PROJECT QUALITY MANAGEMENT

Basics

- ISO 9000-Quality: "the degree to which a set of inherent characteristics fulfill requirements"
- The project management team should determine the appropriate levels of accuracy and precision for use in the quality management plan.
  - *Precision* is a measure of exactness.
  - *Accuracy* is an assessment of correctness.

Definition

- 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.

- Project Quality Management works to ensure that the project requirements, including product requirements, are met and validated.

- Every project should have a quality management plan. Project teams should follow the quality management plan and should have data to demonstrate compliance with the plan-ISO

Introduction

- 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:
  - **Customer satisfaction.** Understanding, evaluating, defining, and managing requirements so that customer expectations are met.
  - **Prevention over inspection.** Quality should be planned, designed, and built into— not inspected into the project's management or the project's deliverables.
  - **Continuous improvement.** The PDCA (plan-do-check-act) cycle is the basis for quality improvement.
    - Total Quality Management (TQM)
    - Six Sigma
    - *Organizational Project Management Maturity Model (OPM3.)*
    - Capability Maturity Model Integrated (CMMI$_R$).

Introduction

- **Management Responsibility.** Success requires the participation of all members of the project team

- **Cost of quality (COQ).** Cost of quality refers to the total cost of the conformance work and the nonconformance work that should be done as a compensatory effort because, on the first attempt to perform that work, the potential exists that some portion of the required work effort may be done or has been done incorrectly..

Project Quality Management processes

Project Quality Management processes, which include:

- **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.

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

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

Quality Planning

- Expected Level of Quality can only be achieved through necessary quality planning during project initiation

- Attributes of Quality Requirements
    - Completeness Criteria
    - Correctness Criteria
    - Usefulness Criteria

Plan Quality Management

- provides guidance and direction on how quality will be managed and validated throughout the project
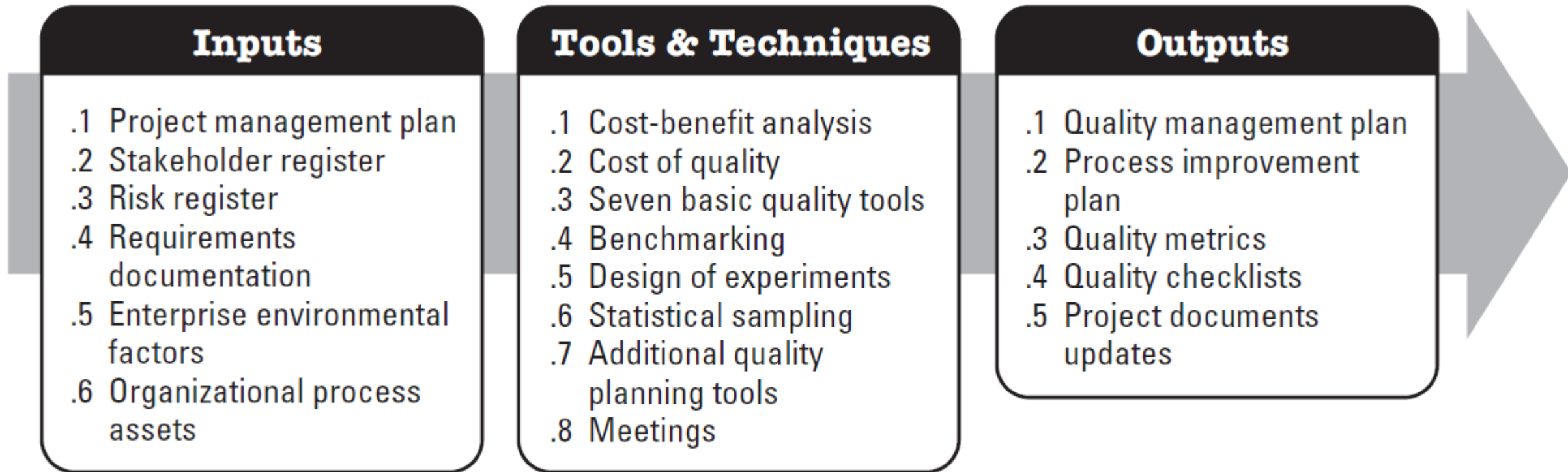
Inputs	Tools & Techniques	Outputs
.1 Project management plan	.1 Cost-benefit analysis	.1 Quality management plan
.2 Stakeholder register	.2 Cost of quality	.2 Process improvement plan
.3 Risk register	.3 Seven basic quality tools	.3 Quality metrics
.4 Requirements documentation	.4 Benchmarking	.4 Quality checklists
.5 Enterprise environmental factors	.5 Design of experiments	.5 Project documents updates
.6 Organizational process assets	.6 Statistical sampling	
	.7 Additional quality planning tools	
	.8 Meetings	

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

Plan Quality Management: Inputs

- **Project Management Plan:-** Scope baseline (*Project scope statement, Work breakdown structure (WBS), WBS dictionary*), Schedule baseline, Cost baseline, Other management plans, etc.

- **Stakeholder Register**

- **Risk Register**

- **Requirements Documentation**

- **Enterprise Environmental Factors**

- **Organizational Process Assets**

Plan Quality Management: Tools and Techniques- Cost of Quality (COQ)

- Cost of quality includes all costs incurred over the life of the product by investment in preventing non-conformance to requirements, appraising the product or service for conformance to requirements, and failing to meet requirements (rework).
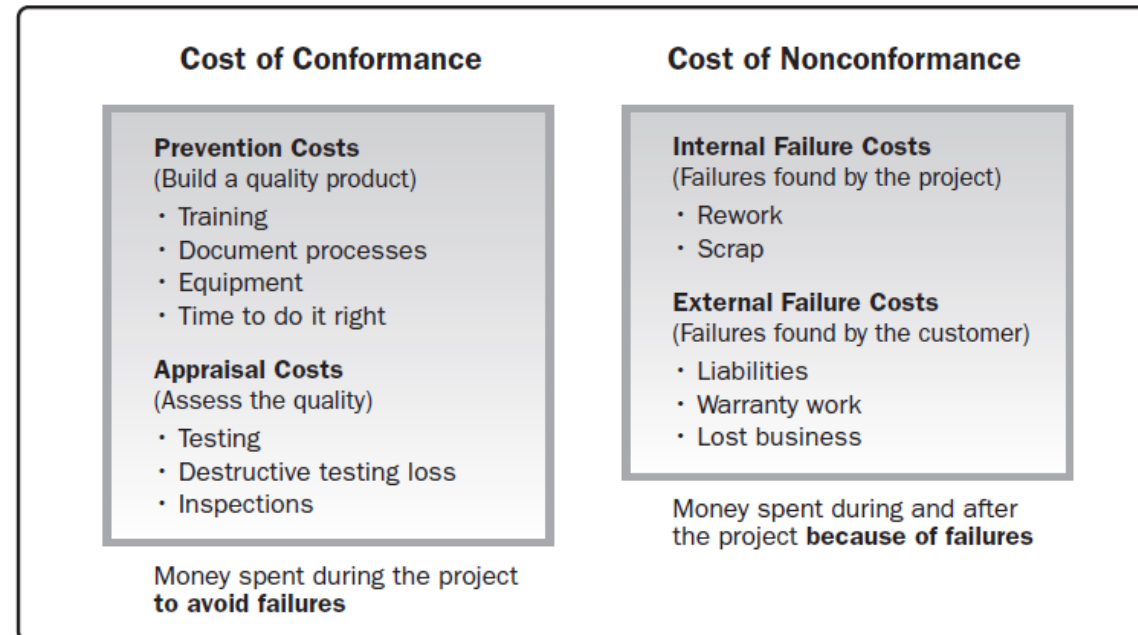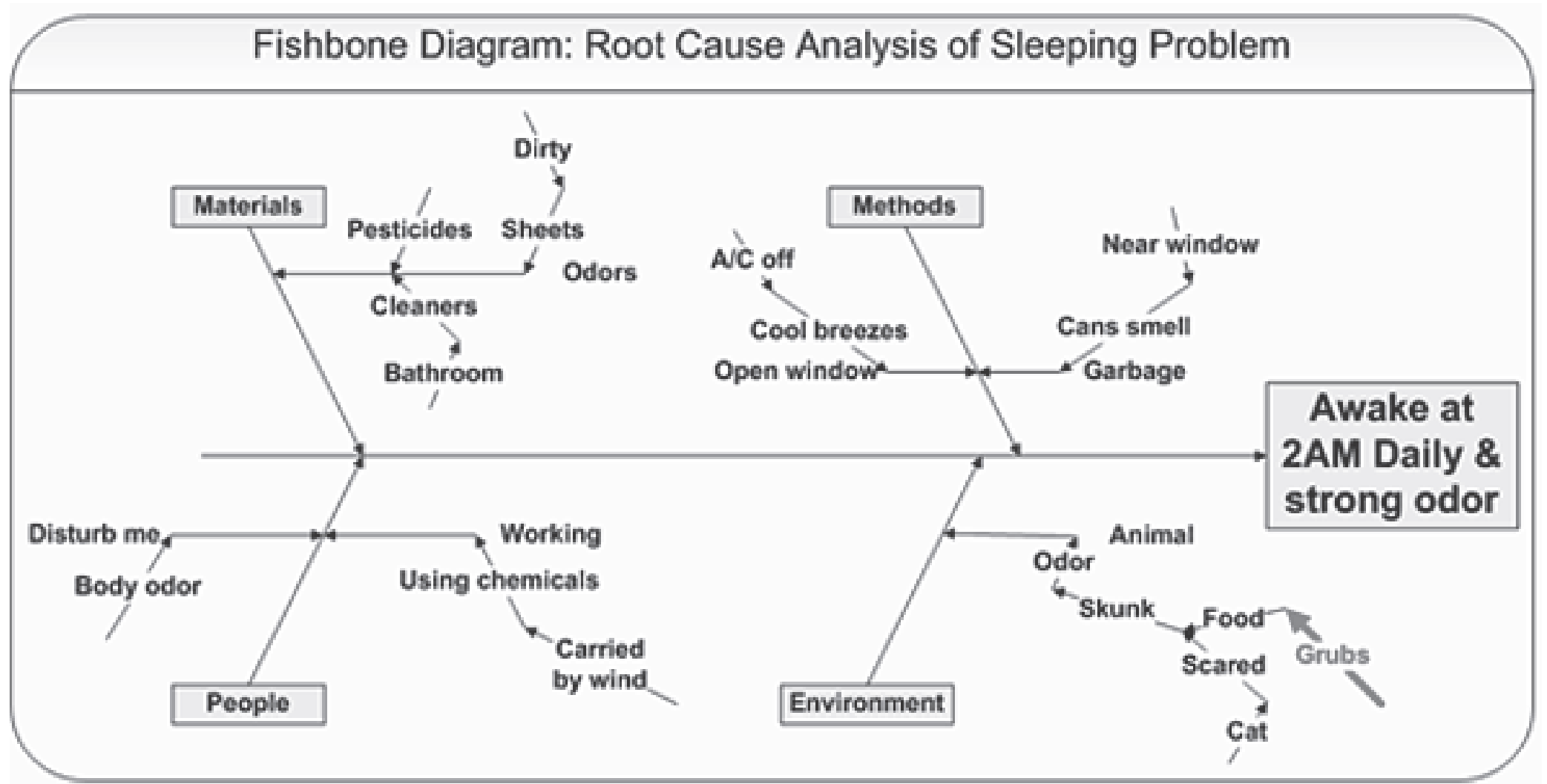
Cost of Conformance

Prevention Costs
(Build a quality product)
- Training
- Document processes
- Equipment
- Time to do it right

Appraisal Costs
(Assess the quality)
- Testing
- Destructive testing loss
- Inspections

Money spent during the project
to avoid failures

Cost of Nonconformance

Internal Failure Costs
(Failures found by the project)
- Rework
- Scrap

External Failure Costs
(Failures found by the customer)
- Liabilities
- Warranty work
- Lost business

Money spent during and after the project **because of failures**
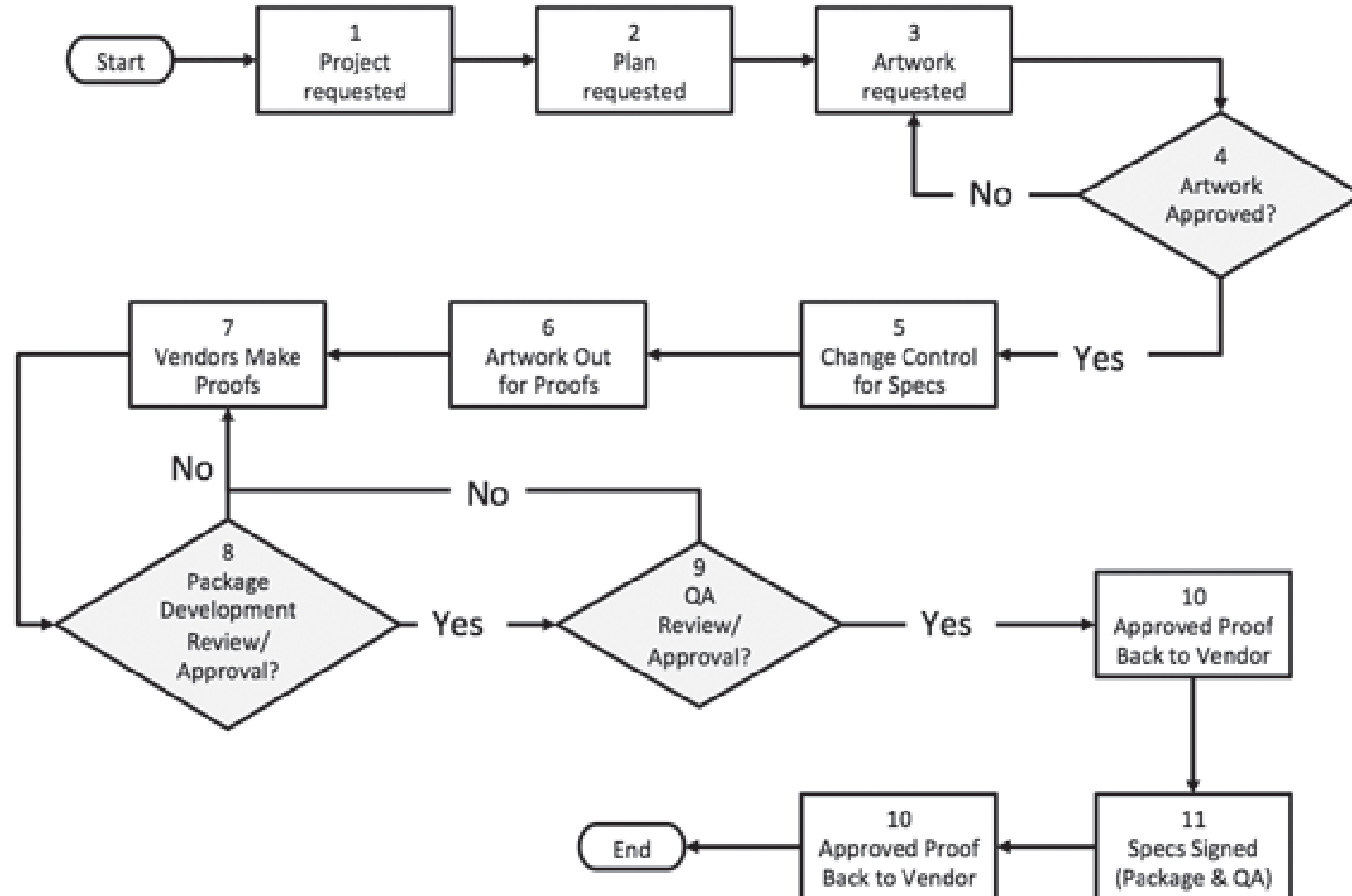
Figure 8-5. Cost of Quality

Seven Basic Quality Tools

- The seven basic quality tools, also known in the industry as 7QC Tools, are used within the context of the **PDCA** (plan-do-check-act, sometimes seen as plan-do-check-adjust) cycle to solve quality-related problems.
  - *Cause-and-effect diagrams*
  - *Flowcharts*
  - *Check sheet*
  - *Pareto diagrams*
  - *Histograms*
  - *Control charts*
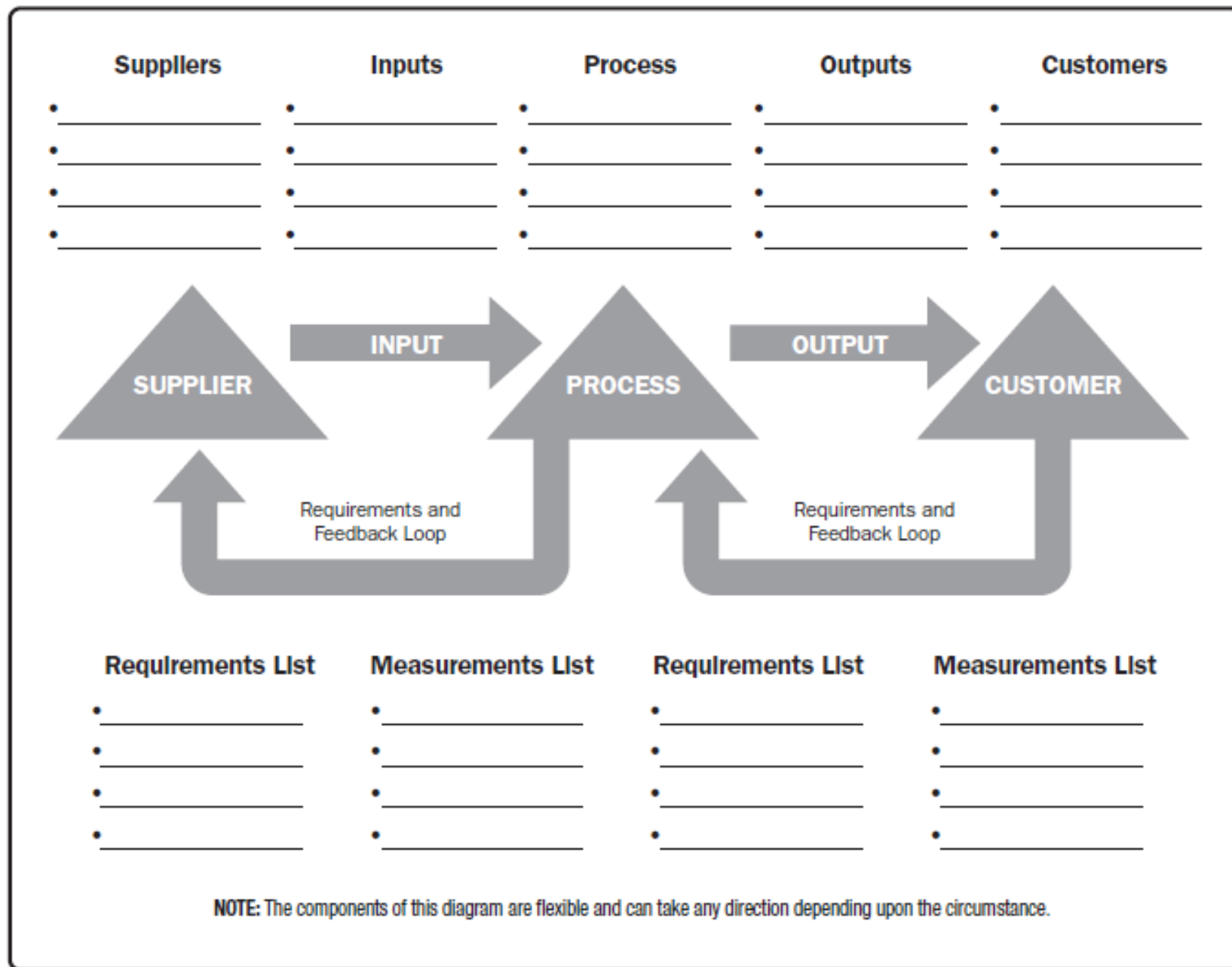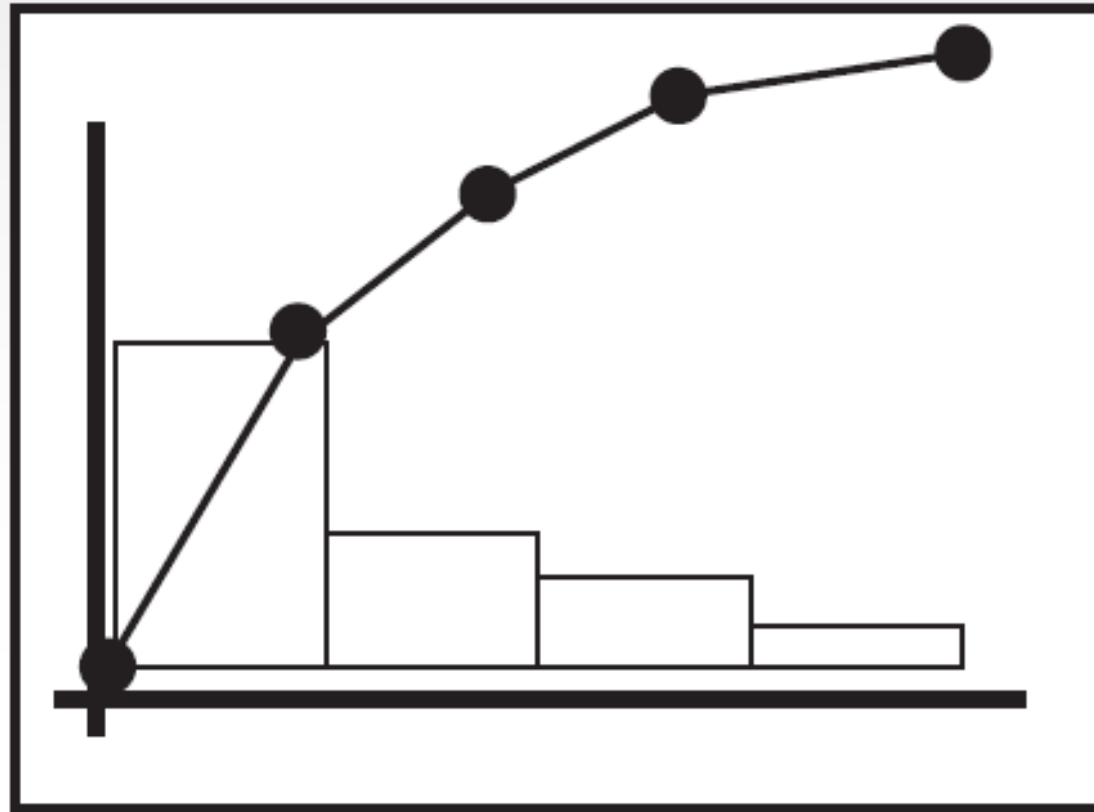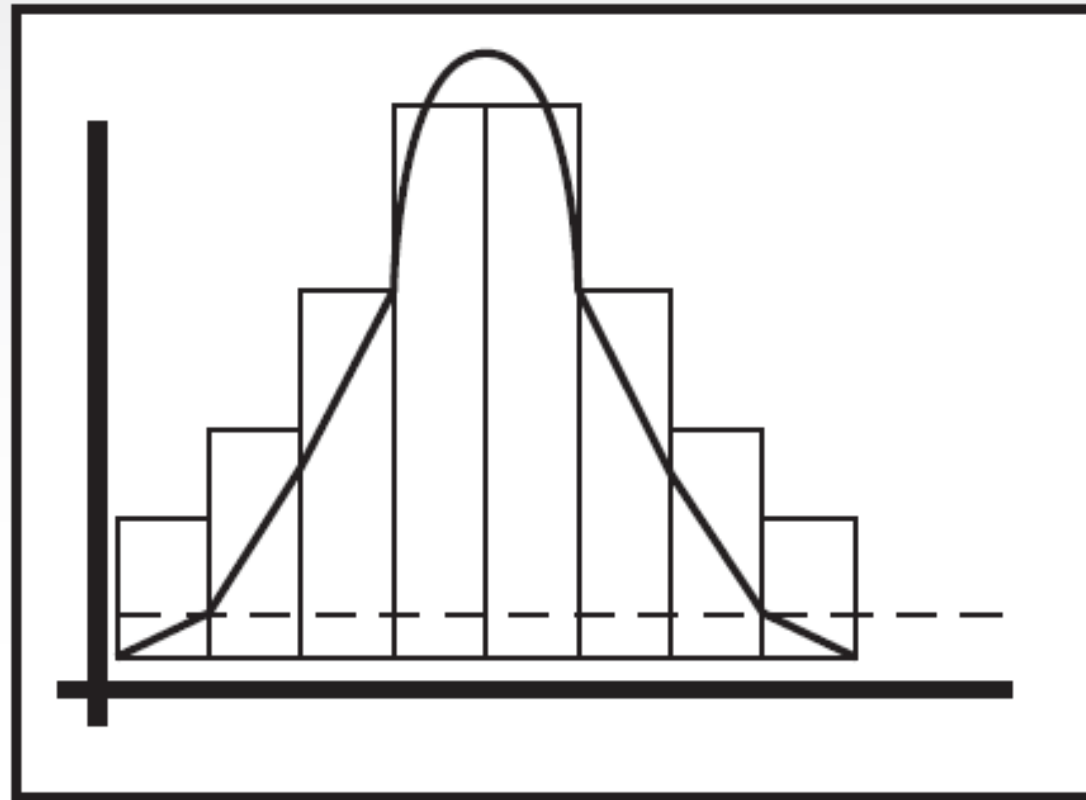 - *Scatter diagrams*

Cause & Effect Diagram

Fishbone Diagram: Root Cause Analysis of Sleeping Problem

Flowcharts

Suppliers | **Inputs** | **Process** | **Outputs** | **Customers**

- _____
- _____
- _____
- _____
- _____

INPUT →

OUTPUT →

SUPPLIER   PROCESS   CUSTOMER

Requirements and Feedback Loop

Requirements and Feedback Loop

Requirements List | **Measurements List** | **Requirements List** | **Measurements List**

- _____
- _____
- _____
- _____

NOTE: The components of this diagram are flexible and can take any direction depending upon the circumstance.

Figure 8-6. The SIPOC Model

Checksheets

Category	Strokes	Frequency
Attribute 1		
Attribute 2		
Attribute ...		
Attribute n		

Pareto Diagrams

Histograms

Control Charts

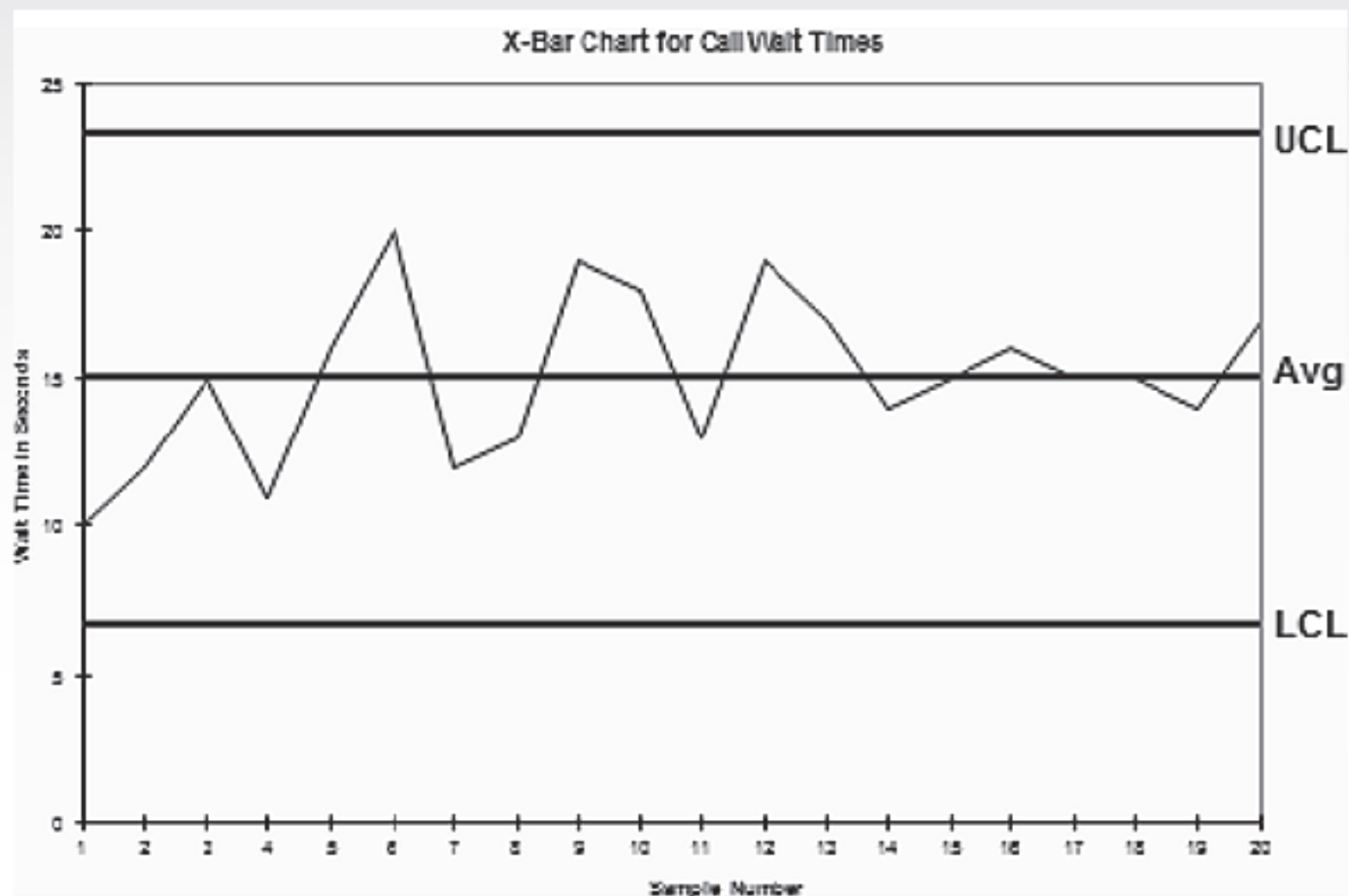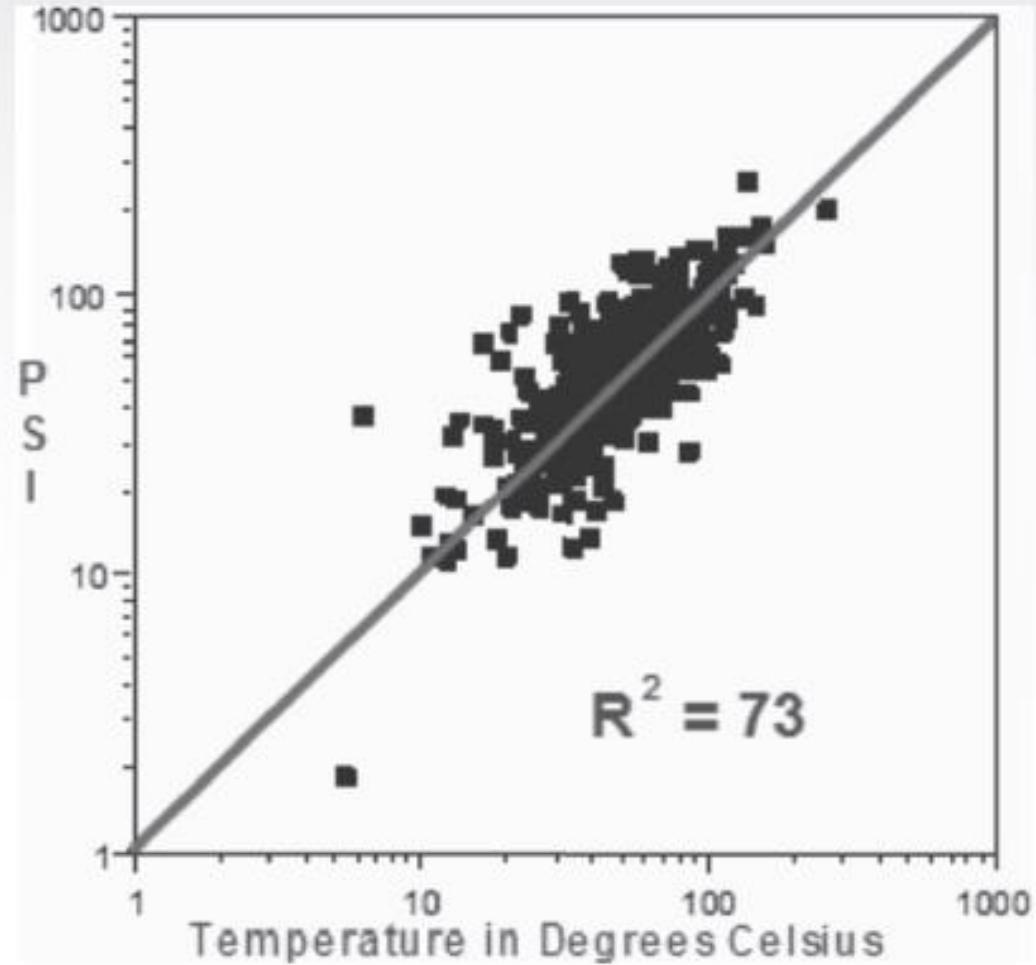X-Bar Chart for Call Wait Times

Scatter Diagrams

Benchmarking

- Benchmarking involves comparing actual or planned project practices to those of comparable projects to identify best practices, generate ideas for improvement, and provide a basis for measuring performance.

- Benchmarked projects may exist within the performing organization or outside of it, or can be within the same application area.

Design of Experiments

- Design of experiments (DOE) is a statistical method for identifying which factors may influence specific variables of a product or process under development or in production.

- DOE also plays a role in optimizing products or processes

Statistical Sampling

- Statistical sampling involves choosing part of a population of interest for inspection

- Sample frequency and sizes should be determined during the Plan Quality Management process

Additional Quality Planning Tools

- **Brainstorming.** This technique is used to generate ideas

- **Force field analysis.** These are diagrams of the forces for and against change.

- **Nominal group technique.** This technique is used to allow ideas to be brainstormed in small groups and then reviewed by a larger group.

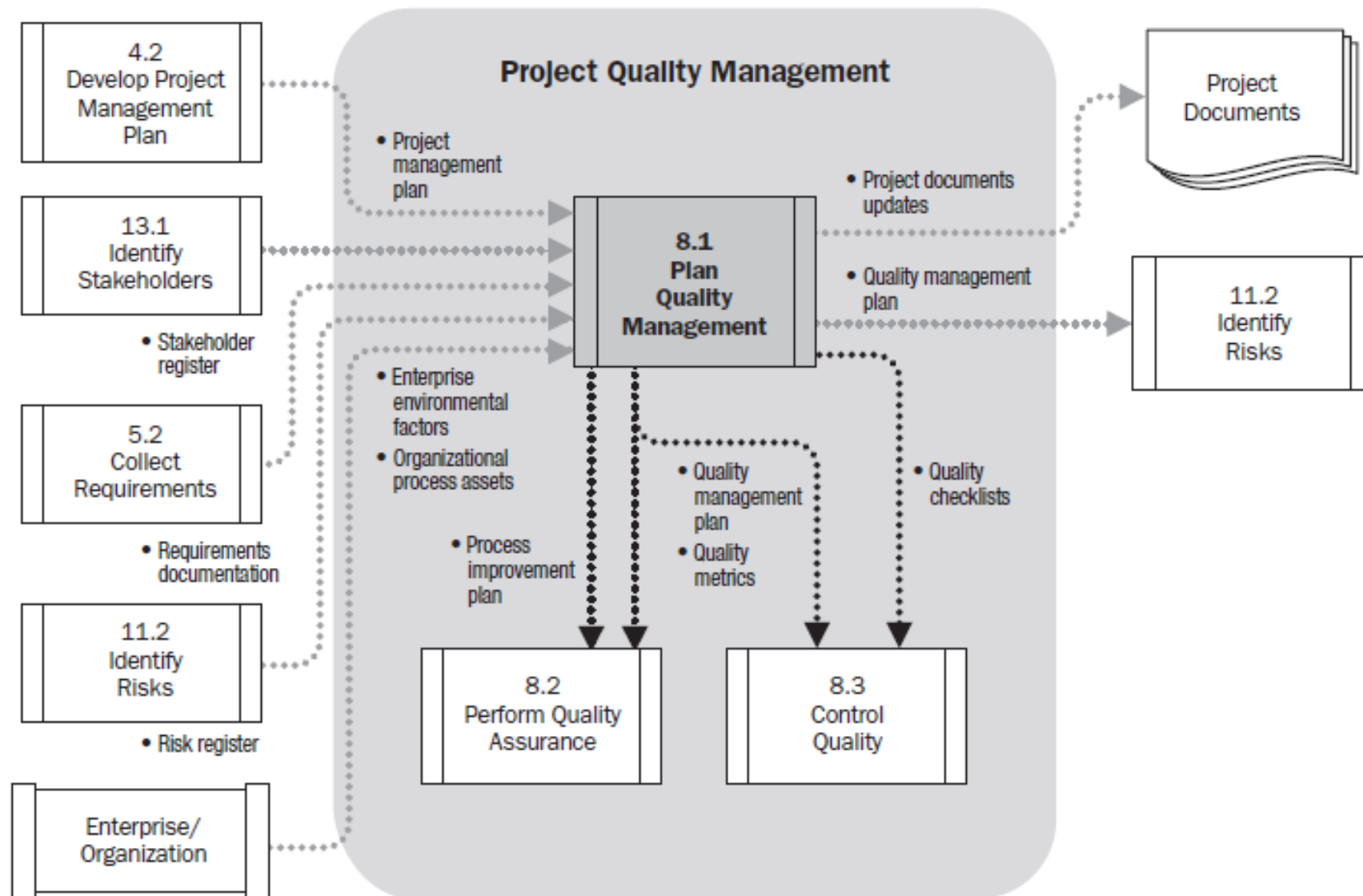- **Quality management and control tools.** These tools are used to link and sequence the activities identified

Figure 8-4. Plan Quality Management Data Flow Diagram

Perform Quality Assurance

- Perform Quality Assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used.

- The key benefit of this process is that it facilitates the improvement of quality processes.

- The quality assurance process implements a set of planned and systematic acts and processes defined within the project's quality management plan.

- Quality assurance seeks to build confidence that a future output or an unfinished output, also known as work in progress, will be completed in a manner that meets the specified requirements and expectations.
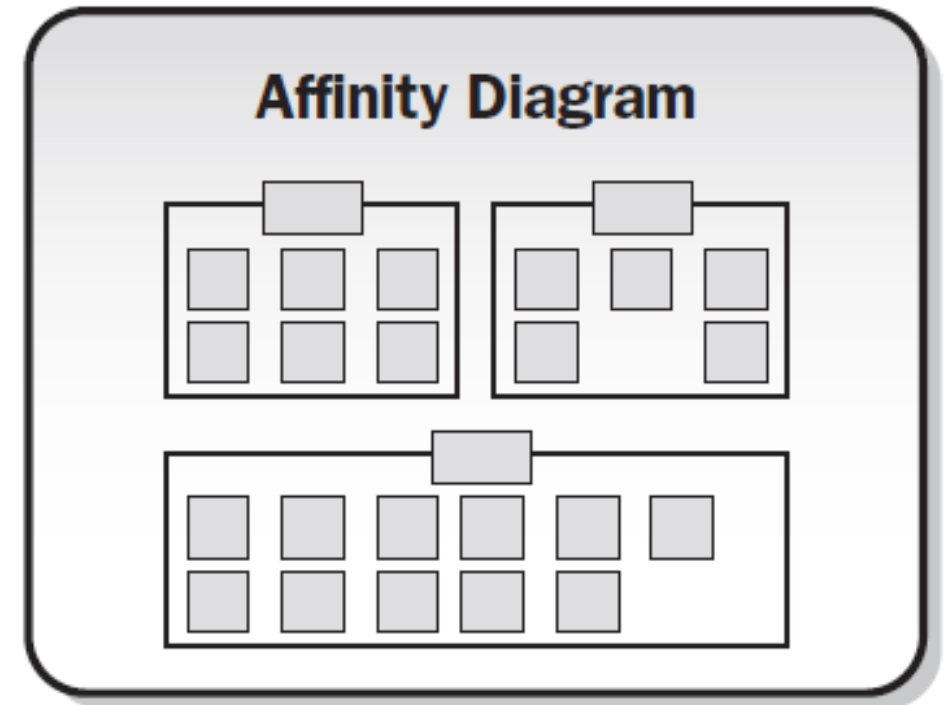
Perform Quality Assurance

Inputs

.1 Quality management plan
.2 Process improvement plan
.3 Quality metrics
.4 Quality control measurements
.5 Project documents

Tools & Techniques

.1 Quality management and control tools
.2 Quality audits
.3 Process analysis

Outputs

.1 Change requests
.2 Project management plan updates
.3 Project documents updates
.4 Organizational process assets updates

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

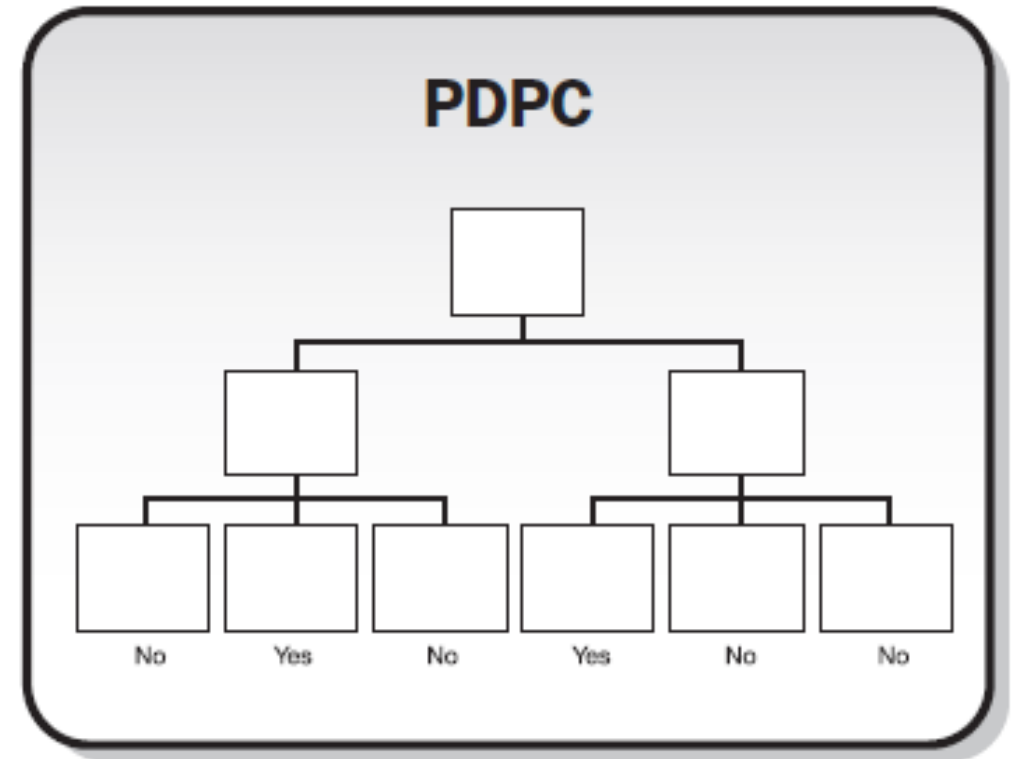# Perform Quality Assurance: Tools and Techniques- Quality Management and Control Tools

- **Affinity diagrams.**
  - The affinity diagram is similar to mind-mapping techniques in that they are ***used to generate ideas*** that can be linked to form organized patterns of thought about a problem.
  - In project management, the creation of the WBS may be enhanced by using the affinity diagram to give structure to the decomposition of scope.

Affinity Diagram

Perform Quality Assurance: Tools and Techniques- Quality Management and Control Tools

- **Process decision program charts (PDPC).**
  - Used to understand a goal in relation to the steps for getting to the goal.
  - The PDPC is *useful as a method for contingency planning* because it aids teams in anticipating intermediate steps that could derail achievement of the goal.

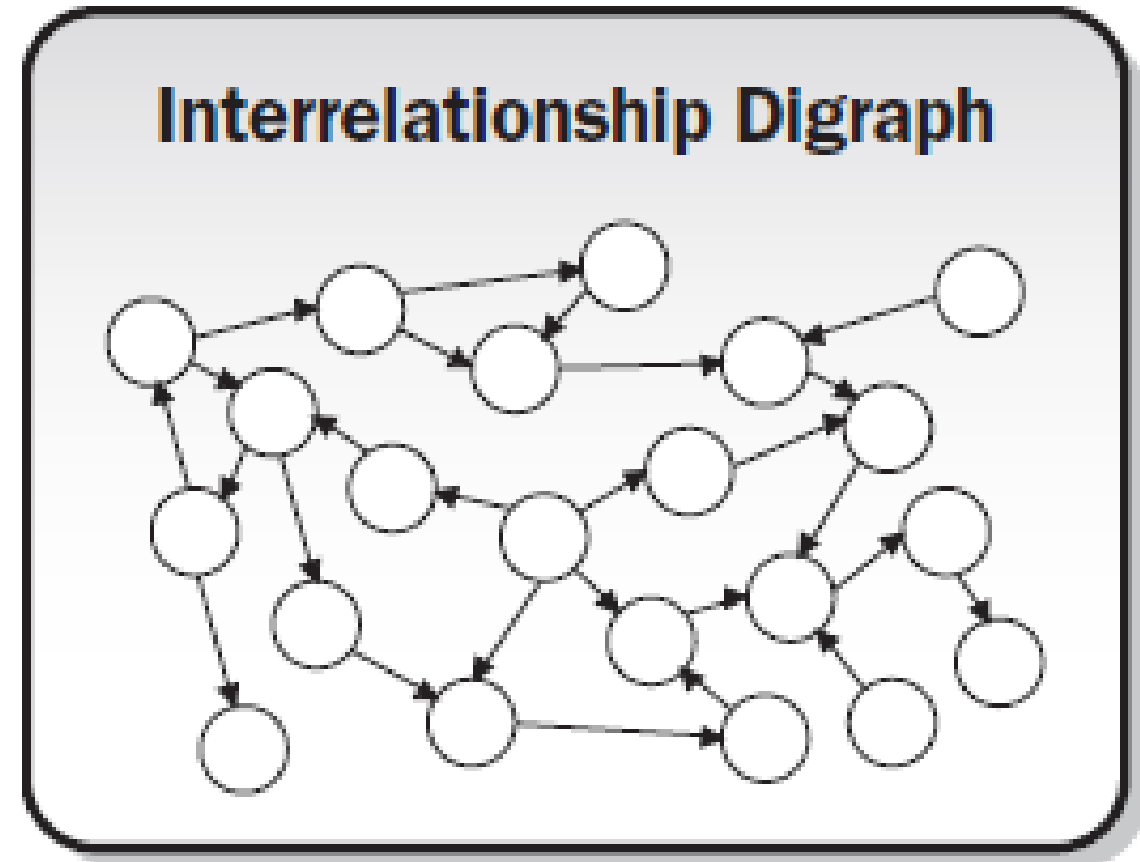# Perform Quality Assurance: Tools and Techniques-Quality Management and Control Tools

- **Interrelationship digraphs.**
  - An adaptation of relationship diagrams.
  - The interrelationship digraphs provide a process for creative problem solving

Interrelationship Digraph

Perform Quality Assurance: Tools and Techniques-Quality Management and Control Tools

- **Tree diagrams.**
  - Also known as systematic diagrams and may be used to represent decomposition hierarchies such as the WBS, RBS (risk breakdown structure), and OBS (organizational breakdown structure).
  - Are useful in visualizing the parent-to-child relationships

Tree Diagrams
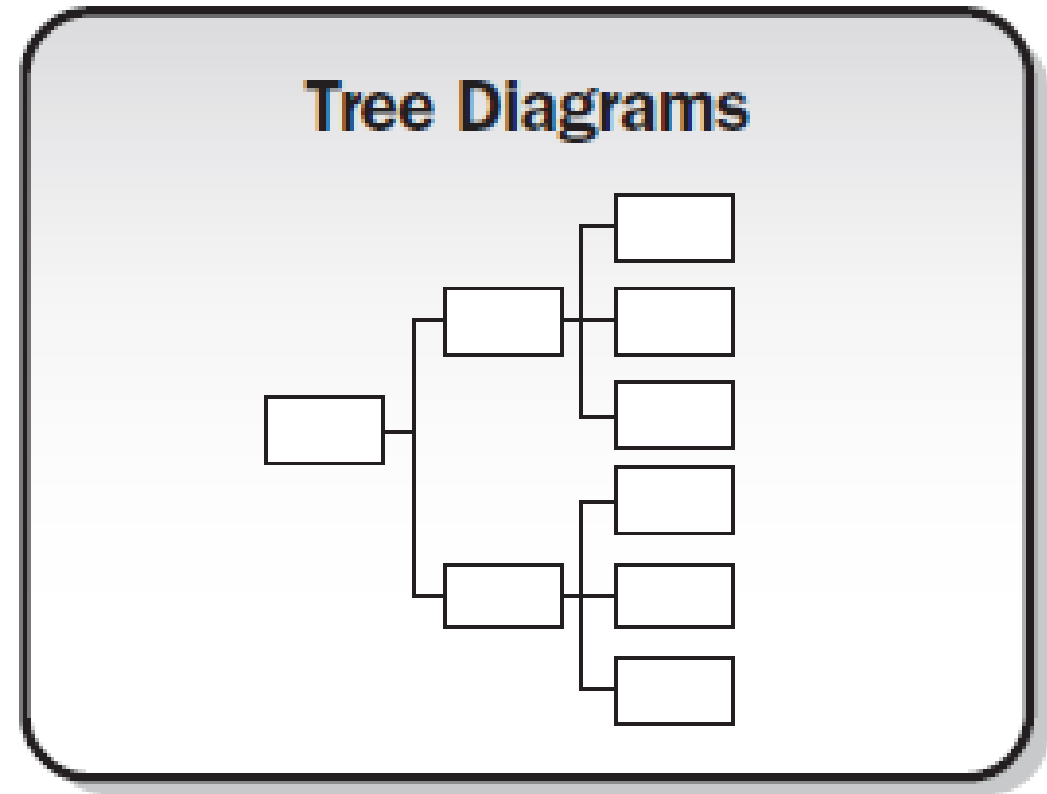
Perform Quality Assurance: Tools and Techniques- Quality Management and Control Tools

- **Prioritization matrices.**
  - Identify the key issues and the suitable alternatives to be prioritized as a set of decisions for implementation.
  - Criteria are prioritized and weighted before being applied to all available alternatives to obtain a mathematical score that ranks the options.

Prioritization Matrices
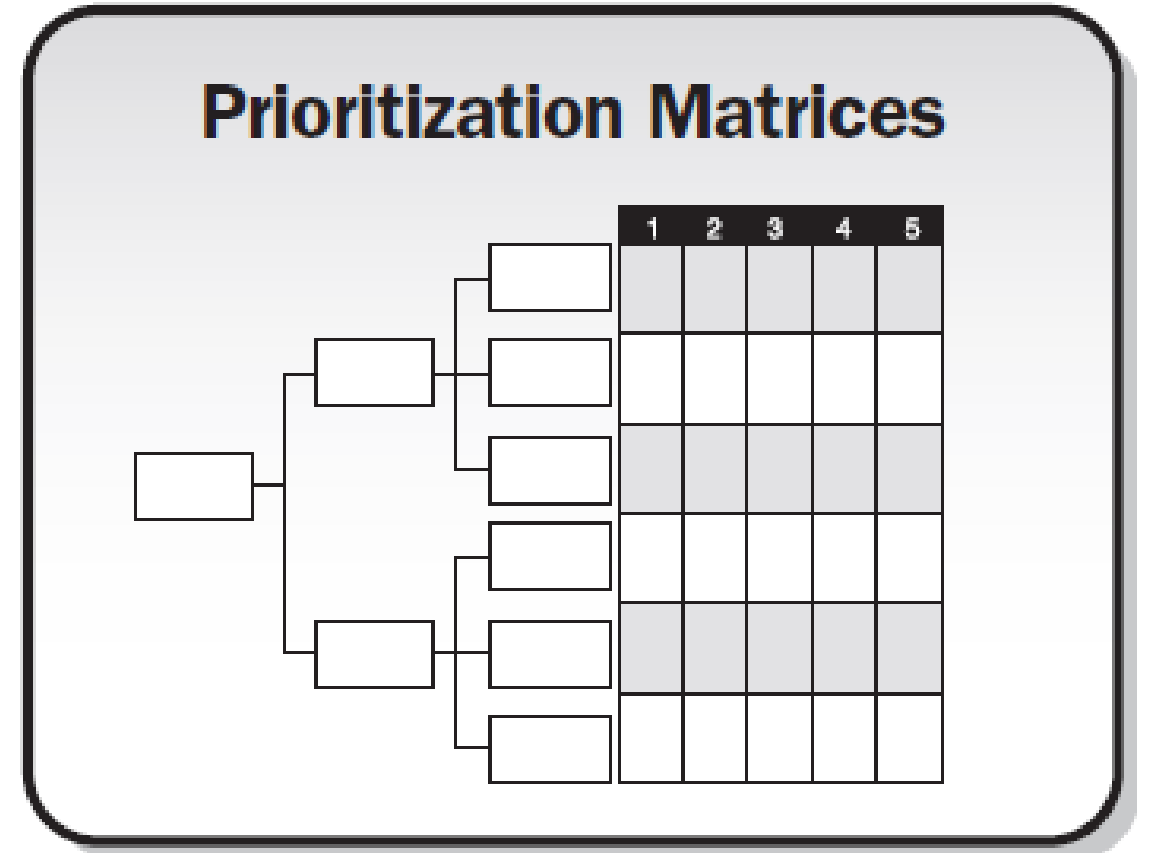
Perform Quality Assurance: Tools and Techniques-Quality Management and Control Tools

- **Activity network diagrams.**
  - Previously known as arrow diagrams.
  - They include both the AOA (Activity on Arrow) and, most commonly used, AON (Activity on Node) formats of a network diagram.
  - Activity network diagrams are used with project scheduling methodologies such as program evaluation and review technique (PERT), critical path method (CPM), and precedence diagramming method (PDM).

Network Diagrams
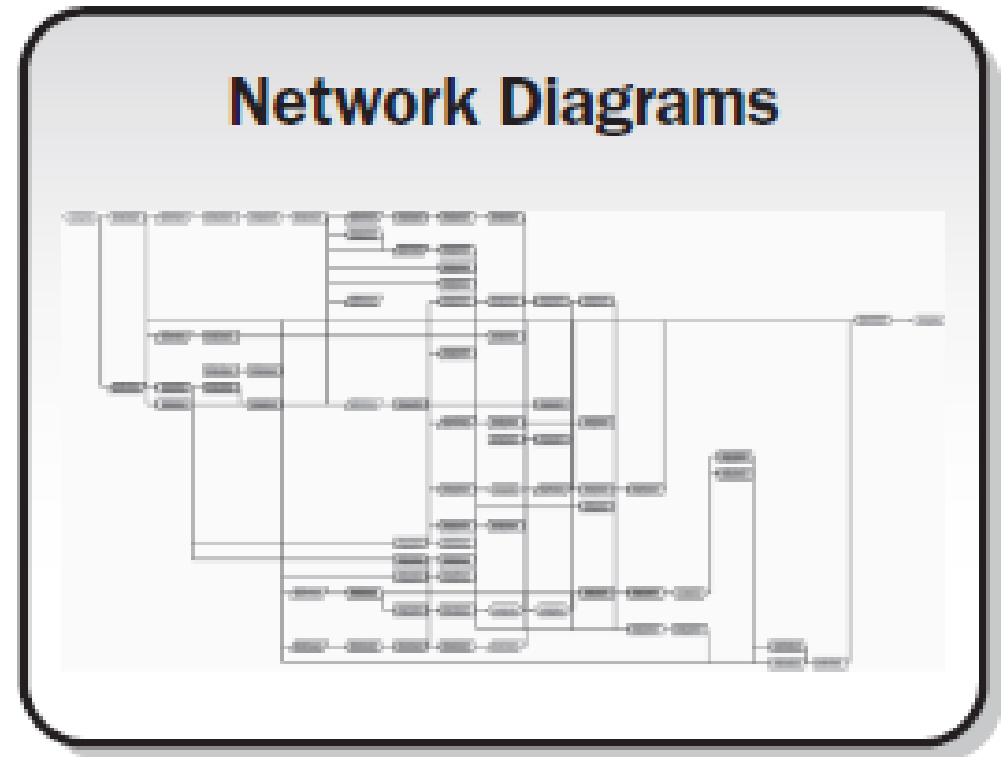
Perform Quality Assurance: Tools and Techniques- Quality Management and Control Tools

- **Matrix diagrams.**
  - A quality management and control tool used to perform data analysis within the organizational structure created in the matrix.
  - The matrix diagram seeks to show the strength of relationships between factors, causes, and objectives that exist between the rows and columns that form the matrix.

Project Quality Management

- 8.1 Plan Quality Management
- 8.3 Control Quality
- 4.2 Develop Project Management Plan
- Quality management plan
- Process improvement plan
- Quality metrics
- Quality control measurements
- Project management plan updates
- 4.5 Perform Integrated Change Control
- Project Documents
- Project documents
- 8.2 Perform Quality Assurance
- Change requests
- Project documents updates
- Project Documents
- Organizational process assets updates
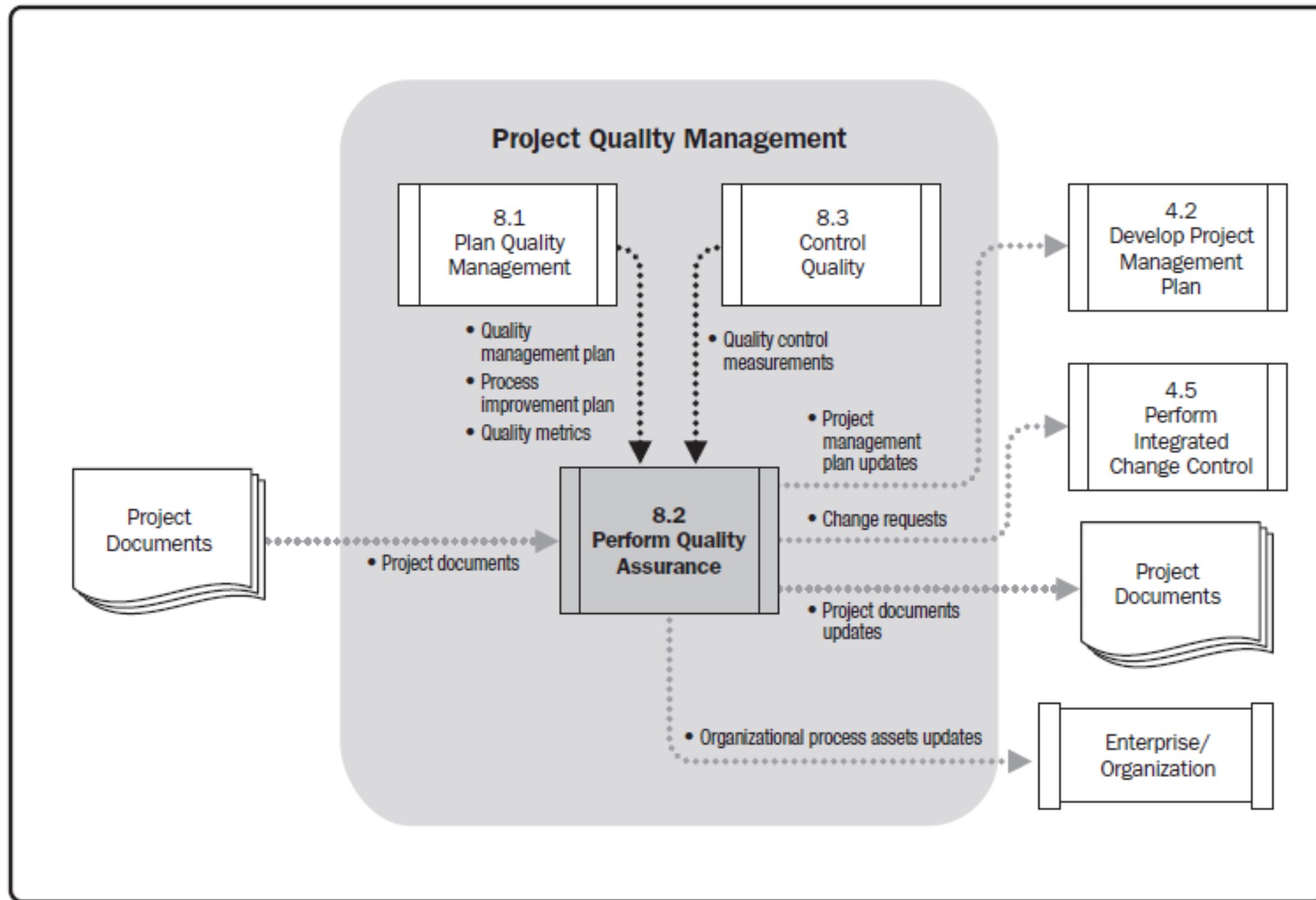- Enterprise/ Organization

Figure 8-9. Perform Quality Assurance Data Flow Diagram

Control Quality

- Control Quality is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes.

- The key benefits of this process include:
  - identifying the causes of poor process or product quality and recommending and/or taking action to eliminate them;
  - validating that project deliverables and work meet the requirements specified by key stakeholders necessary for final acceptance.

- The Control Quality process uses a set of operational techniques and tasks to verify that the delivered output will meet the requirements.

- Quality assurance should be used during the project's planning and executing phases to provide confidence that the stakeholder's requirements will be met and quality control should be used during the project executing and closing phases to formally demonstrate, with reliable data, that the sponsor and/or customer's acceptance criteria have been met.
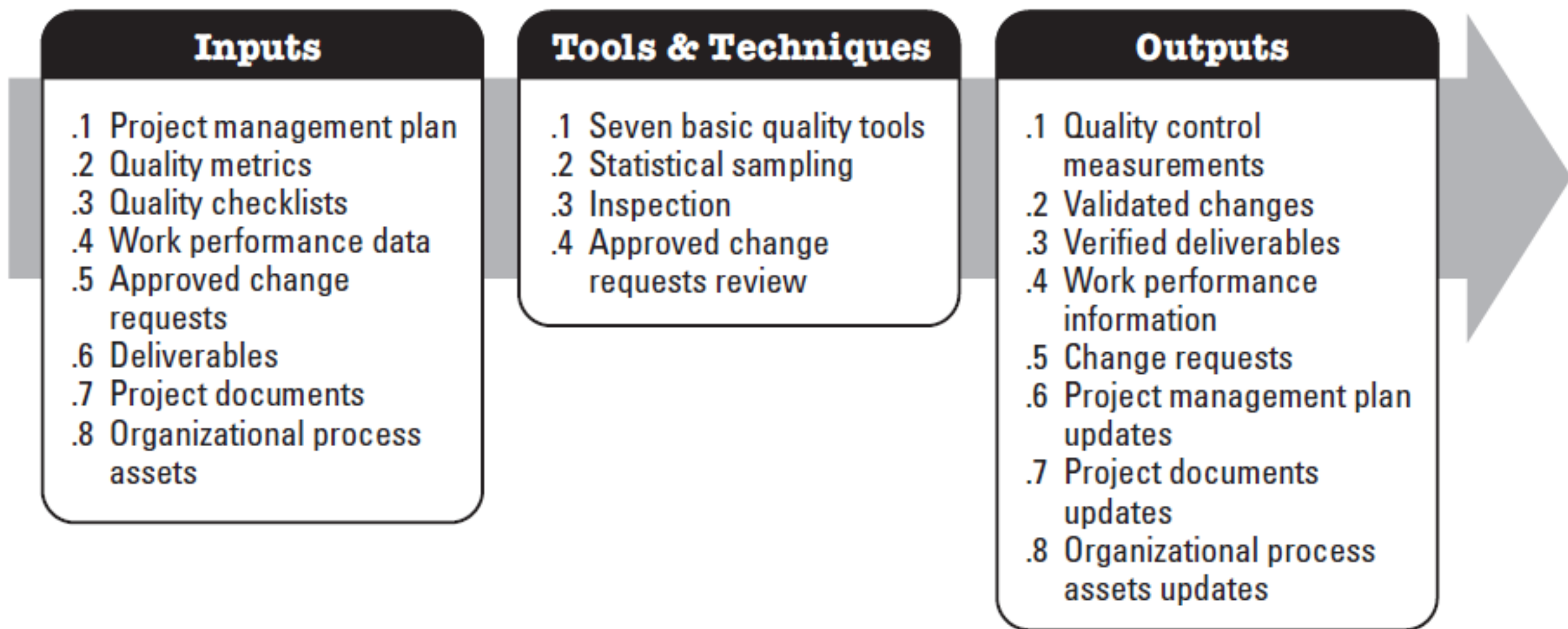
Inputs	Tools & Techniques	Outputs
.1 Project management plan .2 Quality metrics .3 Quality checklists .4 Work performance data .5 Approved change requests .6 Deliverables .7 Project documents .8 Organizational process assets	.1 Seven basic quality tools .2 Statistical sampling .3 Inspection .4 Approved change requests review	.1 Quality control measurements .2 Validated changes .3 Verified deliverables .4 Work performance information .5 Change requests .6 Project management plan updates .7 Project documents updates .8 Organizational process assets updates

Figure 8-11. Control Quality: Inputs, Tools & Techniques, and Outputs
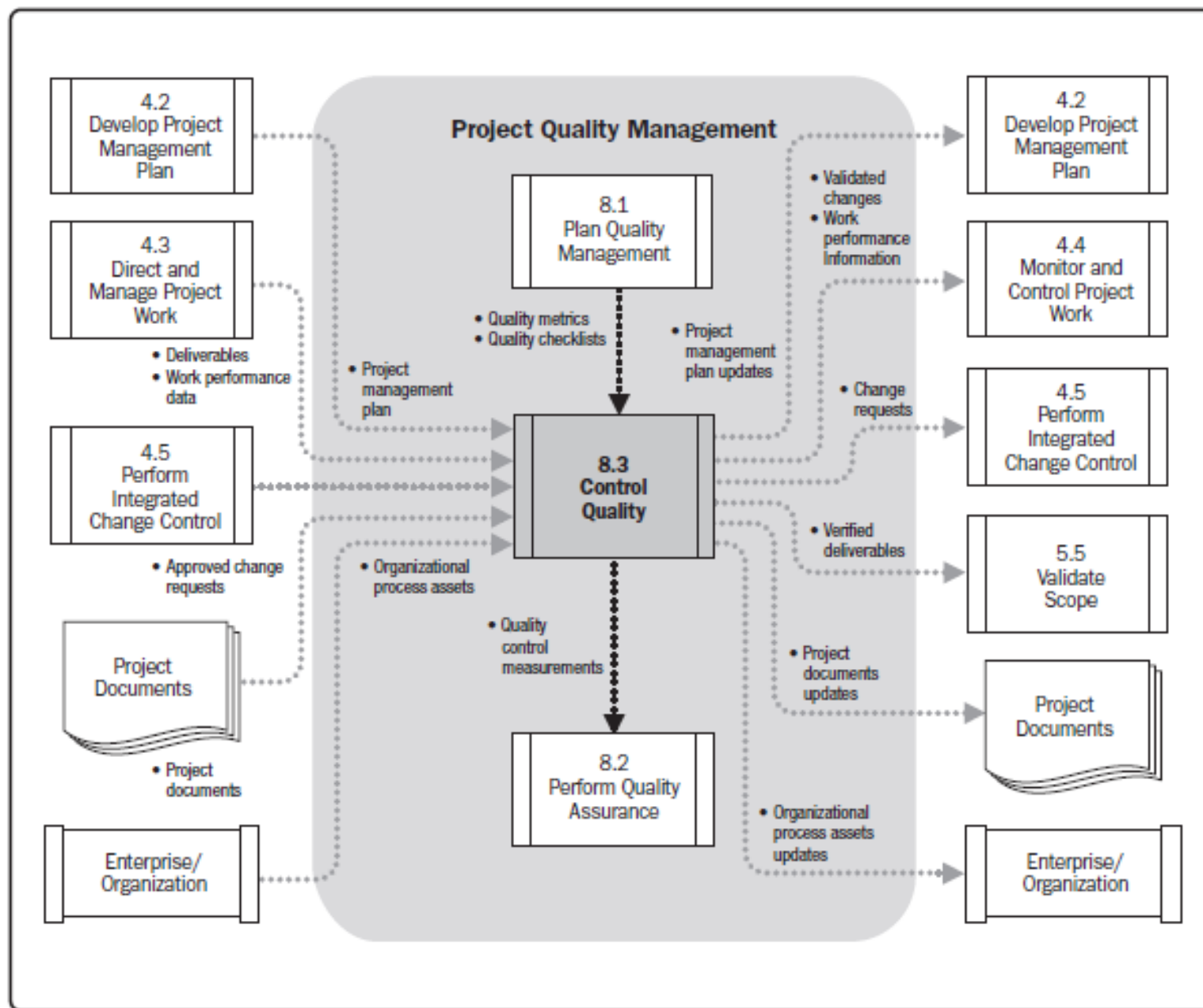
Figure 8-12. Control Quality Data Flow Diagram

Total Quality Management (TQM)

- Total–made up the whole

- Quality–Degree of excellence a product or service provides

- Management–Act, art or manner of handling, controlling, directing etc.

TQM Basic approach

1. A committed management
2. Focused on customer
3. Involvement and utilization of the total work force
4. Continuous improvement
5. Treating suppliers as partners
6. Establish performance measures for each components/ persons

TQM Tools and techniques

- Benchmarking
- Information technology
- Quality management systems
- Environment management system
- Quality function deployment (Customer requirements led design)
- Quality by design
- Failure mode analysis (Reliability)
- Product liability
- Total productive maintenance
- Management tools
- Statistical process control

Kaizen

- **Kaizen**, Japanese for "improvement", or "change for the better" refers to philosophy or practices that focus upon continuous improvement of processes in manufacturing, engineering, and business management.
- The cycle of kaizen activity can be defined as:
  - Standardize an operation and activities.
  - Measure the operation (find cycle time and amount of in-process inventory)
  - Gauge measurements against requirements
  - Innovate to meet requirements and increase productivity
  - Standardize the new, improved operations
  - Continue cycle *ad infinitum*

- Just In Time
  - Zero Inventory Cost
  - Beat the Cost
- Lean Production
  - An integrated view of TQM, Kaizen, JIT
  - Economical, Efficient and Not Wasteful, Effective and Defect Free Production
  - Lean means less head count, less space, less inventory, less cost, less defects and moderately agile management system