

Target: PMP® Certification



Project Quality Management

24	PLAN QUALITY MANAGEMENT		
25	MANAGE QUALITY		
26	CONTROL QUALITY		

Project Quality Management

*** Project Quality Management.** Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken.

Quality	Grade
* The degree to which a set of inherent characteristics fulfills requirements	* A category or rank used to distinguish items that have the same functional use (e.g., “hammer”) but do not share the same requirements for quality (e.g., different hammers may need to withstand different amounts of force).

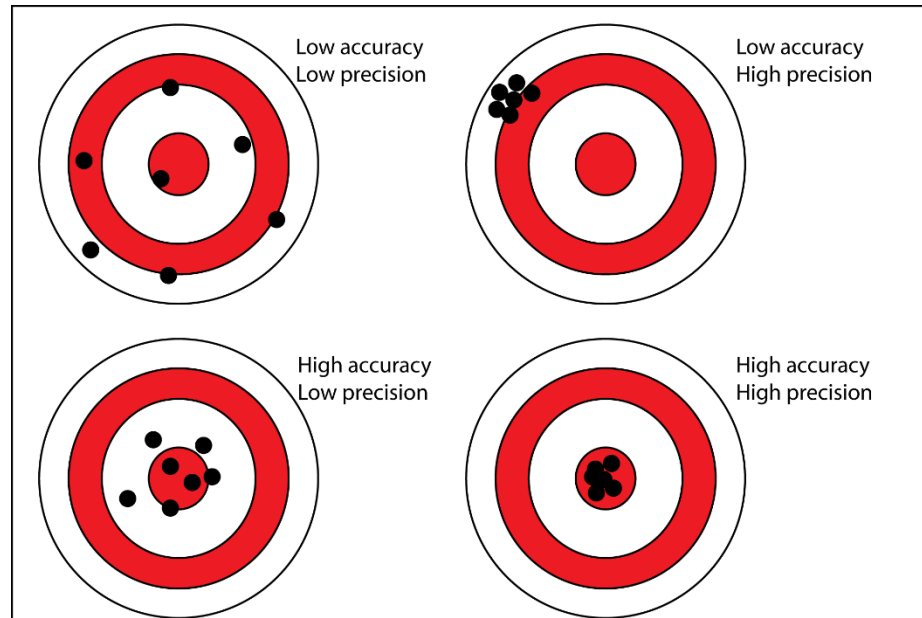
Q Project Quality Management

Precision

* Within the quality management system, precision is a measure of exactness.

Accuracy

* Within the quality management system, accuracy is an assessment of correctness.



Project Quality Management

PMI's approach on Quality Management is compatible with ISO standards. In the context of achieving ISO compatibility, modern quality management approaches seek to minimize variation and to deliver results that meet defined requirements. These approaches recognize the importance of:

- 1. Customer Satisfaction**
- 2. Prevention over inspection**
- 3. Continuous improvement**
- 4. Management Responsibility**
- 5. Cost of quality (COQ)**

Project Quality Management

1. **Customer satisfaction.** To achieve customer satisfaction is needed to have:

Conformance to requirements	Fitness for use
Ensure project produces what it said it would produce	The product satisfies a real need
Crosby's definition of quality	Juran's definition of quality

2. **Prevention over inspection.** “Quality should be planned, designed, and built into—not inspected into the project’s management or the project’s deliverables. The cost of preventing mistakes is generally much less than the cost of correcting mistakes when they are found by inspection or during usage.”

Project Quality Management

3. Continuous improvement

Id	Quality Approach	Short Description
1	Kaizen	Kai = Change, Zen = Good Thought as continuous small improvements in japan culture.
2	JIT	Also known as just-in-time production or the Toyota production system (TPS), is a methodology aimed primarily at reducing flow times within production as well as response times from suppliers and to customers.
3	PDCA	The concept of PDCA cycle was originally developed by Walter Shewhart and promoted by W. Edwards Deming. It is an iterative four-step management method used in business for the control and continuous improvement of processes and products. It is also known as the Deming circle/cycle/wheel, Shewhart cycle, control circle/cycle
4	Juran	Juran's Three Basic Steps to Progress: Continuous improvement, Extensive training, Commitment from senior management. Juran's Ten Steps to Quality Improvement: Focus on goal setting, training, and recognition The Juran Trilogy: Quality planning, Control, Improvement Defines quality as fitness for use
5	Crosby	"Zero defects" – get it right the first time. Prevention is the key and Save the non-conformance costs of quality. The Crosby quality vaccine: Determination, education, implementation. Crosby defines 14 steps for Quality Improvement and defines quality as conformance to requirements.
6	Deming	Defines quality as a continuous improvement process. It is based on the Cycle for Improvement: Plan, Do, Check, Act. Emphasis on statistical process control tools 85% of quality problems require management initiative to be solved Books: Out of the Crisis and The New Economics
7	TQM	It consists of organization-wide efforts to install and make permanent a climate in which an organization continuously improves its ability to deliver high-quality products and services to customers.

Q Project Quality Management

3. Continuous improvement

Id	Quality Approach	Short Description																		
8	Six Sigma	It is a set of techniques and tools for process improvement. It was introduced by Motorola in 1986. Six Sigma seeks to improve the quality of the output of a process by identifying and removing the causes of defects and minimizing variability in manufacturing and business processes. It uses a set of quality management methods, mainly empirical, statistical methods, and creates a special infrastructure of people within the organization, who are experts in these methods PROCESS SIGMA TABLE <table> <tr> <th>SIGMA LEVEL</th><th>DEFECT RATE</th><th>YIELD</th></tr> <tr> <td>2 σ</td><td>308,770 dpmo</td><td>69.10000%</td></tr> <tr> <td>3 σ</td><td>66,811 dpmo</td><td>93.33000%</td></tr> <tr> <td>4 σ</td><td>6,210 dpmo</td><td>99.38000%</td></tr> <tr> <td>5 σ</td><td>233 dpmo</td><td>99.97700%</td></tr> <tr> <td>6 σ</td><td>3.44 dpmo</td><td>99.99966%</td></tr> </table>	SIGMA LEVEL	DEFECT RATE	YIELD	2 σ	308,770 dpmo	69.10000%	3 σ	66,811 dpmo	93.33000%	4 σ	6,210 dpmo	99.38000%	5 σ	233 dpmo	99.97700%	6 σ	3.44 dpmo	99.99966%
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9	Lean Six Sigma	It is a methodology that relies on a collaborative team effort to improve performance by systematically removing waste;[1] combining lean manufacturing/lean enterprise and Six Sigma to eliminate the eight kinds of waste (muda): Time, Inventory, Motion, Waiting, Over production, Over processing, Defects, and Skills (abbreviated as 'TIMWOODS').																		
10	Kanban	It is a scheduling system for lean and just-in-time (JIT) production. Kanban is a system to control the logistical chain from a production point of view, and is an inventory control system. One of the main benefits of Kanban is to establish an upper limit to the work in progress inventory, avoiding overloading of the system																		

Project Quality Management

3. Continuous improvement

Id	Quality Approach	Short Description
11	Malcolm Baldrige	The Malcolm Baldrige National Quality Award recognizes U.S. organizations in the business, health care, education, and nonprofit sectors for performance excellence. To receive a Baldrige Award, an organization must have a role-model organizational management system that ensures continuous improvement in delivering products and/or services, demonstrates efficient and effective operations, and provides a way of engaging and responding to customers and other stakeholders.
12	The Organizational Project Management Maturity Model (OPM3®)	It is a globally recognized best-practice standard for assessing and developing capabilities in executing strategy through projects via Portfolio Management, Program Management, and Project Management. It provides a method for organizations to understand their Organizational Project Management processes and practices, and to make these processes capable of performing successfully, consistently, and predictably.
13	Capability Maturity Model Integration (CMMI®)	It can be used to guide process improvement across a project, division, or an entire organization. CMMI currently addresses three areas of interest: • Product and service development — CMMI for Development (CMMI-DEV), • Service establishment, management, — CMMI for Services (CMMI-SVC), • Product and service acquisition — CMMI for Acquisition (CMMI-ACQ).
14	ISO 9000 series	It is NOT a standard for products and services. It is NOT industry-specific. It is a quality system standard applicable to any product, service, or process, in any industry 9000 – Fundamentals and vocabulary 9001 – Requirements 9004 – Guidelines for performance improvements

Project Quality Management

4. Management Responsibility

- Project Manager has the **ultimate** responsibility for the product of the project
- Team member has **primary** responsibility to check his or her work (self-inspection)
- Senior Management has the ultimate responsibility for quality within the organization as a whole

5. Cost of quality (COQ)

- **Cost of Conformance vs Cost of Nonconformance**
- **Marginal Analysis:** Optimal quality is reached when incremental revenue from improvements is equal with incremental costs to secure it.
- **Gold Plating:** refers to giving customer extras. Advanced quality thinking does not recommend it, neither does PMI.

24**PLAN QUALITY MANAGEMENT**

*** Plan Quality Management.** 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.

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PLAN QUALITY MANAGEMENT



INPUTS

- » Project charter
- » Project management plan
 - Requirements management plan
 - Risk management plan
 - Stakeholder engagement plan
 - Scope baseline
- » Project documents
 - Assumption log
 - Requirements documentation
 - Requirements traceability matrix
 - Risk register
 - Stakeholder register
- » Enterprise Environmental Factors
- » Organizational Process Assets

TOOLS & TECHNIQUES

- ✓ Expert judgment
- ✓ Data gathering
 - Benchmarking
 - Brainstorming
 - Interviews
- ✓ Data analysis
 - Cost-benefit analysis
 - Cost of quality
- ✓ Decision making
 - Multicriteria decision analysis
- ✓ Data representation
 - Flowcharts
 - Logical data model
 - Matrix diagrams
 - Mind mapping
- ✓ Test and inspection planning
- ✓ Meetings

OUTPUTS

- Quality management plan »
- Quality metrics »
- Project management plan Updates »
 - Risk management plan
 - Scope baseline
- Project documents updates »
 - Lessons learned register
 - Requirements traceability matrix
 - Risk register
 - Stakeholder register

24**PLAN QUALITY MANAGEMENT****TOOLS & TECHNIQUES****✓ Cost-benefit analysis**

A cost-benefit analysis for each quality activity compares the cost of the quality activities to the expected benefit from those activities.

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PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Cost of quality

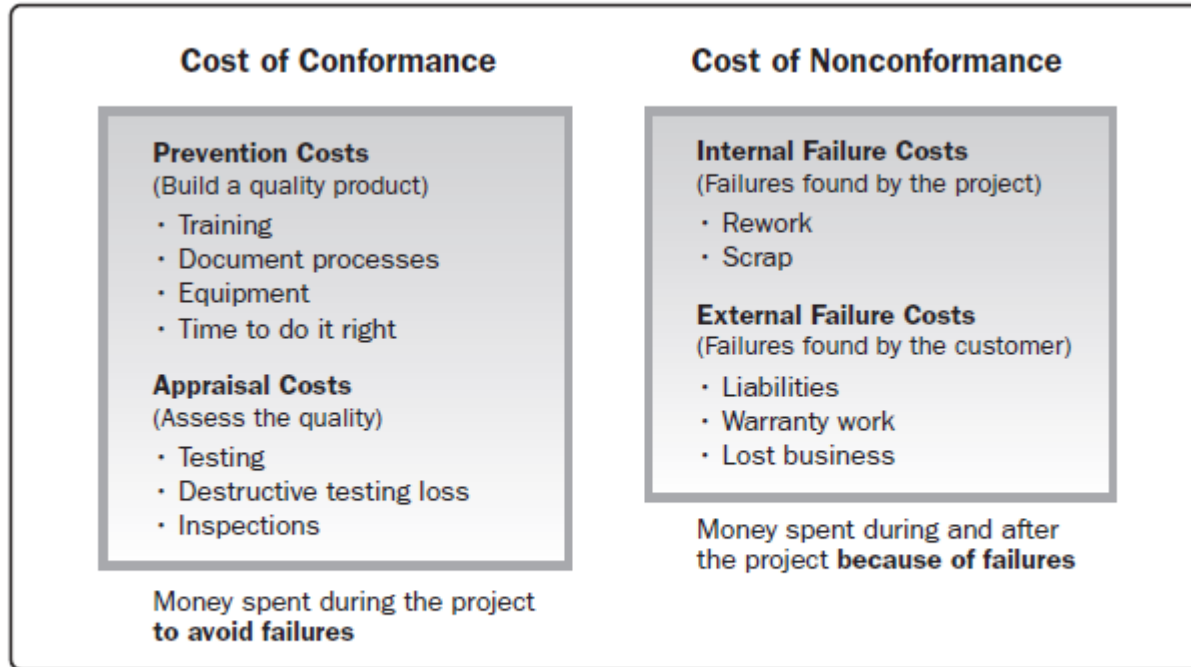


Figure 8-5. Cost of Quality

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PLAN QUALITY MANAGEMENT

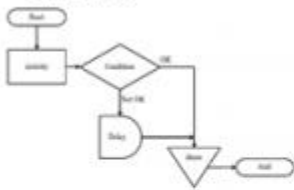


TOOLS & TECHNIQUES

✓ Seven basic quality tools

- Also known as 7QC tools.
- “It has been the Japanese experience that 95% of the problems at workplace can be solve with these 7 Tools” - Kaoru Ishikawa

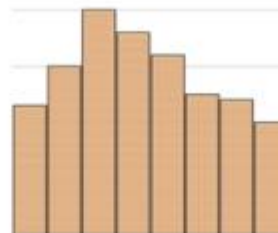
Process Flow Chart



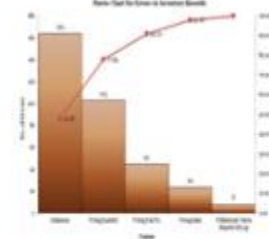
Check Sheet



Histogram



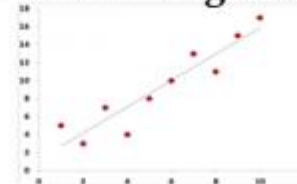
Pareto Analysis



Cause and Effect Diagram



Scatter Diagram



Control Charts



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PLAN QUALITY MANAGEMENT

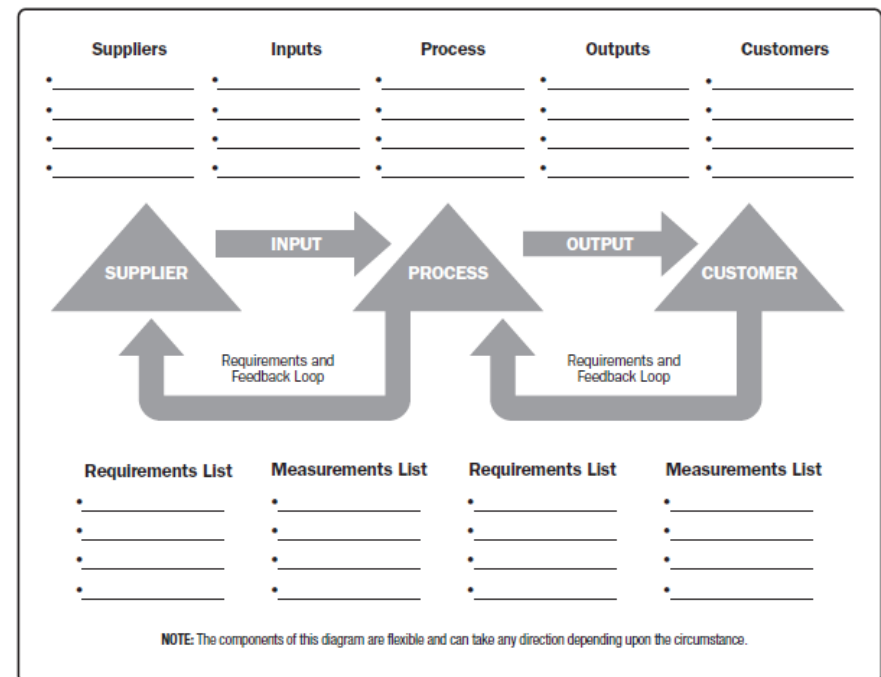


TOOLS & TECHNIQUES

✓ Seven basic quality tools

* **Flowchart.** The depiction in a diagram format of the inputs, process actions, and outputs of one or more processes within a system.

- Sometimes called process maps and used to understand and estimate the cost of quality in a process.
- One common flowchart model is **SIPOC**, which shows the connections among the supplier, input, process, output and customer in a process:



**This definition is 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.*

Project Management Institute, A Guide to the Project Management Body of Knowledge, (PMBOK® Guide) – Sixth Edition, Project Management Institute, Inc., 2017, Figure 8-6, Page 237.

Figure 8-6. The SIPOC Model

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PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Seven basic quality tools

* **Checksheets.** A tally sheet that can be used as a checklist when gathering data.

Useful for gathering attributes data while performing inspections to identify defects.

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PLAN QUALITY MANAGEMENT

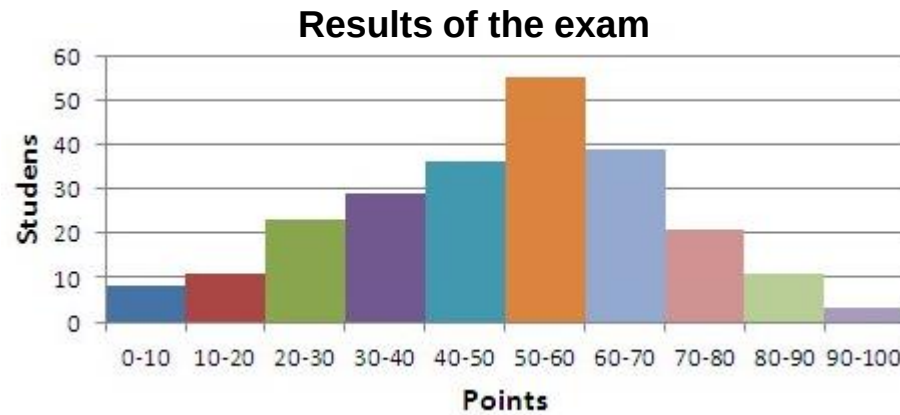


TOOLS & TECHNIQUES

✓ Seven basic quality tools

* **Histogram.** A special form of bar chart used to describe the central tendency, dispersion, and shape of a statistical distribution.

* **Central Tendency.** A property of the central limit theorem predicting that the data observations in a distribution will tend to group around a central location. The three typical measures of central tendency are the mean, median, and mode.



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PLAN QUALITY MANAGEMENT

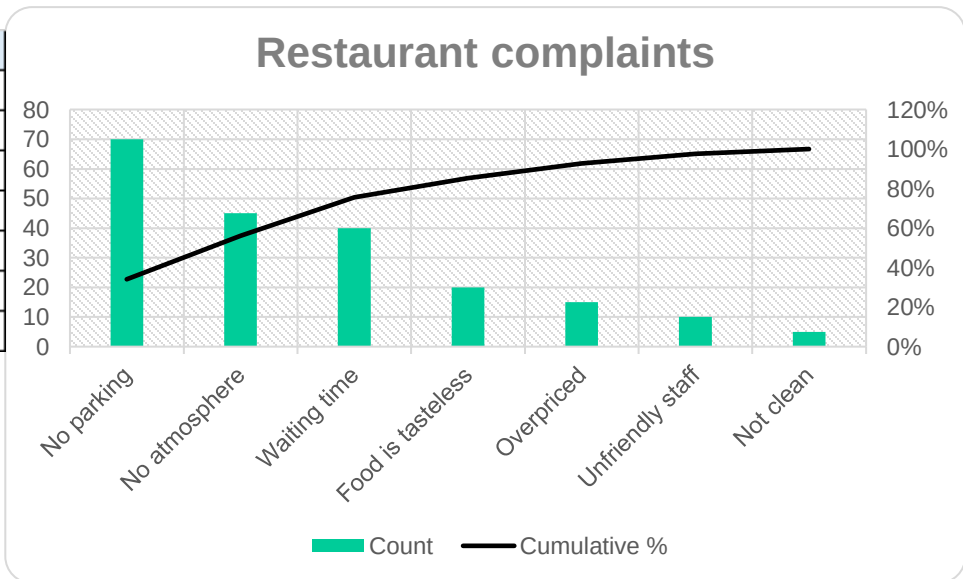


TOOLS & TECHNIQUES

✓ Seven basic quality tools

*** Pareto Diagram.** A histogram, ordered by frequency of occurrence, that shows how many results were generated by each identified cause.

	Count	Cumulative Count	%	Cumulative %
No parking	70	70	34%	34%
No atmosphere	45	115	22%	56%
Waiting time	40	155	20%	76%
Food is tasteless	20	175	10%	85%
Overpriced	15	190	7%	93%
Unfriendly staff	10	200	5%	98%
Not clean	5	205	2%	100%



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PLAN QUALITY MANAGEMENT

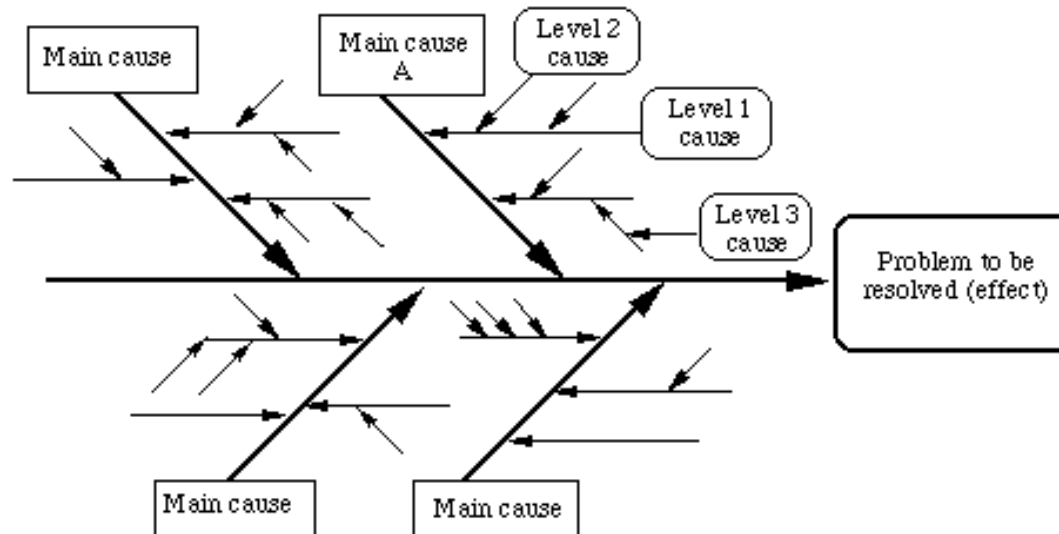


TOOLS & TECHNIQUES

✓ Seven basic quality tools

Cause-and-effect diagrams

- Also known as Fishbone diagrams or as Ishikawa diagrams
- The problem statement placed at the head of the fishbone is used as a starting point to trace the problem's source back to its actionable root cause



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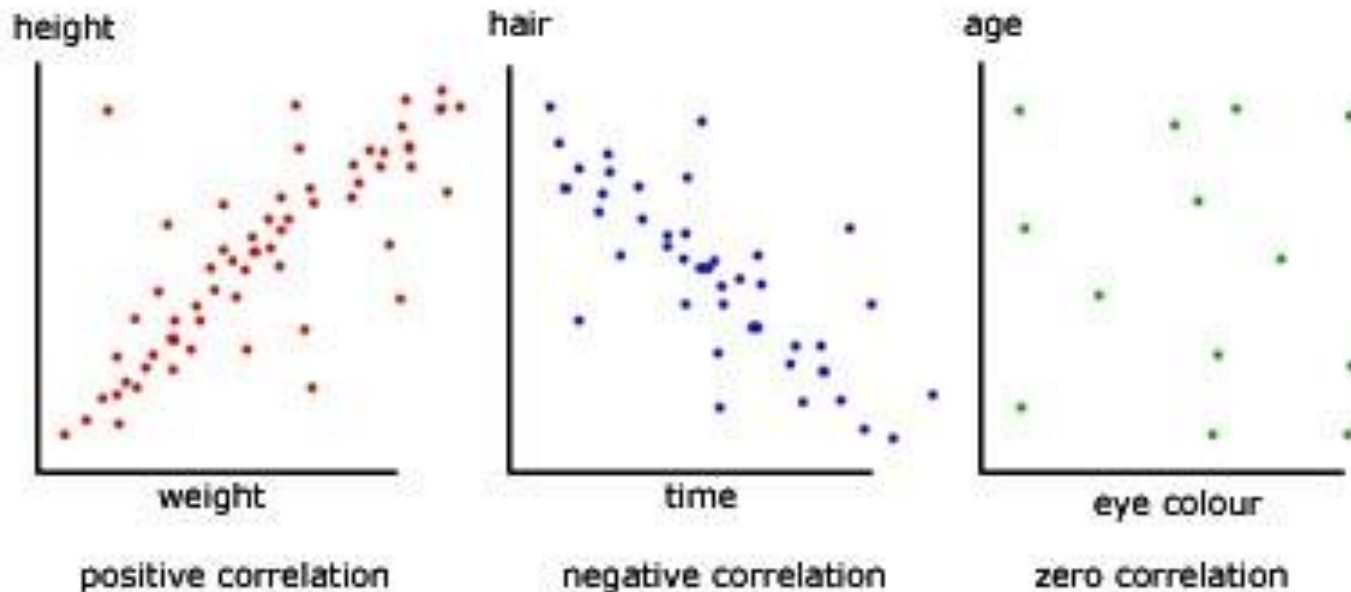
PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Seven basic quality tools

* **Scatter Diagram.** A correlation chart that uses a regression line to explain or to predict how the change in an independent variable will change a dependent variable.



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PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Seven basic quality tools

- * **Control chart.** A graphic display of process data over time and against established control limits, which has a centerline that assists in detecting a trend of plotted values toward either control limit.
- **Upper and lower control limits.** The acceptable range of variation of a process, determined by the selected quality standard
- **Mean.** The middle of the range of acceptable variation of the process
- **Specification limits.** Customer's expectations for quality. They can be either inside or outside of the control limits. Specification limits are not calculated based on the control chart; instead, they are provided by the customer
- **Out of control.** The process is out of control under one of the two circumstances:
 - **A data point** outside of the upper control limit
 - **7 Non-random data points** still within control limits (rule of seven)
- **Rule of seven.** A rule of thumb, seven points on one side of the mean. It indicates that they are not random and the process is out of control
- **Assignable cause.** A data point, a rule of seven, that requires investigation to determine causes

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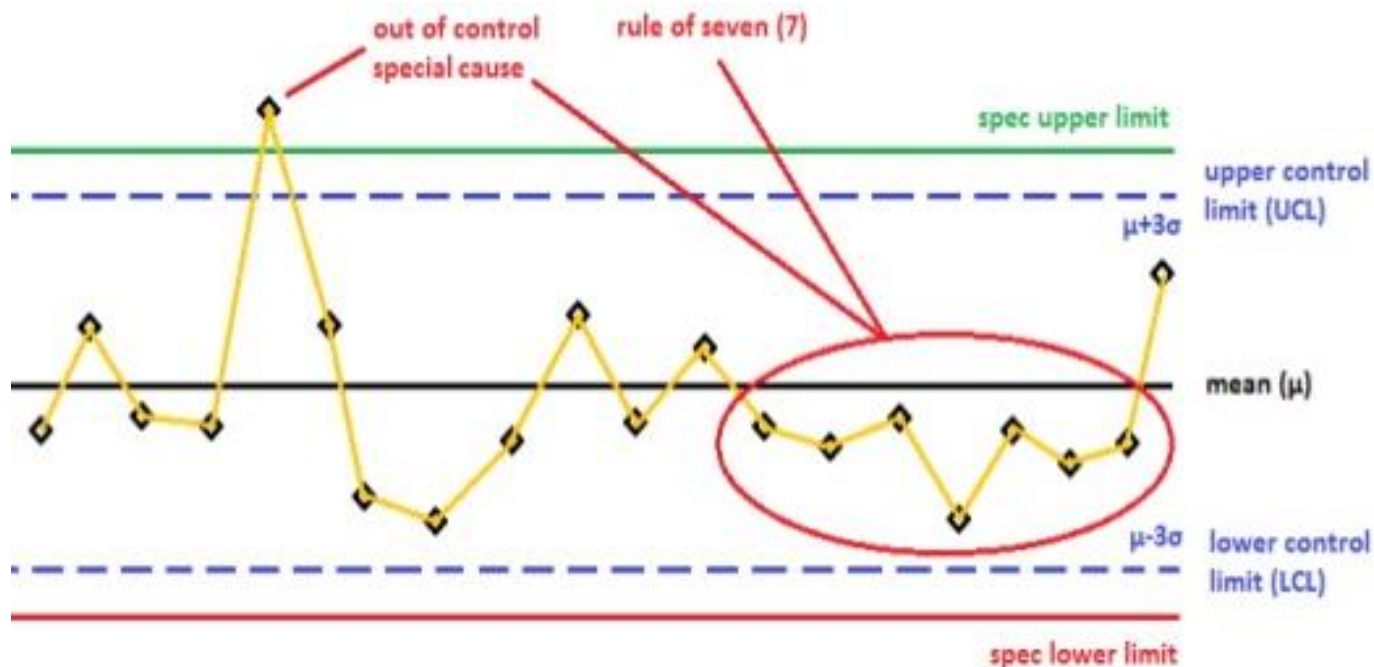
PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Seven basic quality tools

Control chart example:



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PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Benchmarking

* **Benchmarking.** Benchmarking is the comparison of actual or planned practices, such as processes and operations, to those of comparable organizations to identify best practices, generate ideas for improvement, and provide a basis for measuring performance.

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PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Design of experiments

- * **Design of Experiments (DOE).** A statistical method for identifying which factors may influence specific variables of a product or process under development or in production.
- It provides a statistical framework for systematically changing all of the important factors, rather than changing the factors one at a time.
 - For example, sport shoes designers use this technique to determine which combination of gel and adherence material for sole is most desirable for different running surfaces.

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PLAN QUALITY MANAGEMENT



TOOLS & TECHNIQUES

✓ Statistical sampling

***Statistical Sampling.** Choosing part of a population of interest for inspection.

- It is established the frequency, the size, the rules to select the sampling.
- It's used when studying entire population would:
 - Take too long
 - Cost too much
 - Be too destructive
- For example to evaluate Euro NCAP ranking for a car or to assess bulb lifetime

24**PLAN QUALITY MANAGEMENT****TOOLS & TECHNIQUES**

✓ Additional quality planning tools

- Brainstorming
- Force field analysis
- Nominal group technique
- Quality management and control tools (will be detailed at Perform Quality Assurance process)

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PLAN QUALITY MANAGEMENT



OUTPUTS

[Quality management plan »](#)

*** Quality Management Plan.** A component of the project or program management plan that describes how an organization's quality policies will be implemented.

Usually contains:

- The quality practices and standards that apply to the project
- Who will be involved in managing quality, when and how
- The meetings and reports that will address quality
- What parts of the project and deliverables will be measured and when
- etc

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PLAN QUALITY MANAGEMENT



OUTPUTS

Process improvement plan »

* **Process Improvement Plan.** A subsidiary plan of the project management plan. It details the steps for analyzing processes to identify activities that enhance their value.

It refers to both project management and product development processes.

“Areas to consider include:

- **Process boundaries.** Describe the purpose of the process, the start and end of the process, its inputs and outputs, the process owner, and the stakeholders of the process.
- **Process configuration.** Provides a graphic depiction of processes, with interfaces identified, used to facilitate analysis.
- **Process metrics.** Along with control limits, allows analysis of process efficiency.
- **Targets for improved performance.** Guide the process improvement activities.”

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PLAN QUALITY MANAGEMENT



OUTPUTS

Quality metrics »

* **Quality Metrics.** A description of a project or product attribute and how to measure it.

Examples of quality metrics:

- Number of bugs by criticality
- Number of test cases failed out of number of test cases executed
- Mean Time to Fix

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PLAN QUALITY MANAGEMENT



OUTPUTS

Quality checklists »

* **Quality Checklists.** A structured tool used to verify that a set of required steps has been performed.

The Checksheets from T&T are a type of checklist.

Checksheets	Checklists
Primary purpose is for gathering data	Is intended to help verify a required action has taken place or an item has been included

24**PLAN QUALITY MANAGEMENT****OUTPUTS****Project documents updates »**

Project documents updates examples:

- **Stakeholder register**
- **Responsibility assignment matrix**
- **WBS and WBS Dictionary**

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MANAGE QUALITY



* **Manage Quality.** The process of translating the quality management plan into executable quality activities that incorporate the organization's quality policies into the project.

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MANAGE QUALITY



INPUTS

- » Project management plan
 - Quality management plan
- » Project documents
 - Lessons learned register
 - Quality control measurements
 - Quality metrics
 - Risk report
- » Organizational process assets

TOOLS & TECHNIQUES

- ✓ Data gathering
 - Checklists
- ✓ Data analysis
 - Alternatives analysis
 - Document analysis
 - Process analysis
 - Root cause analysis
- ✓ Decision making
 - Multicriteria decision analysis
- ✓ Data representation
 - Affinity diagrams
 - Cause-and-effect diagrams
 - Flowcharts
 - Histograms
 - Matrix diagrams
 - Scatter diagrams
- ✓ Audits
- ✓ Design for X
- ✓ Problem solving
- ✓ Quality improvements methods

OUTPUTS

- Quality reports »
- Test and evaluation documents »
- Change requests »
- Project management plan updates »
 - Quality management plan
 - Scope baseline
 - Schedule baseline
 - Cost baseline
- Project documents updates »
 - Issue log
 - Lessons learned register
 - Risk register

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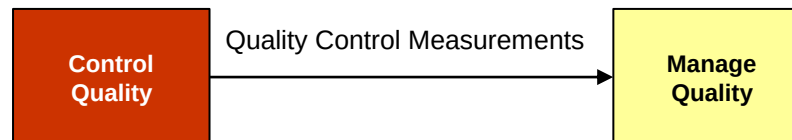
MANAGE QUALITY



INPUTS

» Quality control measurements

* **Quality Control Measurements.** The documented results of control quality activities.

**Legend:**

Executing process

M&C process

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MANAGE QUALITY



TOOLS & TECHNIQUES

✓ Quality management and control tools

* **Quality Management and Control Tools.** They are a type of quality planning tools used to link and sequence the activities identified.

- Affinity diagrams
- Process decision program charts (PDPC)
- Interrelationship digraphs
- Tree diagrams
- Prioritization matrices
- Activity network diagrams
- Matrix diagrams

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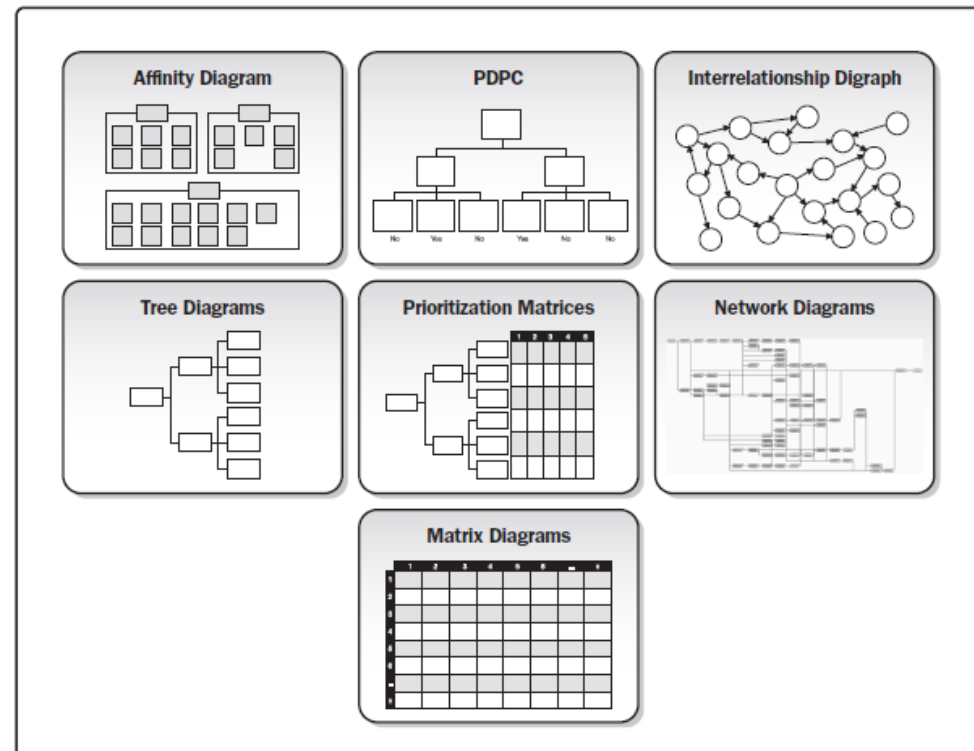


Figure 8-10. Storyboard Illustrating the Seven Quality Management and Control Tools

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MANAGE QUALITY



TOOLS & TECHNIQUES

✓ Quality management and control tools

- **Affinity diagrams:** used to visually group similar ideas together
- **Process decision program charts (PDPC):** designed to help prepare contingency plans. The emphasis of the PDPC is to identify the consequential impact of failure on activity plans, and create appropriate contingency plans to limit risks.
- **Interrelationship digraphs:** displays all the interrelated cause-effect relationships for up to 50 relevant items and factors involved in a complex problem and describe the desired outcomes
- **Tree diagrams:** used to breakdown broad categories into finer levels of detail to move from generalities to specifics.
- **Prioritization matrices:** often a combination of a tree diagram feeding into a matrix diagram. Criteria are prioritized and weighted before being applied to all available alternatives to obtain a mathematical score that ranks the options.
- **Activity network diagrams:** similar with those from Sequence Activities process. Also known as arrow diagrams. They include both the AOA (Activity on Arrow) and, most commonly used, AON (Activity on Node).
- **Matrix diagrams:** shows the relationship between items. At each intersection a relationship is either absent or present.

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MANAGE QUALITY



TOOLS & TECHNIQUES

✓ Quality audits

* **Quality Audits.** A quality audit is a structured, independent process to determine if project activities comply with organizational and project policies, processes, and procedures.

The objectives of a quality audit may include:

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

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MANAGE QUALITY



TOOLS & TECHNIQUES

✓ Process analysis

* **Process Analysis.** A process analysis follows the steps outlined in the process improvement plan to identify needed improvements.

25**MANAGE QUALITY****OUTPUTS****Project documents updates »**

Project documents updates examples:

- **Quality audit reports**
- **Training plans**
- **Process documentation**

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MANAGE QUALITY



OUTPUTS

Organizational process assets
updates »

OPA updates examples:

- **Organization's quality standards**
- **The Quality Management System**

*** Quality Management System.** The organizational framework whose structure provides the policies, processes, procedures, and resources required to implement the quality management plan. The typical project quality management plan should be compatible to the organization's quality management system.

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CONTROL QUALITY



* **Control Quality.** 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.
The project management team may have a **working knowledge of statistical control processes** to evaluate data contained in the control quality outputs.

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CONTROL QUALITY



PREVENTION	INSPECTION
Proactive	Reactive
Keeping errors out of the process	Catching errors before the customer does

ATTRIBUTE SAMPLING	VARIABLE SAMPLING
Pass-fail testing	Measuring results along a scale
Example: Airbag system testing	Example: Fuel consumption

TOLERANCES	CONTROL LIMITS
Specified range of acceptable results	That identify the boundaries of common variation in a statistically stable process or process performance

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CONTROL QUALITY



INPUTS

- » Project management plan
 - Quality management plan
- » Project documents
 - Lessons learned register
 - Quality metrics
 - Test and evaluation documents
- » Approved change requests
- » Deliverables
- » Work performance data
- » Enterprise Environmental Factors
- » Organizational Process Assets

TOOLS & TECHNIQUES

- ✓ Data gathering
 - Checklists
 - Check sheets
 - Statistical sampling
 - Questionnaires and surveys
- ✓ Data analysis
 - Performance reviews
 - Root cause analysis
- ✓ Inspection
- ✓ Testing/product evaluations
- ✓ Data representation
 - Cause-and-effect diagrams
 - Control charts
 - Histogram
 - Scatter diagrams
- ✓ Meetings

OUTPUTS

- Quality control measurements »
- Verified deliverables »
- Work performance information »
- Change requests »
- Project management plan updates »
 - Quality management plan
- Project documents updates »
 - Issue log
 - Lessons learned register
 - Risk register
 - Test and evaluation documents

26

CONTROL QUALITY



TOOLS & TECHNIQUES

✓ Inspection

*** Inspection.** Examining or measuring to verify whether an activity, component, product, result, or service conforms to specified requirements.

Inspection	Audit
Inspect a deliverable (and not a process)	Audit a process (and not a deliverable)

26

CONTROL QUALITY



TOOLS & TECHNIQUES

✓ Approved change requests review

*** Approved Change Requests Review.** A review of the change requests to verify that these were implemented as approved.

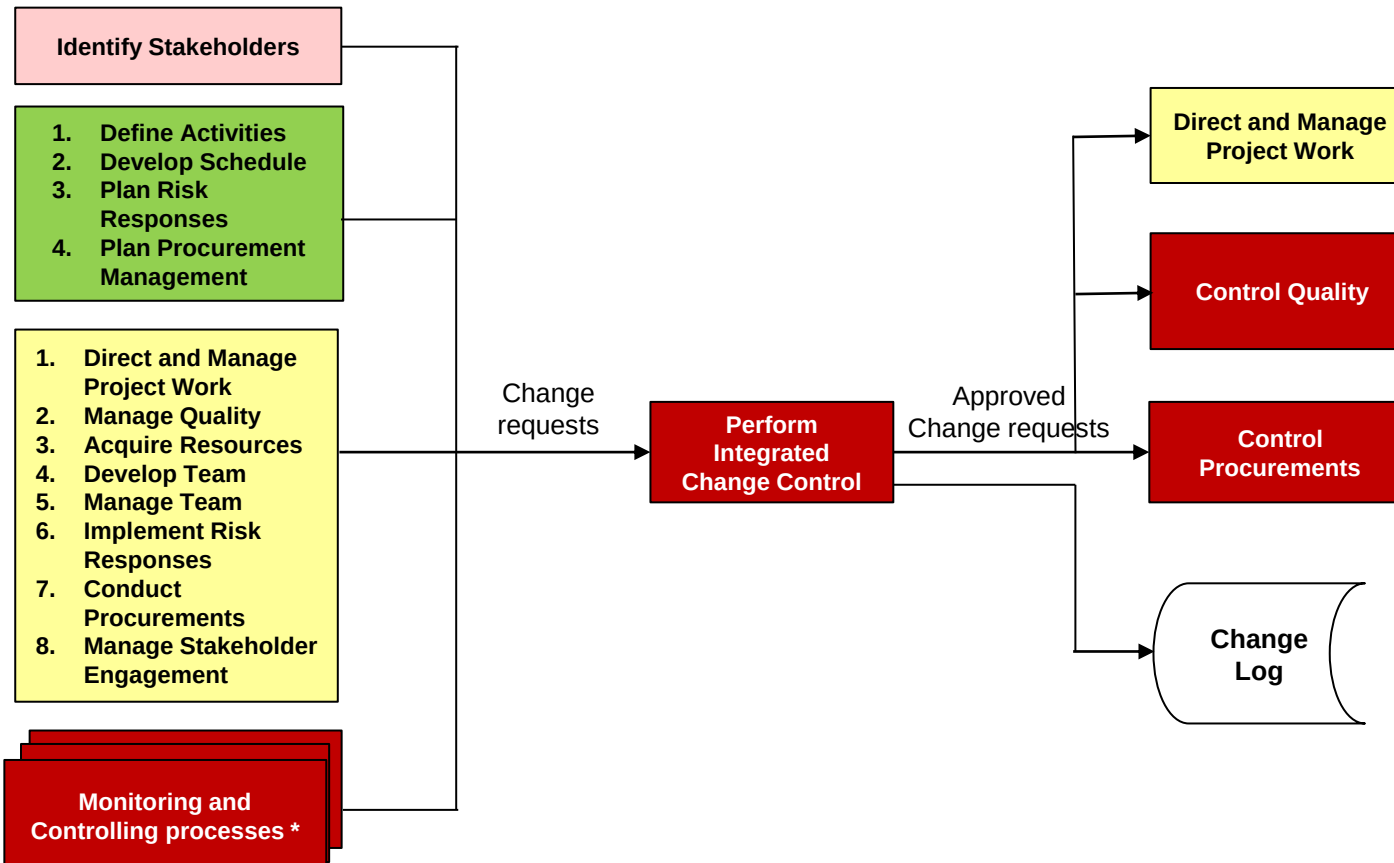
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CONTROL QUALITY

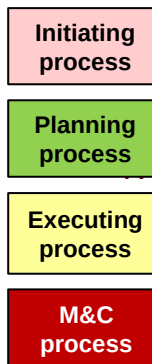


OUTPUTS

Validated changes »



Legend:



* except „Perform Integrated Change Control“

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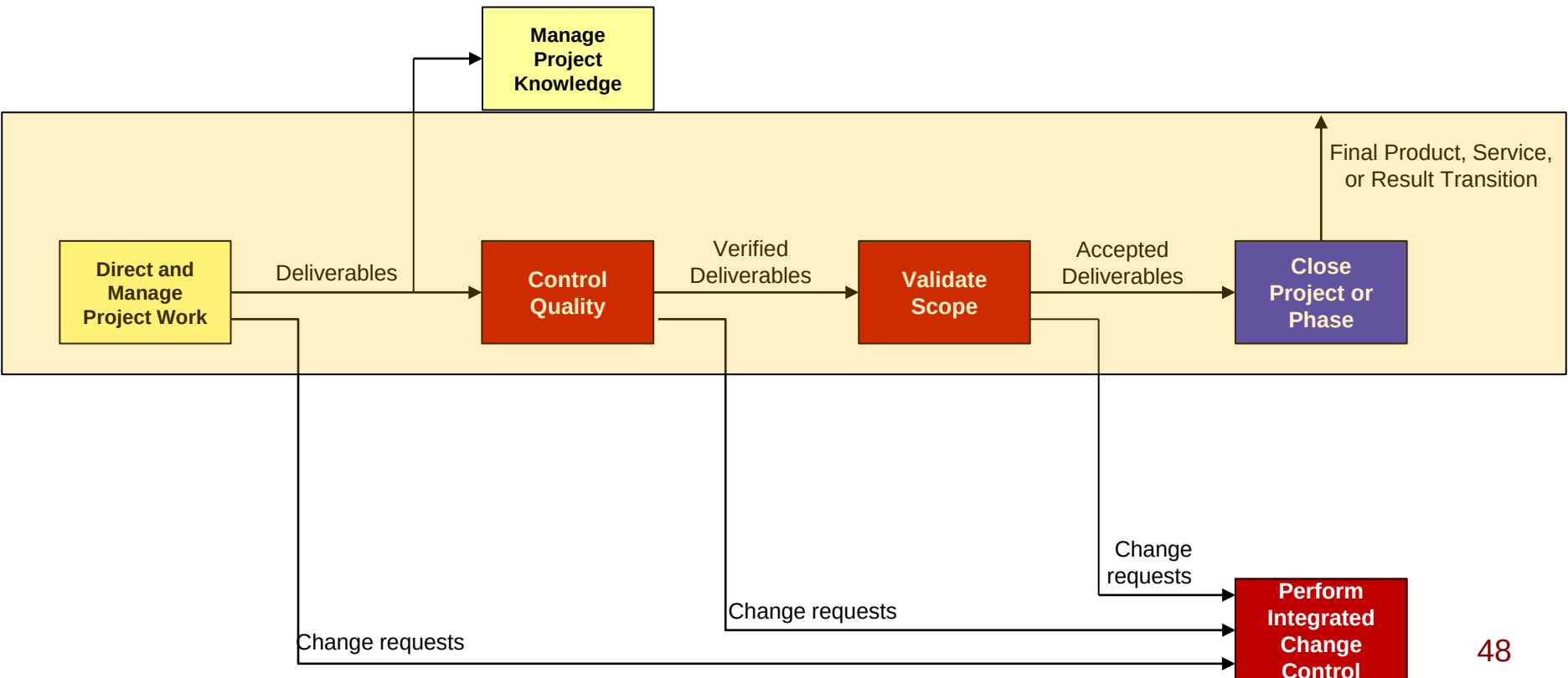
CONTROL QUALITY



OUTPUTS

Verified deliverables »

- A goal of the Control Quality process is to determine the correctness of deliverables.
- Verified deliverables are an input to Validate Scope for formalized acceptance



26

CONTROL QUALITY



OUTPUTS

Work performance
information »

*** Work Performance Information.** The performance data collected from various controlling processes, analyzed in context and integrated based on relationships across areas.

26**CONTROL QUALITY****OUTPUTS****Project documents updates »**

Project documents updates examples:

- Quality standards
- Agreements
- Quality audit reports and change logs supported with corrective action plans
- Training plans and assessments of effectiveness
- Process documentation, such as information obtained using the seven basic quality tools or the quality management and control tools

26**CONTROL QUALITY****OUTPUTS**

Organizational process assets
updates »

OPA updates examples:

- Completed checklists
- Lessons learned documentation

Project Quality Management

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PLAN QUALITY MANAGEMENT



25

MANAGE QUALITY



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CONTROL QUALITY



Q Project Quality Management



- Quality vs Grade
- Precision vs Accuracy
- Kaizen
- JIT
- PDCA
- Juran
- Crosby
- Deming
- TQM
- Six Sigma
- Lean Six Sigma
- Kanban
- Malcolm Baldrige
- OPM3®
- CMMI®
- ISO 9000 series
- Cost of Quality
- Marginal Analysis
- Gold plating
- Benchmarking
- Design of Experiments
- 7 Basic Quality Tools
- Statistical sampling
- Quality management plan content
- Process improvement plan content
- 7 Quality Management and Control Tools
- Quality audit
- Attribute sampling vs Variable sampling
- Change requests workflow
- Deliverable workflow

Project Quality Management

25 Questions
25 minutes