SEN319 Software Project Management (Fall 2023)

Project Quality Management

Asst.Prof.Dr. Hasan ÇİFCİ

Agenda

- PM Knowledge Areas
- Project Constraints
- Key Concepts
- Quality Improvement Initiatives
- Maturity Models
- Individual Contributions to Quality Management
- Project Quality Management Processes
- Plan Quality Management
- Manage Quality
- Control Quality

PM Knowledge Areas

Integration	• Coordinate activities across all project management areas and process groups
Scope	• Ensure the project work includes all elements required to complete the work
Schedule	• Ensure the project work is completed in a timely way
Cost	• Plan, estimate, manage and control project finances
Quality	• Ensure the project delivers a quality output that is fit for purpose
Resource	• Secure, manage and monitor use of resources throughout the project
Communications	• Ensure communications on the project are planned and carried out appropriately
Risk	• Identify, assess and manage risk
Procurement	• Carry out purchasing and contracting as required
Stakeholder	• Identify and engage stakeholders throughout the project

Project Constraints

Main Constraints:

- Scope
- Time
- Cost

Additional Constraints:

- Quality
- Resources
- Risk

Key Concepts

"If GM had kept up with technology like the computer industry has, we would all be driving twenty-five dollar cars that got 1000 miles to the gallon."

At COMDEX, Bill Gates reportedly compared the computer industry with the auto industry.

GENERAL MOTORS COMPANY

In response to Bill's comments, General Motors issued a press release stating: if GM had developed technology like Microsoft, we would all be driving cars with the following characteristics:

1. For no reason whatsoever your car would crash twice a day.

2. Every time they painted the lines on the road you would have to buy a new car.

3. Occasionally, executing a maneuver such as a left turn, would cause your car to shut down and refuse to restart, in which case you would have to re-install the engine.

5. New seats would force everyone to have the same size butt.

6. Occasionally for no reason whatsoever, your car would lock you out and refuse to let you in until you simultaneously lifted the door handle, turned the key, and grabbed hold of the radio antenna.

8. Every time GM introduced a new model, car buyers would have to learn how to drive all over again because none of the controls would operate in the same manner as the old car.

9. You'd press the "start" button to shut off the engine.

Key Concepts

Definitions of Quality

- «The totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs.» (ISO8042:1994)
- «The degree to which a set of inherent characteristics fulfils requirements» (ISO9000:2000)

Other experts define quality based on:

- **Conformance to requirements** means that the project's processes and products meet written specifications.
  - For example, if the project scope statement requires delivery of 100 computers with specific processors and memory, you could easily check whether suitable computers had been delivered.
- **Fitness for use** means that a product can be used as it was intended.
  - For example: if these computers were delivered without monitors or keyboards and were left in boxes on the customer's shipping dock, the customer might not be satisfied because the computers would not be fit for use. The customer may have assumed that the delivery included monitors and keyboards, unpacking the computers, and installation so they would be ready to use.

Key Concepts

Conformance to Requirements vs Fitness for Use

Quality = Conformance to Requirements + Fitness for Use

All requirements agreed on must be met/present

E.g.: A car must have 2 doors. If a door is missing then it's a case of non-conformity. Which means the car is defective.

Non-conformity gives DEFECTS.

All requirements that have been met or present, should function the way they were intended to.

E.g.: Say the door exist and all requirements about the door have been met, however the door makes irritating sound every time it's opened or closed. This means the door is unfit to use and this is an error.

Non-fitness gives ERRORS/BUGS.

Key Concepts

Quality vs Grade

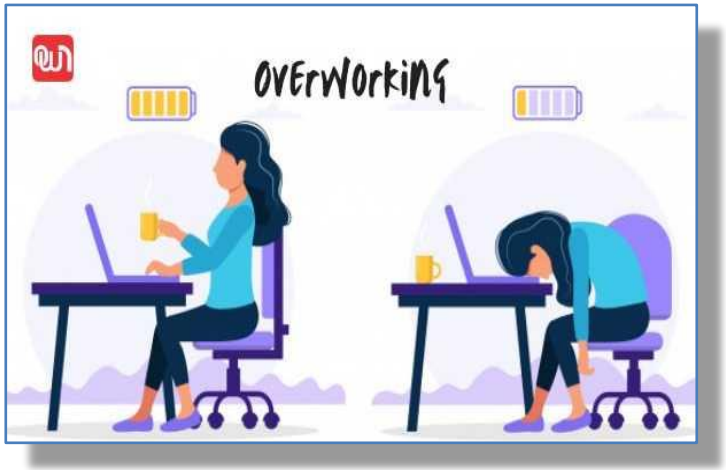
Which car has better quality? Tesla or Şahin?

- **Question itself was wrong and these two cars cannot be compared.**
- **These two cars belong to a completely different grade.**
- **Grade as a design intent is a category assigned to deliverables having the same functional use but different technical characteristics.**
- **While a quality level that fails to meet quality requirements is always a problem, a low-grade product may not be a problem.**
- **Quality cannot be compared across grades. Quality can only be compared within the grade.**

Key Concepts

Overworking and Rushing

- **Meeting customer requirements by overworking the project team may result in decreased profits and increased levels of overall project risks, employee attrition, errors, or rework.**

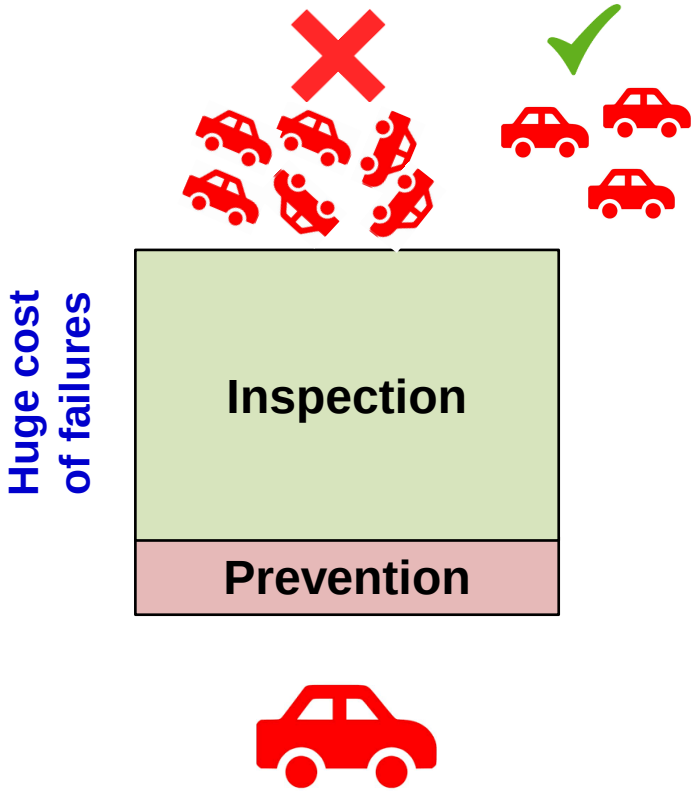


- **Meeting project schedule objectives by rushing planned quality inspections may result in undetected errors, decreased profits, and increased post-implementation risks.**

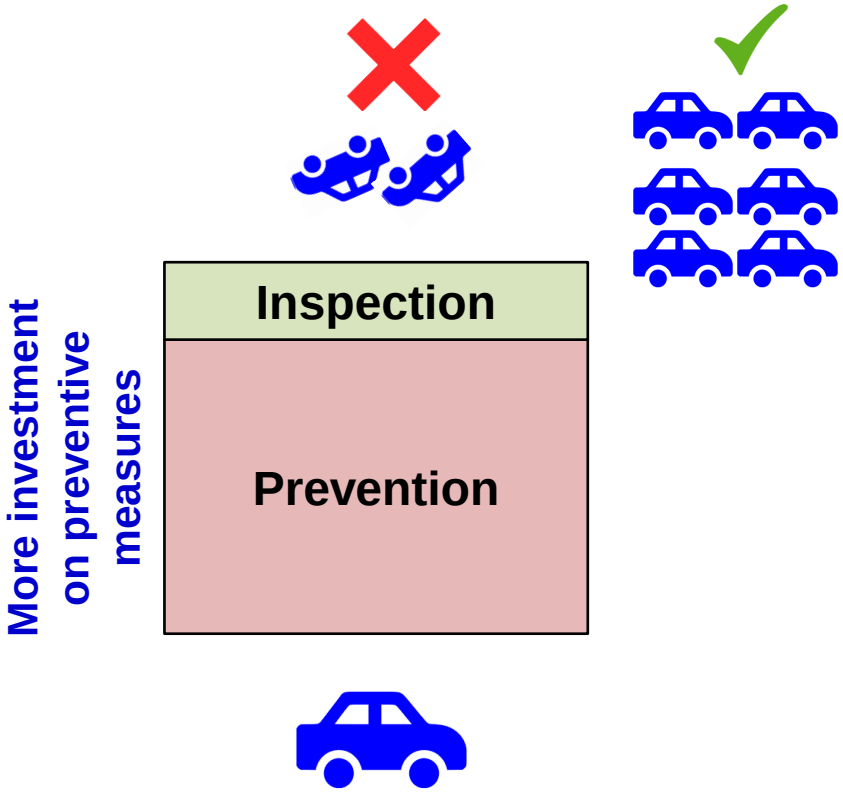
Key Concepts

Prevention is Preferred over Inspection

- **Inspection**: Keeping errors out of the hands of the customer.



- **Prevention**: Keeping errors out of the process.



Key Concepts

Attribute Sampling vs Variable Sampling

- **Attribute Sampling**: The result either conforms or does not conform.

Conform or does not conform

- **Variable Sampling**: The result is rated on a continuous scale that measures the degree of conformity.

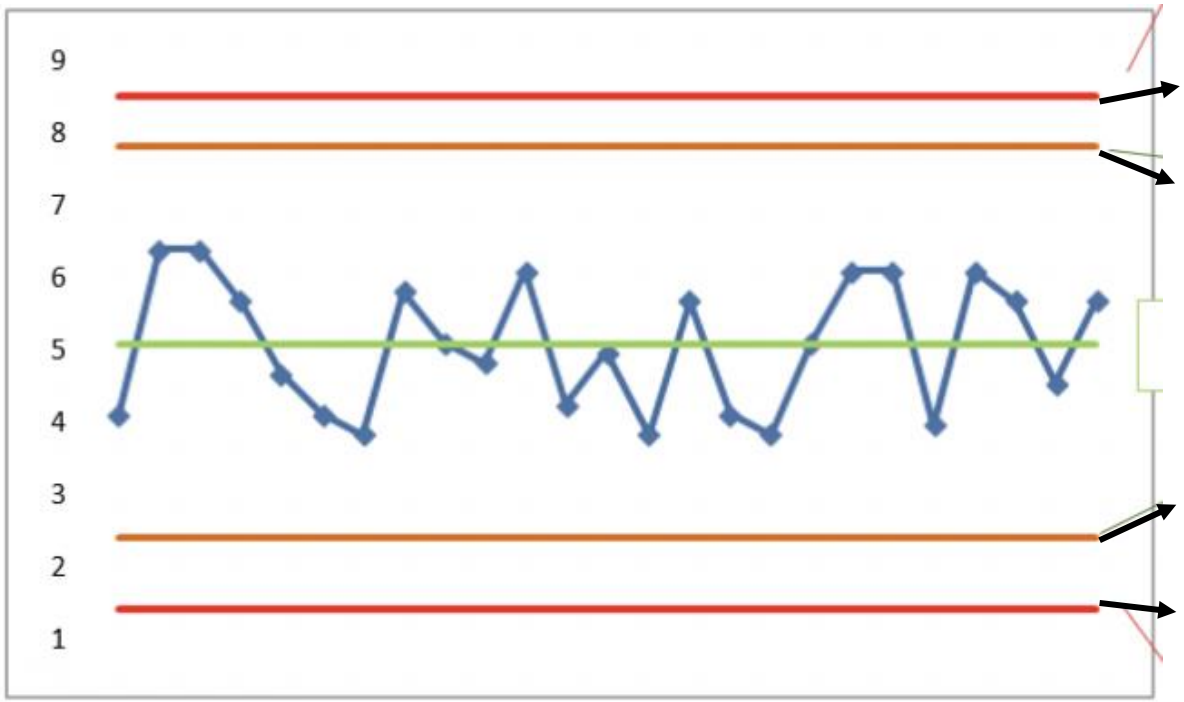
1; 1.5; 2; 2.3; 1.3

Degree of conformity

Key Concepts

Tolerance vs Control Limit

- **Tolerance**: Specified range of acceptable results.
- **Control Limit**: Identify the boundaries of common variation in a statistically stable process or process performance.



Key Concepts

Cost of Quality (COQ)

- COQ includes all costs incurred over the life of the product by investment in
  1. Prevention costs: Preventing nonconformance to requirements,
  2. Appraisal costs: Appraising the product or service for conformance to requirements,
  3. Failure costs (internal/external): Failing to meet requirements (rework).

     Internal: Found by the project team.

     External: Found by the customer.

COQ=Cost of conformance (Prevention + Appraisal) + Cost of non-conformance

- A study reported that software bugs cost the U.S. economy $59.6 billion each year and that one third of the bugs could be eliminated by an improved testing infrastructure

Key Concepts

Cost of Quality (COQ)

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**

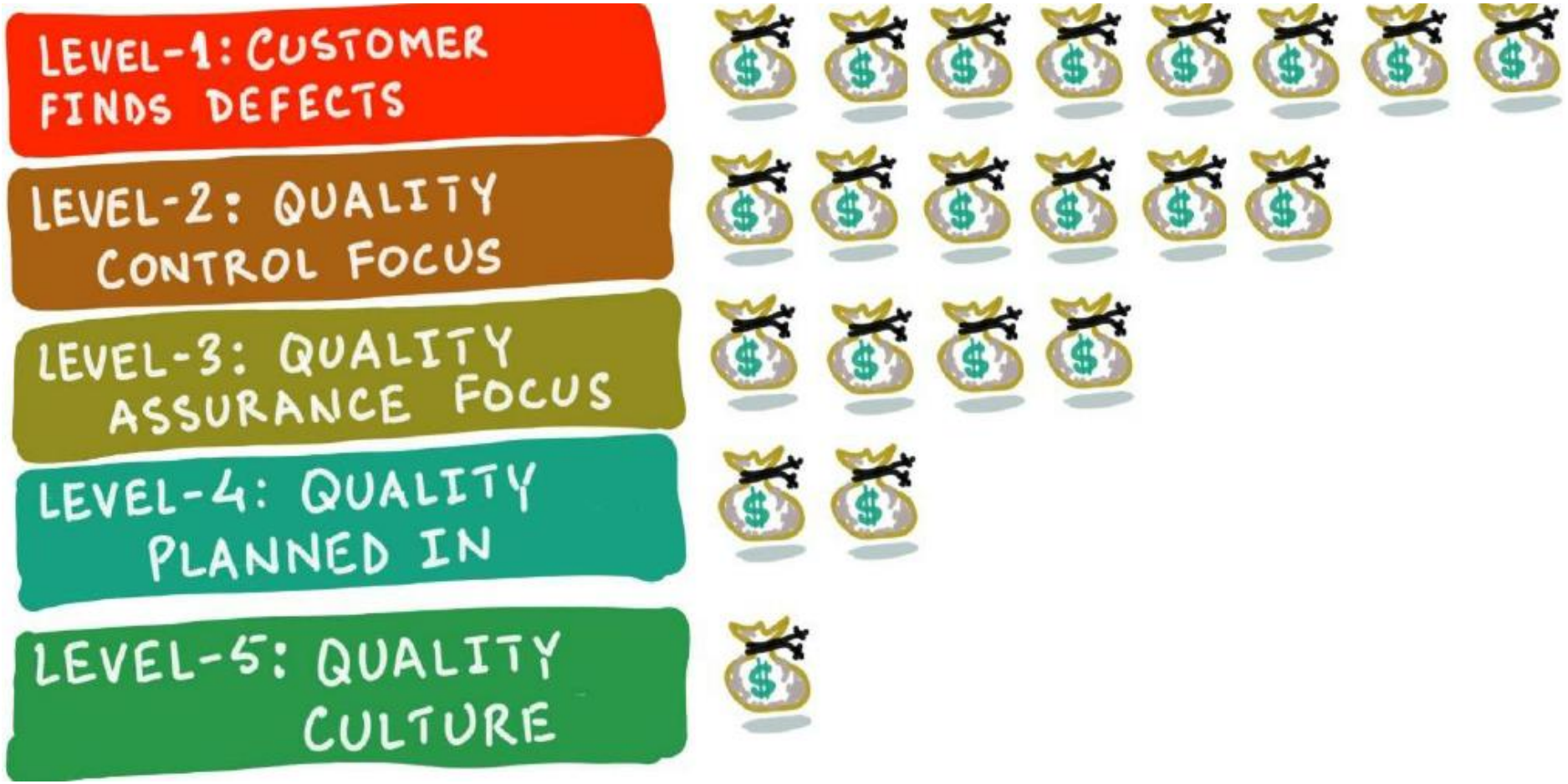
Key Concepts

Levels of Increasingly Effective Quality Management

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.

Key Concepts

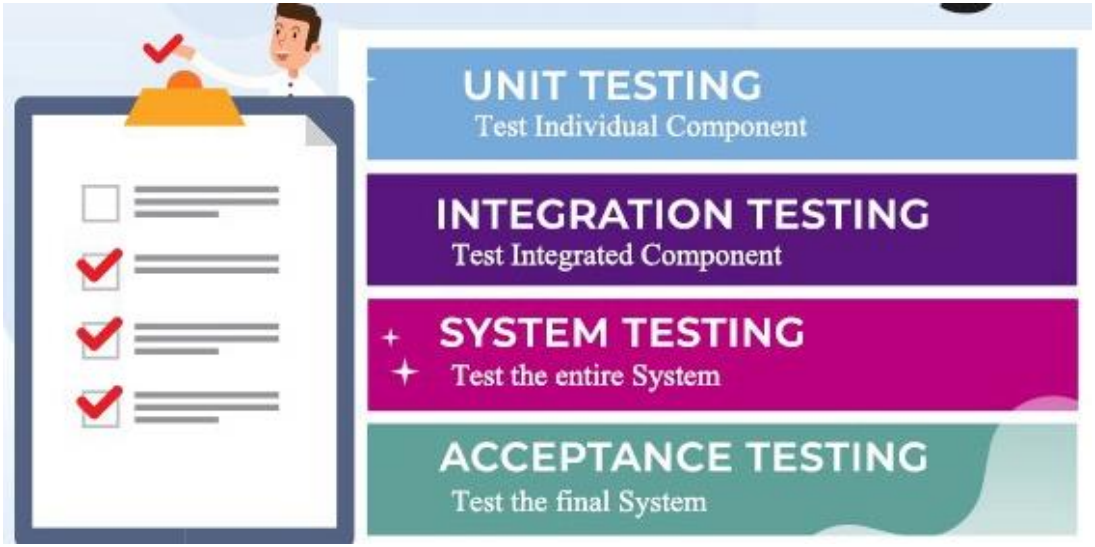
Levels of Increasingly Effective Quality Management



Key Concepts

Types of Tests

- **Unit testing** tests each individual component (often a program) to ensure it is as defect-free as possible
- **Integration testing** occurs between unit and system testing to test functionally grouped components
- **System testing** tests the entire system as one entity
- **User acceptance testing** is an independent test performed by end users prior to accepting the delivered system



Key Concepts

ISO Standards

- **ISO 9000, a quality system standard developed by the ISO, is a three-part, continuous cycle of planning, controlling, and documenting quality in an organization.**
- **The ISO 9000 family addresses various aspects of quality management and contains some of ISO's best known standards.**
- **The standards provide guidance and tools for companies and organizations who want to ensure that their products and services consistently meet customer's requirements, and that quality is consistently improved.**

Key Concepts

Responsibility for the Quality of Projects

- **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.**
  - **Project managers are ultimately responsible for quality management on their projects**

Quality Improvement Initiatives

Well Known Initiatives/Methods

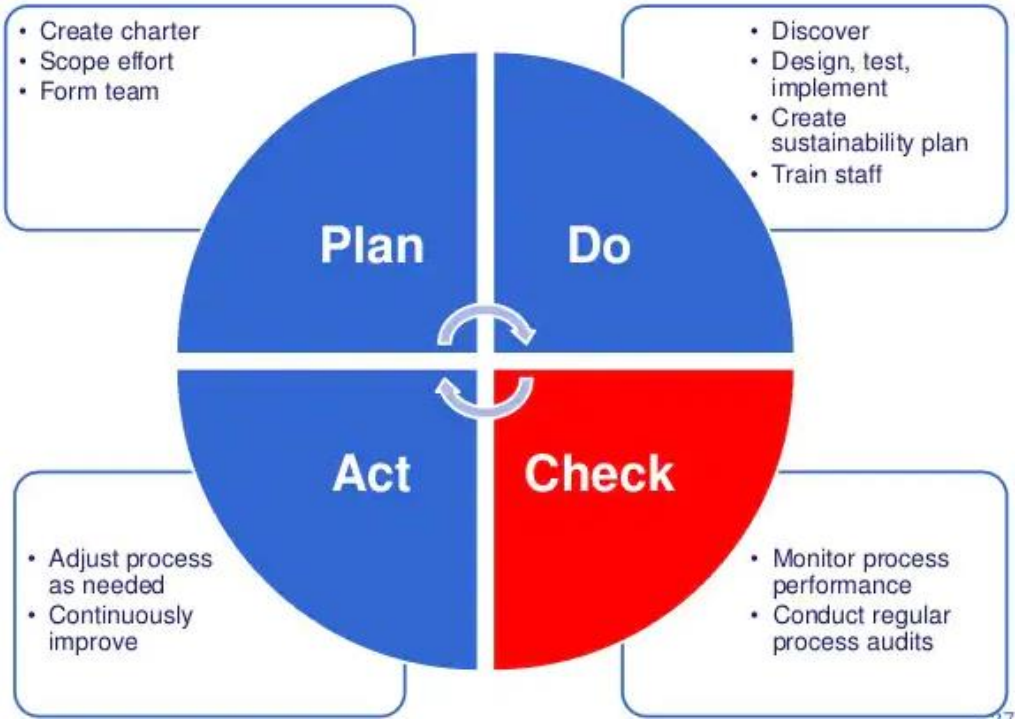
1. Plan-Do-Check-Act (PDCA) Cycle
2. Total Quality Management (TQM)
3. Kaizen
4. Six Sigma
5. Lean Six Sigma
6. Business Process Reengineering (BPR)

Quality Improvement Initiatives

Plan-Do-Check-Act (PDCA) Cycle

- **PDCA is an iterative design and 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, the Shewhart cycle, the control circle/cycle, or plan–do–study–act (PDSA).**

1. **Plan: Recognize an opportunity and plan a change.**
2. **Do: Test the change. Carry out a small-scale study.**
3. **Check: Review the test, analyze the results and identify what you've learned.**
4. **Act: Take action based on what you learned.**



Quality Improvement Initiatives

Total Quality Management (TQM)

- TQM consists of organization-wide efforts to install and make permanent climate where employees continuously improve their ability to provide on demand products and services that customers will find of particular value.
  - "Total" emphasizes that departments in addition to production.
  - "Management" emphasizes that executives are obligated to actively manage quality through funding, training, staffing, and goal setting.

Key Takeaways of TQM

- TQM is an ongoing process of detecting and reducing or eliminating errors.
- It is used to streamline supply chain management, improve customer service, and ensure that employees are trained.
- The focus is to improve the quality of an organization's outputs, including goods and services, through the continual improvement of internal practices.
- Total quality management aims to hold all parties involved in the production process accountable for the overall quality of the final product or service.

Quality Improvement Initiatives

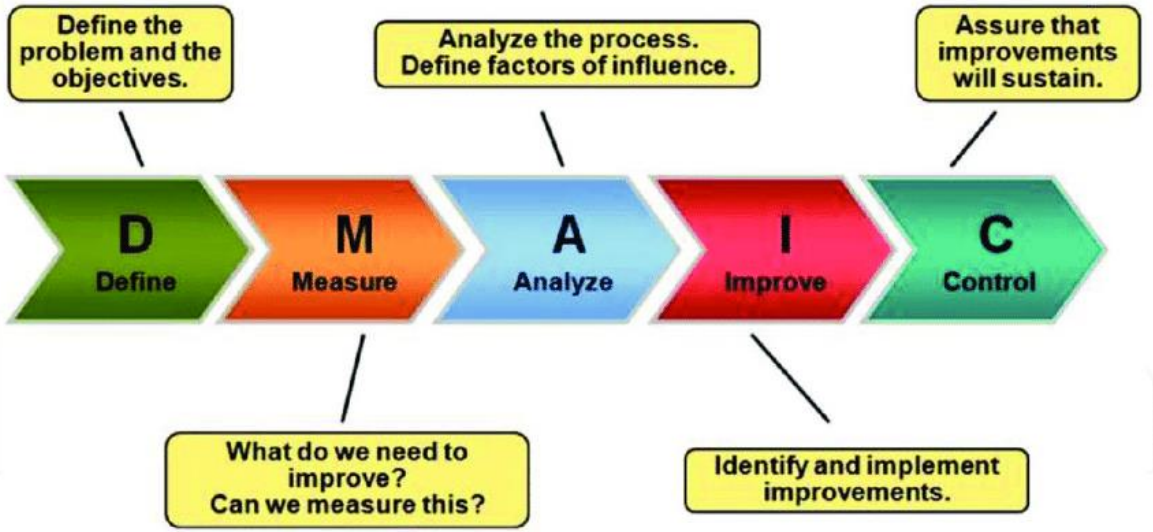
Kaizen

- **Kaizen is a Japanese term meaning "change for the better" or "continuous improvement."**
- **It is a Japanese business philosophy regarding the processes that continuously improve operations and involve all employees (from the CEO to the assembly line workers).**
- **Kaizen also applies to processes, such as purchasing and logistics, that cross organizational boundaries into the supply chain.**
- **Techniques such as PDCA cycle and 5 Whys *(an iterative interrogative technique used to explore the cause-and-effect relationships underlying a particular problem)* are used in Kaizen.**

Quality Improvement Initiatives

Six Sigma - Definition

- **Six Sigma: A comprehensive and flexible system for achieving, sustaining and maximizing business success.**
  - **Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes.**
- **Developed within Motorola in 1986 to compete with the Kaizen (or lean manufacturing) business model in Japan.**
- **Six Sigma projects normally follow a five-phase improvement process called DMAIC (Define, Measure, Analyze, Improve, and Control -pronounced «de-MAY-ick»).**



Quality Improvement Initiatives

Six Sigma - DMAIC

1. **Define**: Define the problem/opportunity, process, and customer requirements. Important tools used include a **project charter, a description of customer requirements and process maps**.
2. **Measure**: Define measures and then collect, compile and display data. Measures are defined in terms of defects per opportunity.
3. **Analyze**: Scrutinize process details to find improvement opportunities. Investigate and verify data to prove the suspected root causes of quality problems and substantiates the problem statement. An important tool in this phase is the **fishbone or Ishikawa diagram**.
4. **Improve**: Generate solutions and ideas for improving the problem. A final solution is verified with the project sponsor, and the Six Sigma team develops a plan to pilot test the solution.
5. **Control**: Track and verify the stability of the improvements and the predictability of the solution. **Control charts** are one tool used in the control phase.

Quality Improvement Initiatives

Six Sigma - Project Selection and Management

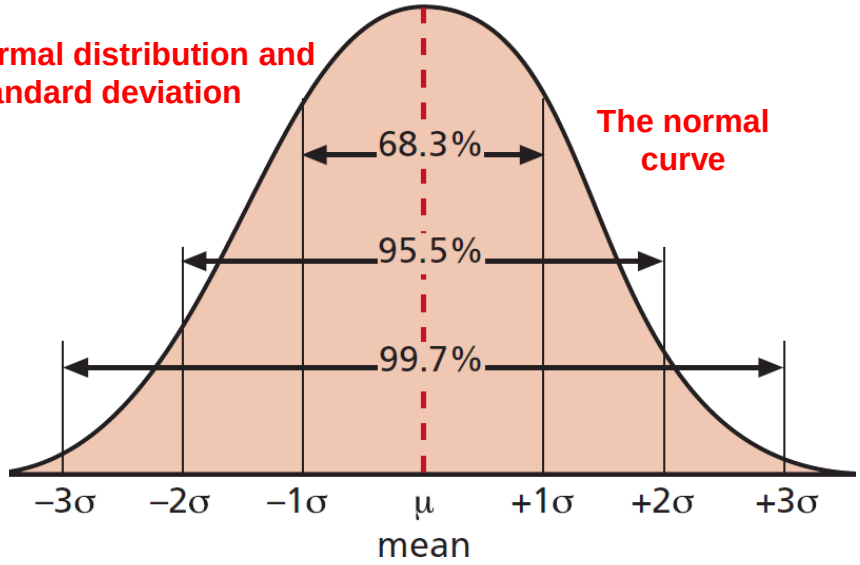
- **Organizations implement Six Sigma by selecting and managing projects.**
  - **An important part of project management is good project selection.**
- **Organizations must be careful to apply higher quality where it makes sense. Why can't all companies benefit from Six Sigma?**
  - **Because minimizing defects does not matter if an organization makes a product that people do not want.**
- **What makes a project a potential Six Sigma project?**
  - **First, there must be a quality problem or gap between the current and desired performance.**
  - **Second, the project should not have a clearly understood problem.**
  - **Third, the solution should not be predetermined, and an optimal solution should not be apparent.**
- **Once a project is selected as a good candidate for Six Sigma, many project management concepts, tools, and techniques come into play.**

Quality Improvement Initiatives

Six Sigma - Statistics

- An important concept in Six Sigma is improving quality by reducing variation.
- The term sigma means standard deviation. Statisticians use the Greek symbol σ (sigma) to represent the standard deviation.
  - Standard deviation measures how much variation exists in a distribution of data.
  - A small standard deviation means that data clusters closely around the middle of a distribution and there is little variability among the data.
  - A large standard deviation means that data is spread around the middle of the distribution and there is relatively greater variability.

Normal distribution and Standard deviation



- In any normal distribution;
  - 68.3% of the population is within one standard deviation (1σ) of the mean,
  - 95.5% of the population is within two standard deviations (2σ), and
  - 99.7% of the population is within three standard deviations (3σ) of the mean.

Quality Improvement Initiatives

Six Sigma - Sigma and Defective Units

- Standard deviation is a key factor in determining the acceptable number of defective units in a population.

Specification Range (in ± Sigmas)	Percent of Population within Range	Defective Units per Billion
1	68.27	317,300,000
2	95.45	45,400,000
3	99.73	2,700,000
4	99.9937	63,000
5	99.999943	57
6	99.9999998	2

Quality Improvement Initiatives

Six Sigma - Six Sigma Conversion Table

- Six Sigma uses a scoring system that accounts for time, an important factor in determining process variations.
- Conversion table applied to Six Sigma projects.
  - The yield represents the number of units handled correctly through the process steps.
  - A defect is any instance in which the product or service fails to meet customer requirements.

Sigma	Yield	Defects per Million Opportunities (DPMO)
1	31.0%	690,000
2	69.2%	308,000
3	93.3%	66,800
4	99.4%	6,210
5	99.97%	230
6	99.99966%	3.4

A process operating at six sigma means there are no more than 3.4 defects per million opportunities.

Quality Improvement Initiatives

Six Sigma - Six 9s of Quality

- Six 9s of quality is a measure of quality control equal to 1 fault in 1 million opportunities.
- In the telecommunications industry, it means
  - 99.9999% service availability or
  - 30 seconds of down time a year.
- This level of quality has also been stated as;
  - The target goal for the number of errors in a communications circuit, system failures, or errors in lines of code.

Quality Improvement Initiatives

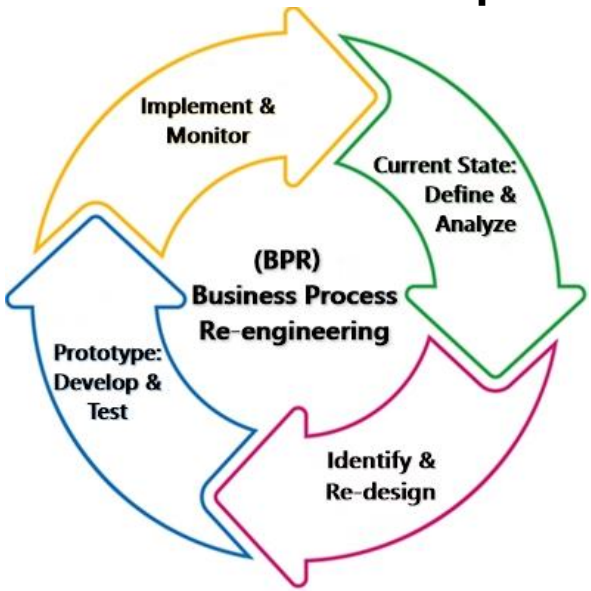
Lean Six Sigma

- **Lean Six Sigma is a method that relies on a collaborative team effort to improve performance by systematically removing waste and reducing variation.**
- **It combines lean manufacturing/lean enterprise and Six Sigma to eliminate the eight kinds of waste (muda):**
  - **Defects,**
  - **Over-Production,**
  - **Waiting,**
  - **Non-Utilized Talent,**
  - **Transportation (unnecessary or excessive movement of materials, products, people, equipment, and tools),**
  - **Inventory (excess in products and materials that are not yet processed),**
  - **Motion (unnecessary movement by people) and**
  - **Extra-Processing.**

Quality Improvement Initiatives

Business Process Reengineering (BPR)

- BPR is a business management strategy, originally pioneered in the early 1990s, focusing on the analysis and design of workflows and business processes within an organization.
- It is the radical redesign of business processes to achieve dramatic improvements in critical aspects like quality, output, cost, service and speed.
- BPR aims at cutting down enterprise costs and process redundancies on a very huge scale and become world-class competitors.



Maturity Models

- **Another approach to improving quality in software development projects and project management in general is the use of maturity models, which are frameworks for helping organizations improve their processes and systems.**
- **Maturity models describe an evolutionary path of increasingly organized and systematically more mature processes.**
- **Many maturity models have generally 5 levels describing characteristics of the least/most organized or mature organizations.**
- **Three popular maturity models include:**

1. **Software Quality Function Deployment (SQFD) Model**
2. **Capability Maturity Model Integration (CMMI)**
3. **Project management maturity models**
   - **Organizational Project Management Maturity Model (OPM3®)**
   - **Center for Business Practices**
   - **ESI International's Project Framework**
   - **The International Institute for Learning's model**
   - **Harold Kerzner's Project Management Maturity Model**

Maturity Models

Software Quality Function Deployment (SQFD) Model

- SQFD model is an adaptation of the quality function deployment model suggested in 1986 as an implementation vehicle for Total Quality Management (TQM).
- SQFD focuses on defining user requirements and planning software projects.
- The result of SQFD is a set of measurable technical product specifications and their priorities.
- Having clearer requirements can lead to fewer design changes, increased productivity, and, ultimately, software products that are more likely to satisfy stakeholder requirements.

Maturity Models

Capability Maturity Model Integration (CMMI)

- **Another popular maturity model is in continuous development at the Software Engineering Institute (SEI) at Carnegie Mellon University.**
- **Administered by the CMMI Institute, a subsidiary of ISACA.**
- **CMMI is "*a process improvement approach that provides organizations with the essential elements of effective processes. It can be used to guide process improvement across a project, a division, or an entire organization. CMMI helps integrate traditionally separate organizational functions, set process improvement goals and priorities, provide guidance for quality processes, and provide a point of reference for appraising current processes*."**
- **It is required by many U.S. Government contracts, especially in software development.**

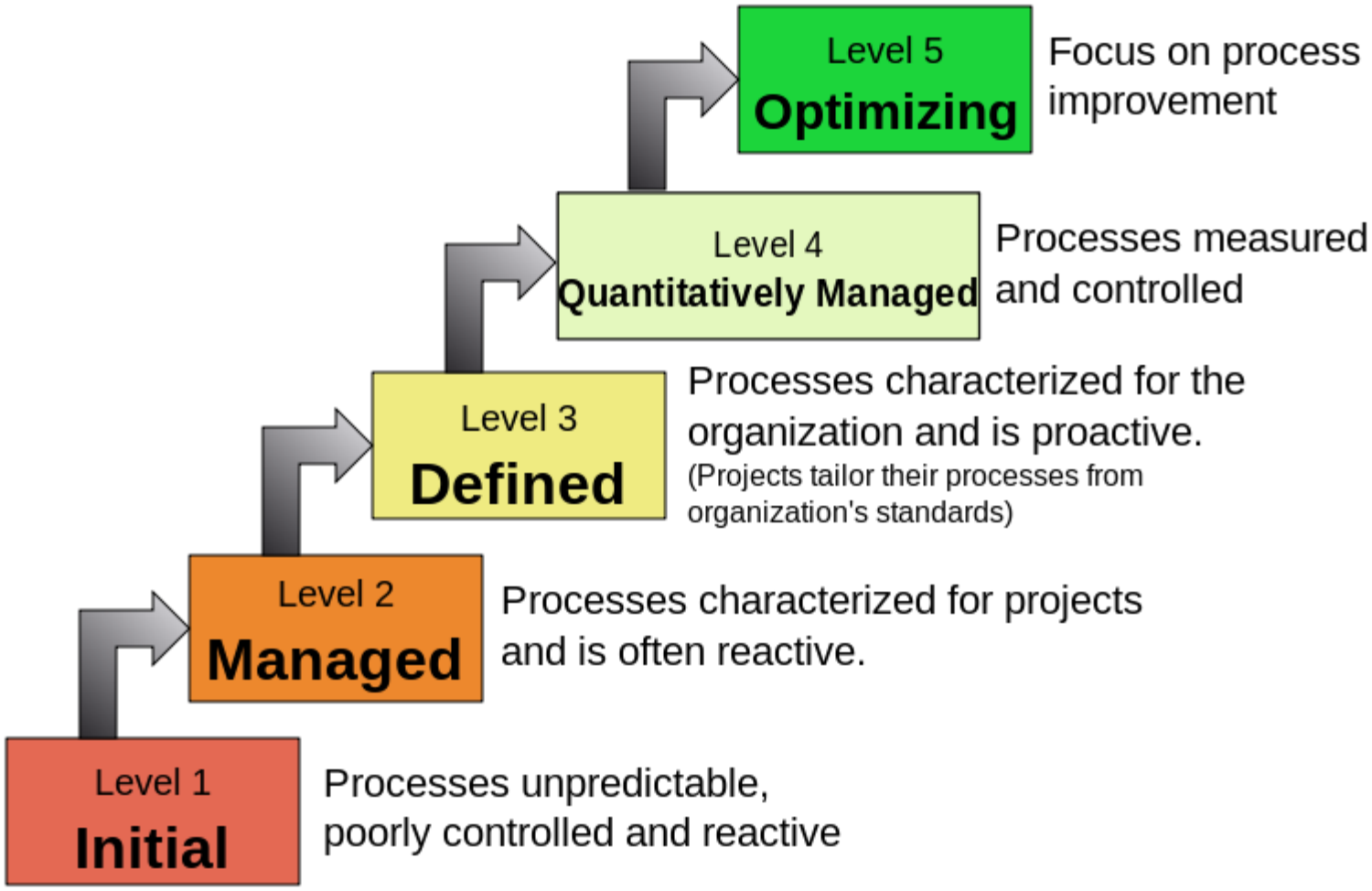
Maturity Models

Capability Maturity Model Integration (CMMI)

- **0. Incomplete: A process is either not performed or partially performed. No generic goals exist and one or more of the specific goals of the process area are not satisfied. Work may or may not get completed.**
- **1. Initial: Processes are usually ad-hoc, chaotic and unpredictable. Work gets completed but is often delayed and over budget.**
- **2. Managed: The process is planned and executed based on policies and employs skilled people who have adequate resources to produce controlled outputs.**
- **3. Defined: A process is rigorously defined. Standards, process descriptions, and procedures for each project are tailored from the organization's set of standard processes.**
- **4. Quantitatively managed: A process is controlled using statistical and other quantitative techniques. Organization is data-driven with quantitative performance improvement objectives.**
- **5. Optimizing: Organization is focused on continuous improvement and is built to pivot and respond to opportunity and change. The organization's stability provides a platform for agility and innovation.**

Maturity Models

Capability Maturity Model Integration (CMMI)



Maturity Models

Project Management Maturity Models – OPM3

- In the late 1990s, several organizations began developing project management maturity models based on the CMMI.
- Just as organizations realized the need to improve their software development processes and systems, they also realized the need to enhance their project management processes and systems for all types of projects.
- The PMI published Organizational Project Management Maturity Model (OPM3®) in 2003.
- It offers best practices for the interaction of portfolio management, program management and project management.
- OPM3 was recognized as an American national standard.

Individual Contributions to Quality Management

- **Modern quality management requires customer satisfaction, prefers prevention to inspection, and recognizes management responsibility for quality.**
- **Several noteworthy people helped develop the following theories, tools, and techniques that define modern quality management.**
  - **Deming was famous for his work in rebuilding Japan and his 14 Points for Management**
  - **Juran wrote the Quality Control Handbook and ten steps to quality improvement**
  - **Crosby wrote Quality is Free and suggested that organizations strive for zero defects**
  - **Ishikawa developed the concepts of quality circles and fishbone diagrams**
  - **Taguchi developed methods for optimizing the process of engineering experimentation**
  - **Feigenbaum developed the concept of total quality control**
  - **Malcolm Baldrige and Malcolm Baldrige National Quality Award**

Individual Contributions to Quality Management

Deming and His 14 Points for Management

- Dr. W. Edwards Deming is known primarily for his work on quality control in Japan.
- Deming went to Japan after World War II at the request of the Japanese government to assist in improving productivity and quality.
- Deming, a statistician and former professor at New York University, taught Japanese manufacturers that higher quality meant greater productivity and lower cost.
- Many people are familiar with the Deming Prize, an award given to recognize high quality organizations, and Deming's Cycle for Improvement: Plan, Do, Check, and Act.
- Most Six Sigma principles are based on the Plan-Do-Check-Act model created by Deming.

Individual Contributions to Quality Management

Deming and His 14 Points for Management

1. Create constancy of purpose for improvement of product and service.
2. Adopt the new philosophy.
3. Cease dependence on inspection to achieve quality.
4. End the practice of awarding business based on price tag alone. Instead, minimize total cost by working with a single supplier.
5. Improve constantly and forever every process for planning, production, and service.
6. Institute training on the job.
7. Adopt and institute leadership.
8. Drive out fear.
9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations, and targets for the workforce.
11. Eliminate numerical quotas for the workforce and numerical goals for management.
12. Remove barriers that rob people of workmanship. Eliminate the annual rating or merit system.
13. Institute a vigorous program of education and self-improvement for everyone.
14. Put everyone in the company to work to accomplish the transformation.

Individual Contributions to Quality Management

Juran - Quality Control Handbook

- **Joseph M. Juran, like Deming, taught Japanese manufacturers how to improve their productivity.**
- **U.S. companies later discovered him as well.**
- **He wrote the first edition of the Quality Control Handbook in 1974, stressing the importance of top management commitment to continuous product quality improvement.**
- **He also developed the Juran Trilogy:**
  1. **Quality improvement,**
  2. **Quality planning, and**
  3. **Quality control.**

Individual Contributions to Quality Management

Malcolm Baldrige National Quality Award

- **The Malcolm Baldrige National Quality Award originated in 1987 to recognize companies that have achieved a level of world-class competition through quality management.**
- **Given by the President of the United States to U.S. Businesses.**
- **Three awards each year in different categories:**
  - **Manufacturing**
  - **Service**
  - **Small business**
  - **Education and health care**

Project Quality Management Processes

Project Quality Management				
Initiating	Planning	Executing	Monitoring & Controlling	Closing
	1. Plan Quality Management	2. Manage Quality	3. Control Quality	

Project Quality Management Processes

- **Project quality management involves three main processes:**
  1. **Plan Quality Management: Includes identifying which quality requirements and standards are relevant to the project and how to satisfy them. Incorporating quality standards into project design is a key part of quality planning. For an IT project, quality standards might include allowing for system growth, planning a reasonable response time for a system, or ensuring that the system produces consistent and accurate information. Quality standards can also apply to IT services.**
  2. **Manage Quality: Involves translating the quality management plan into executable quality activities. These activities must adhere to the organization's quality policies.**
  3. **Control Quality: Involves monitoring specific project results to ensure that they are complete, correct, and meet customer expectations.**

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.**
- **The key benefit of this process is that it provides guidance and direction on how quality will be managed and verified throughout the project.**
- **This process is performed once or at predefined points in the project.**

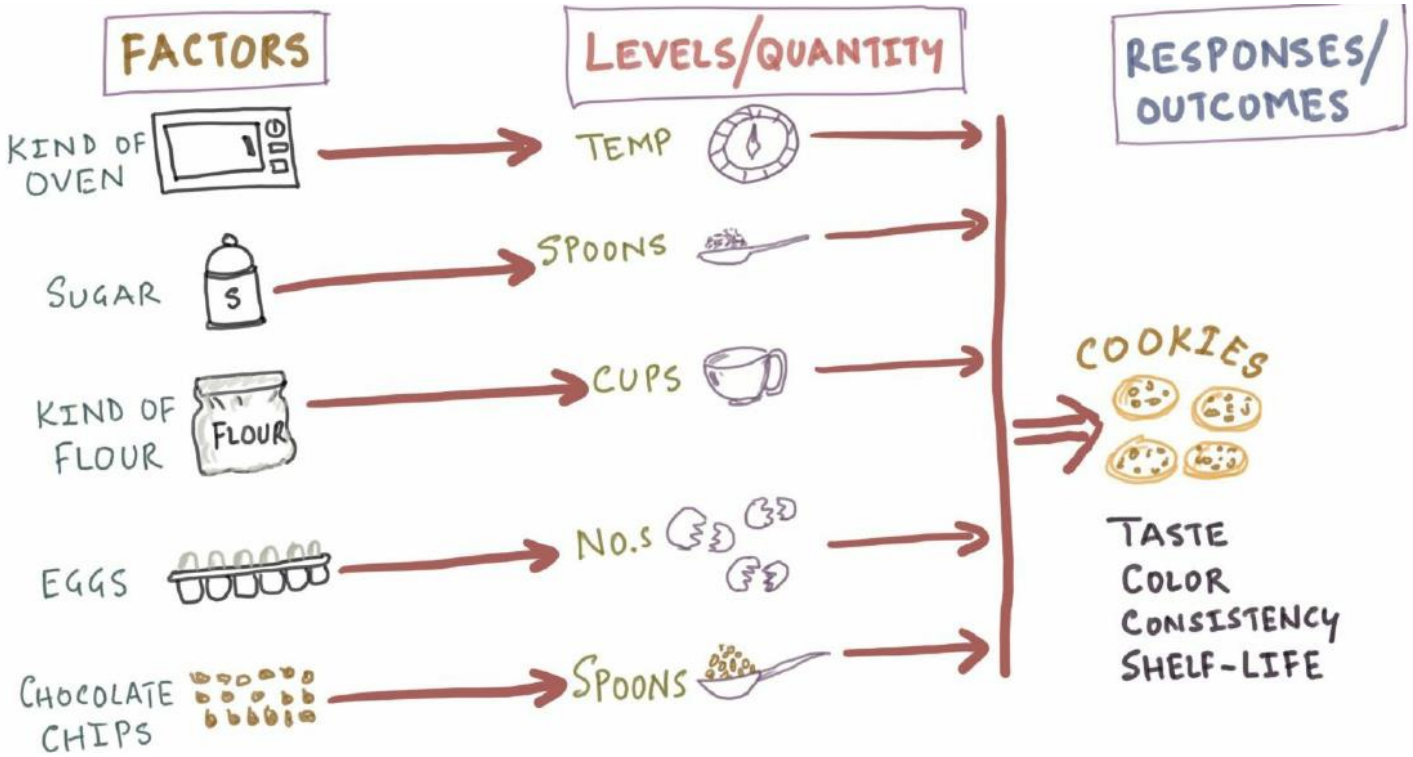
Plan Quality Management

Inputs	Tools & Techniques	Outputs
.1 Project charter .2 Project management plan • Requirements management plan • Risk management plan • Stakeholder engagement plan • Scope baseline .3 Project documents • Assumption log • Requirements documentation • Requirements traceability matrix • Risk register • Stakeholder register .4 Enterprise environmental factors .5 Organizational process assets	.1 Expert judgment .2 Data gathering • Benchmarking • Brainstorming • Interviews .3 Data analysis • Cost-benefit analysis • Cost of quality .4 Decision making • Multicriteria decision analysis .5 Data representation • Flowcharts • Logical data model • Matrix diagrams • Mind mapping .6 Test and inspection planning .7 Meetings	.1 Quality management plan .2 Quality metrics .3 Project management plan updates • Risk management plan • Scope baseline .4 Project documents updates • Lessons learned register • Requirements traceability matrix • Risk register • Stakeholder register

Plan Quality Management

Tools and Techniques: Design of Experiments

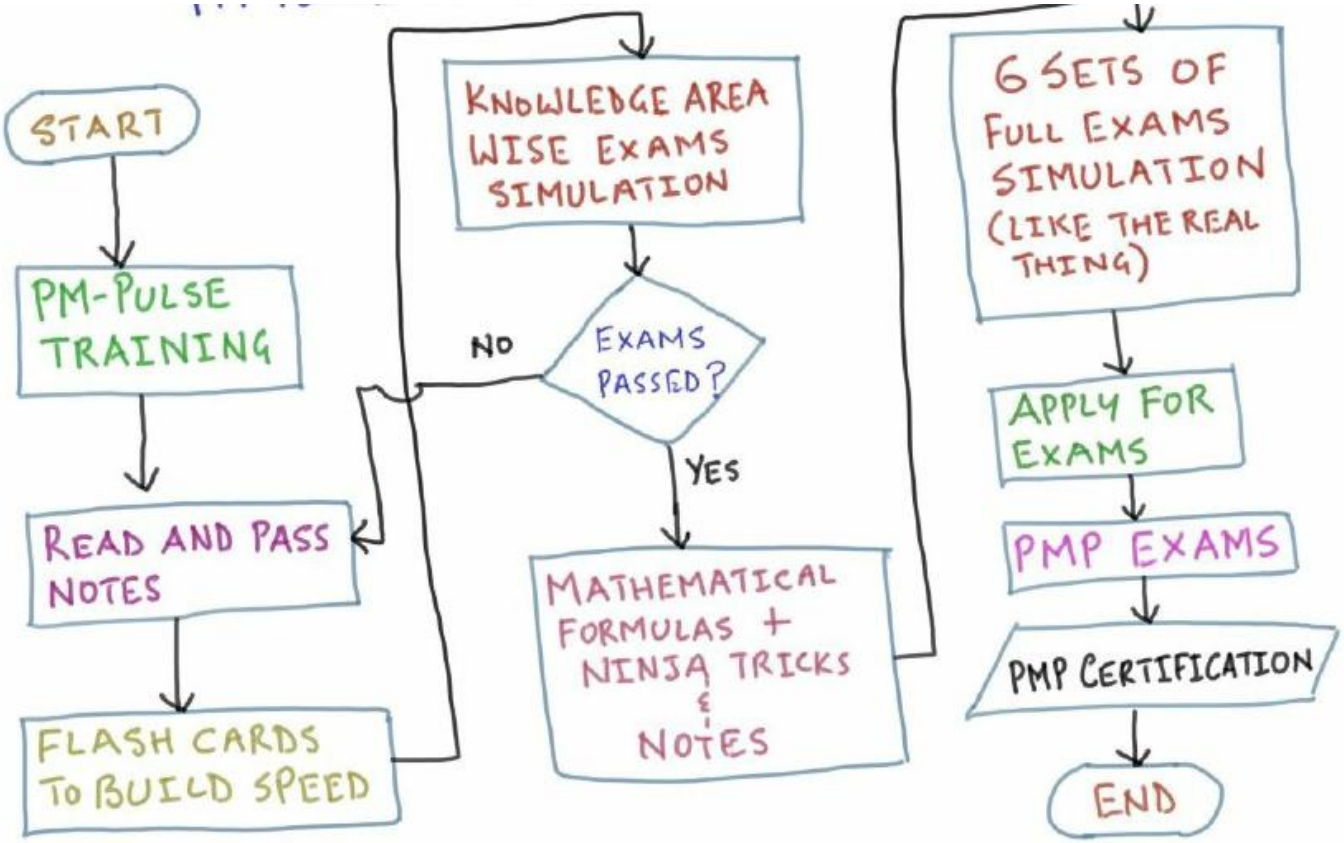
- **Design of Experiments is a technique that helps identify which variables have the most influence on the overall outcome of a process.**
- **Understanding which variables affect outcome is a very important part of quality planning.**



Plan Quality Management

Tools and Techniques: Flowcharts

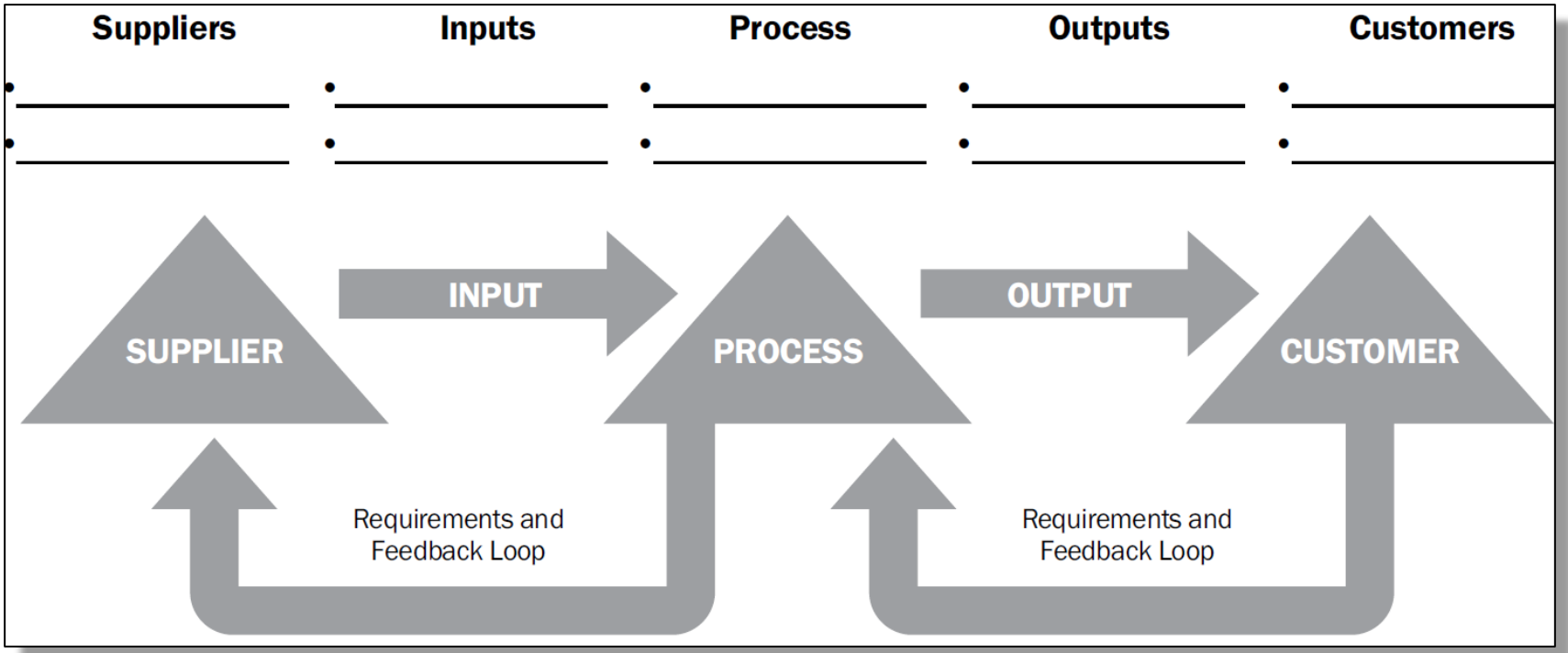
- Flowcharts (Process Maps) can be used to map the various branches of the process with stop points, decision points and conditional points.
- Flowcharts may prove useful in understanding and estimating the cost of quality for a process.



Plan Quality Management

Tools and Techniques: Flowcharts - SIPOC

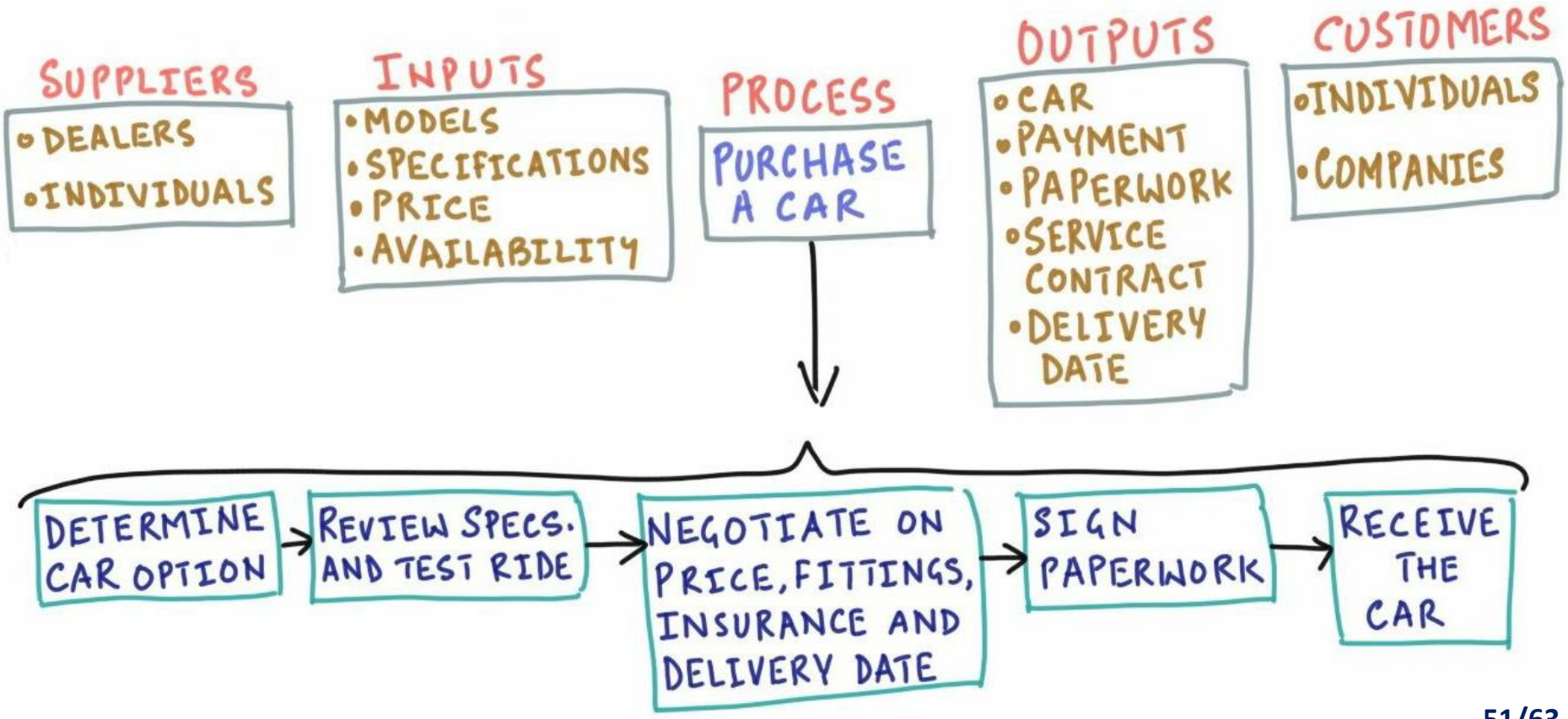
- Another version of the Flow Chart is called the SIPOC (Supplier – Inputs – Process – Outputs – Customer).
- SIPOC is a high level process map but shows sufficient details to use it for analyzing the various components of process.
- It is a visual tool for documenting a business process from beginning to end.



Plan Quality Management

Tools and Techniques: Flowcharts - SIPOC

Car Purchasing Process



Plan Quality Management

Important Scope Aspects of IT Projects that Affect Quality

- **Functionality** is the degree to which a system performs its intended function
- **Features** are the system's special characteristics that appeal to users
- **System outputs** are the screens and reports the system generates
- **Performance** addresses how well a product or service performs the customer's intended use
- **Reliability** is the ability of a product or service to perform as expected under normal conditions
- **Maintainability** addresses the ease of performing maintenance on a product

Plan Quality Management

Outputs: Quality Management Plan

- **The quality management plan may include but is not limited to the following components:**
  - **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; and**
  - **Major procedures relevant for the project, such as dealing with nonconformance, corrective actions procedures, and continuous improvement procedures.**

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.**
- **The key benefits of this process are that it increases the probability of meeting the quality objectives as well as identifying ineffective processes and causes of poor quality.**
- **This process is performed throughout the project.**

Manage Quality

Inputs

.1 Project management plan
- Quality management plan

.2 Project documents
- Lessons learned register
- Quality control measurements
- Quality metrics
- Risk report

.3 Organizational process assets

Tools & Techniques

.1 Data gathering
- Checklists

.2 Data analysis
- Alternatives analysis
- Document analysis
- Process analysis
- Root cause analysis

.3 Decision making
- Multicriteria decision analysis

.4 Data representation
- Affinity diagrams
- Cause-and-effect diagrams
- Flowcharts
- Histograms
- Matrix diagrams
- Scatter diagrams

.5 Audits

.6 Design for X

.7 Problem solving

.8 Quality improvement methods

Outputs

.1 Quality reports

.2 Test and evaluation documents

.3 Change requests

.4 Project management plan updates
- Quality management plan
- Scope baseline
- Schedule baseline
- Cost baseline

.5 Project documents updates
- Issue log
- Lessons learned register
- Risk register

Manage Quality

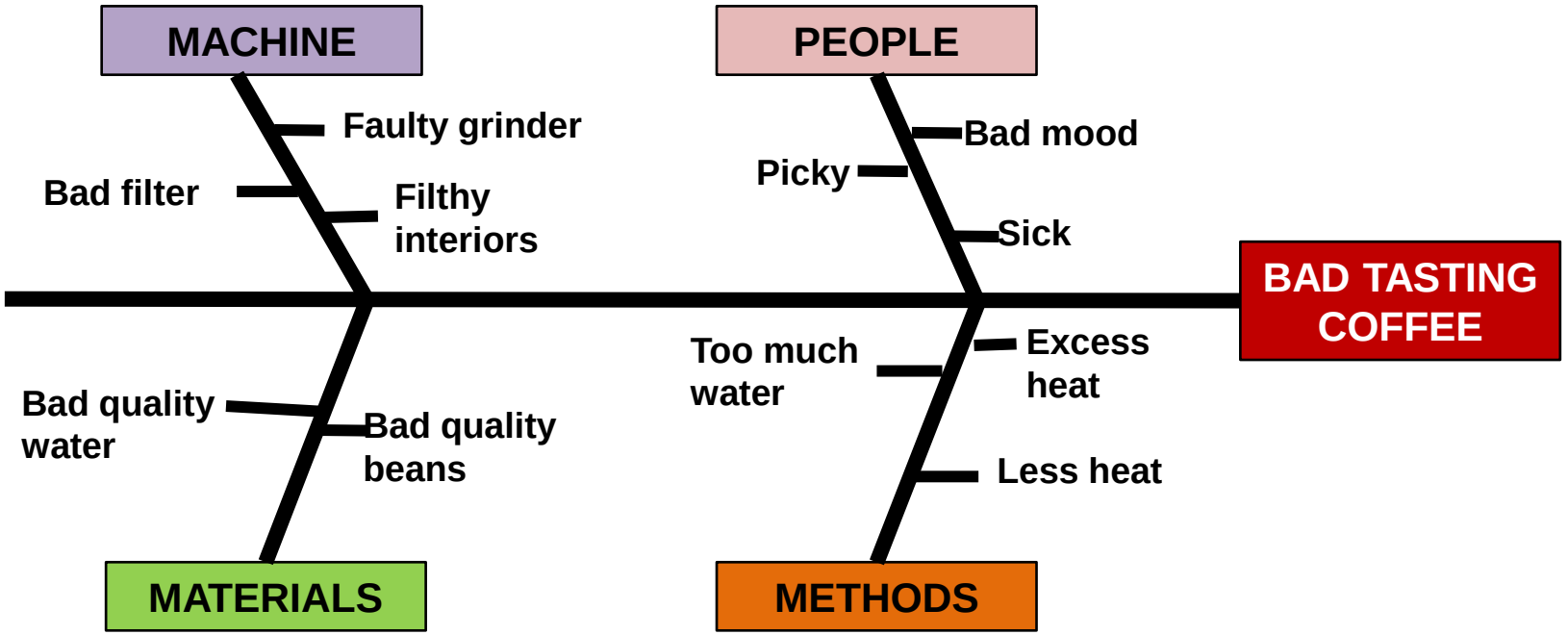
Quality Assurance

- The term quality assurance is often used to describe the activities related to satisfying the relevant quality standards for a project.
- Managing quality includes all of the quality assurance activities plus product design and process improvements.
- Another goal of quality assurance is continuous quality improvement. Kaizen is the Japanese word for improvement or change for the better.
- Lean involves evaluating processes to maximize customer value while minimizing waste.
- Benchmarking generates ideas for quality improvements by comparing specific project practices or product characteristics to those of other projects or products within or outside the performing organization.
- A quality audit is a structured review of specific quality management activities that help identify lessons learned that could improve performance on current or future projects.

Manage Quality

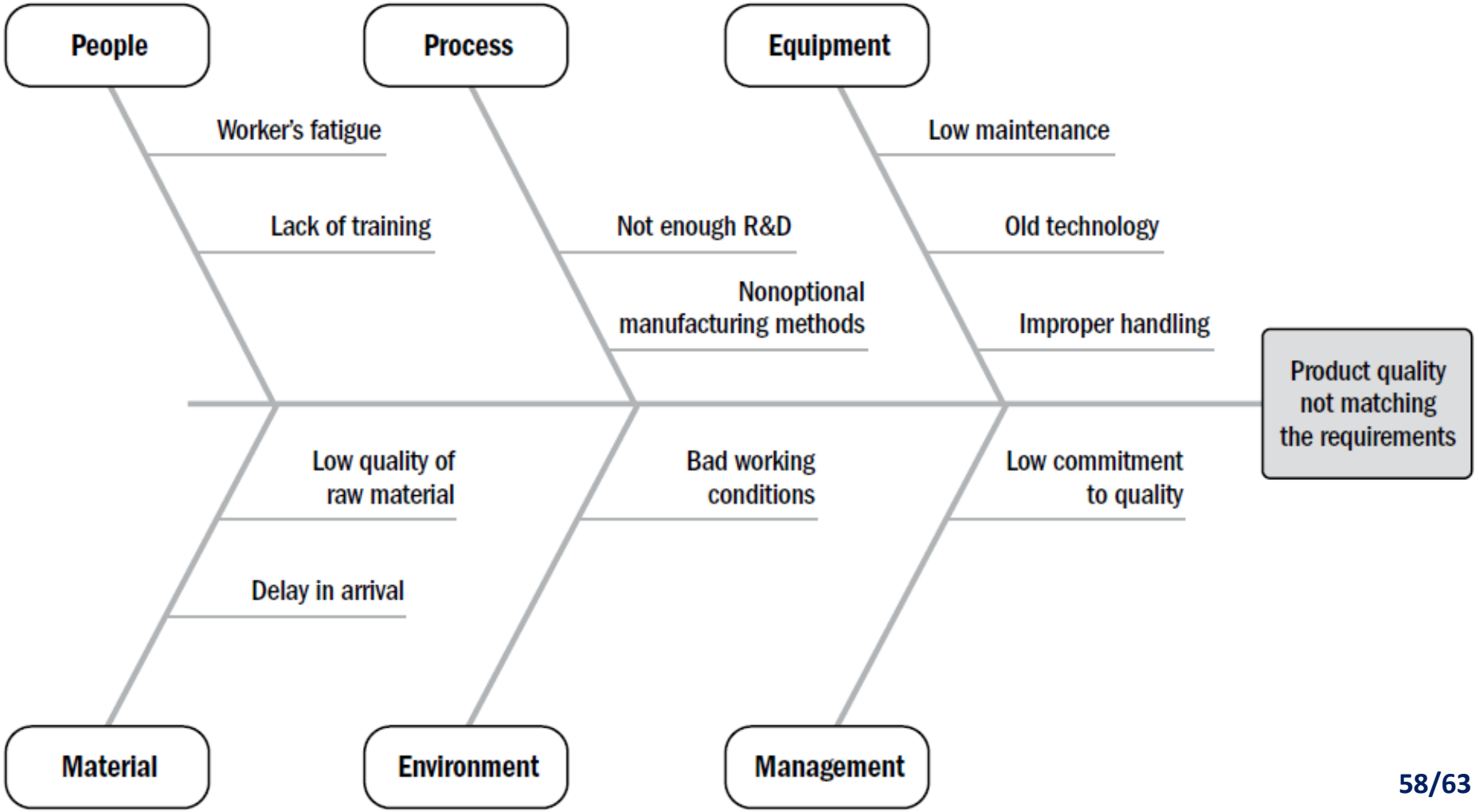
Tools and Techniques: Root Cause Analysis (RCA)

- RCA is an analytical technique used to determine the basic underlying reason that causes a variance, defect, or risk.
- It may also be used as a technique for identifying root causes of a problem and solving them.
- Another names: Ishikawa Diagram, Fishbone Diagram



Manage Quality

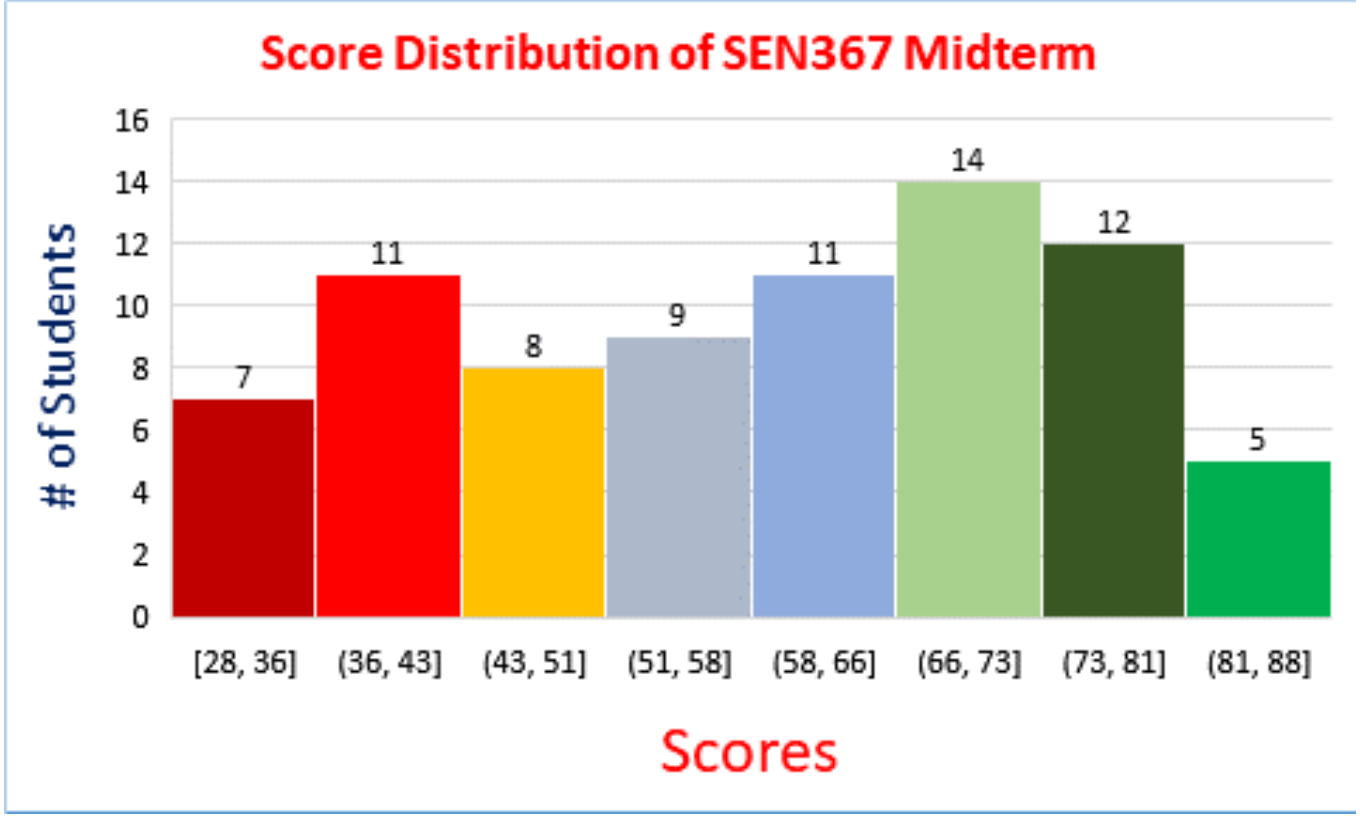
Tools and Techniques: Root Cause Analysis (RCA)



Manage Quality

Tools and Techniques: Histograms

- A histogram is a bar graph of a distribution of variables.
- Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency.



Control Quality

- **Control Quality is the process of monitoring and recording results of executing the quality management activities in order to assess performance and ensure the project outputs are complete, correct, and meet customer expectations.**
- **The key benefit of this process is verifying that project deliverables and work meet the requirements specified by key stakeholders for final acceptance.**
- **Control Quality process determines if the project outputs do what they were intended to do. Those outputs need to comply with all applicable standards, requirements, regulations, and specifications.**
- **This process is performed throughout the project.**

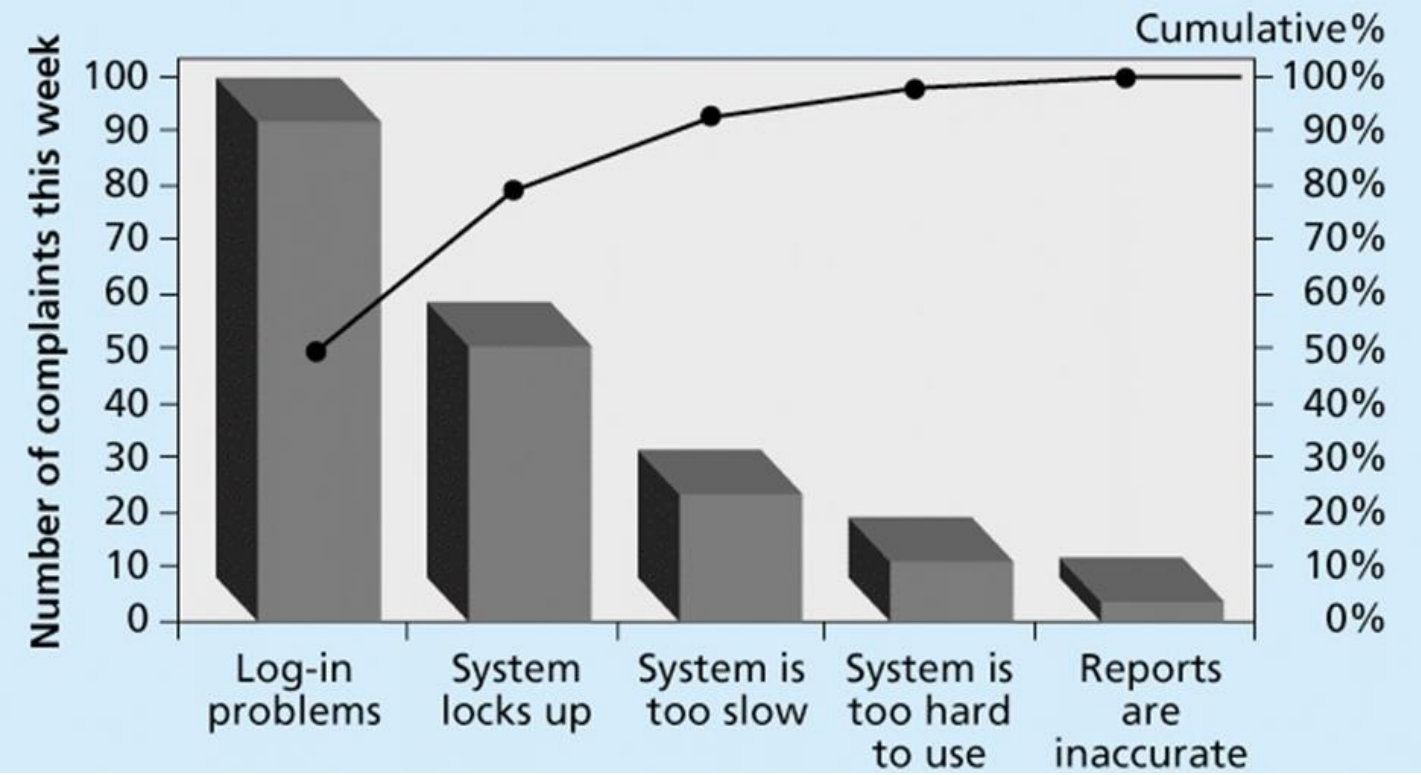
Control Quality

Inputs	Tools & Techniques	Outputs
.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	.1 Data gathering • Checklists • Check sheets • Statistical sampling • Questionnaires and surveys .2 Data analysis • Performance reviews • Root cause analysis .3 Inspection .4 Testing/product evaluations .5 Data representation • Cause-and-effect diagrams • Control charts • Histogram • Scatter diagrams .6 Meetings	.1 Quality control measurements .2 Verified deliverables .3 Work performance information .4 Change requests .5 Project management plan updates • Quality management plan .6 Project documents updates • Issue log • Lessons learned register • Risk register • Test and evaluation documents

Control Quality

Tools and Techniques: Pareto Charts

- **A Pareto chart is a histogram that can help to 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.**



Thank you…

Hasan ÇİFCİ