the beginning of the project are met and the resulting product is usable.
- Quality management includes creating and following policies and procedures that meet the project's defined quality needs.
- Quality Planning defines the standards, templates, policies, and procedures; Quality Assurance determines if the project is complying with the policies and procedures; and Quality Control measures specific project results against standards.
- Plan Quality Management, Manage Quality, and Control Quality are the three Project Quality Management processes.
- Quality tools are used to plan and achieve the desired levels of quality.
- At Six Sigma level, there would be only three defects out of a million units manufactured.

Additional Reading

(Refer to the exercises provided in the PMP Classroom Exercises)



- Exercise 14
- Exercise 15

PROJECT MANAGEMENT

Quiz

Quiz

1. **Which of the following is not used in Manage Quality?**

A. Checklists

B. Flowchart

C. Inspection

D. Process analysis

Quiz

1. **Which of the following is not used in Manage Quality?**

A. Checklists

B. Flowchart

C. Inspection

D. Process analysis

The correct answer is: **C**

Inspection is a Control Quality tool. The other options are used in **Manage Quality**,

Quiz

2. Management wants to ensure that a project is following defined quality standards. Which of the following should be used?

A. Risk management plan

B. Work Breakdown Structure (WBS)

C. Statement of work

D. Quality audit

Quiz

2. **Management wants to ensure that a project is following defined quality standards. Which of the following should be used?**

A. Risk management plan

B. Work Breakdown Structure (WBS)

C. Statement of work

D. Quality audit

The correct answer is: **D**

A quality audit periodically reviews quality management activities and assures that the project deliverables meet the expected quality standards.

Quiz

3. **As a project manager, which would you give the highest priority: quality, cost, or schedule?**

A. It would depend on the prevailing circumstances of the project.

B. Quality is most important; cost and schedule come later.

C. Cost is most important; everything else comes later.

D. Completing the project on schedule is most important.

Quiz

3. **As a project manager, which would you give the highest priority: quality, cost, or schedule?**

A. It would depend on the prevailing circumstances of the project.

B. Quality is most important; cost and schedule come later.

C. Cost is most important; everything else comes later.

D. Completing the project on schedule is most important.

The correct answer is: **A**

Since quality, cost, and schedule are part of the project constraints, they are equally important. However, depending on the specific circumstances of the project, one may take precedence over the others.

Quiz

4. **John, a project manager, is encountering numerous problems in his project. He wants to identify the root causes of the problems so that he can focus on them. Which of the following tools should he use?**

A. Fishbone diagram

B. Control chart

C. Scatter Diagram

D. Histogram

Quiz

4 **John, a project manager, is encountering numerous problems in his project. He wants to identify the root causes of the problems so that he can focus on them. Which of the following tools should he use?**

A Fishbone diagram

B Control chart

C Scatter Diagram

D Histogram

The correct answer is: **A**

Fishbone diagram helps in understanding the root cause of problems.

Quiz

5. As a project manager, you are ensuring that quality standards are followed for your project. In which process are the quality standards identified?

A. Develop Project Charter

B. Collect Requirements

C. Plan Quality Management

D. Manage Quality

Quiz

5. As a project manager, you are ensuring that quality standards are followed for your project. In which process are the quality standards identified?

A. Develop Project Charter

B. Collect Requirements

C. Plan Quality Management

D. Manage Quality

The correct answer is: **C**

Plan Quality Management defines what quality standards should be chosen for the project and how to satisfy them.

Quiz

6. Which of the following is an example of cost of conformance?

A. Quality training

B. Cost of rework

C. Warranty cost

D. Scrap

Quiz

6. Which of the following is an example of cost of conformance?

A. Quality training

B. Cost of rework

C. Warranty cost

D. Scrap

The correct answer is: **A**

Quality training helps increase productivity and reduce the probability of errors occurring, i.e., helps in prevention. Hence, it can be classified as the cost of conformance.

Quiz

7. If the mean of a normal distribution is 100, what percentage of data falls within one standard deviation of the mean?

A. 83 to 117

B. 66 to 134

C. 75 to 125

D. 80 to 120

Quiz

7. If the mean of a normal distribution is 100, what percentage of data falls within one standard deviation of the mean?

A. 83 to 117

B. 66 to 134

C. 75 to 125

D. 80 to 120

The correct answer is: **B**

One standard deviation of the mean covers 68% data, or 34% on either side of the mean.

Quiz

8. **Approved change requests are an input to _____ process.**

A. Manage Quality

B. Plan Quality Management

C. Control Quality

D. Perform Quality Assurance

Quiz

8. Approved change requests are an input to _____ process.

A. Manage Quality

B. Plan Quality Management

C. Control Quality

D. Perform Quality Assurance

The correct answer is: **C**

Approved change requests are an output of Perform Integrated Change Control and input to the Control Quality process.

This concludes

"Project Quality Management."

The next lesson is

"Project Resource Management."