Project Quality Management

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Learning Objectives

- Define project quality management and understand how quality relates to various aspects of information technology projects.
- Understand quality planning and the components of a Quality Assurance / Management Plan.
- Describe what quality assurance is.
- Describe what quality control is.
- Understand the tools and techniques for quality control, such as Pareto analysis, statistical sampling, Six Sigma, quality control charts, and testing.

What Went Wrong?

- In 1986, two hospital patients died after receiving fatal doses of radiation from a Therac 25 machine after a software problem caused the machine to ignore calibration data.

- Britain's Coast Guard was unable to use its computers for several hours in May 2004 after being hit by the Sasser virus, which knocked out the electronic mapping systems, e-mail, and other computer functions, forcing workers to revert to pen, paper, and radios.

- More than 100 incidents of lost or stolen financial information were reported over the past year, including personal information of 1.2 federal employees, 200,000 online trading customers, and 33,000 Air Force officers

What Is Project Quality?

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

- Other experts define quality based on:
  - Conformance to requirements: the project’s processes and products meet written specifications.
  - Fitness for use: a product can be used as it was intended.

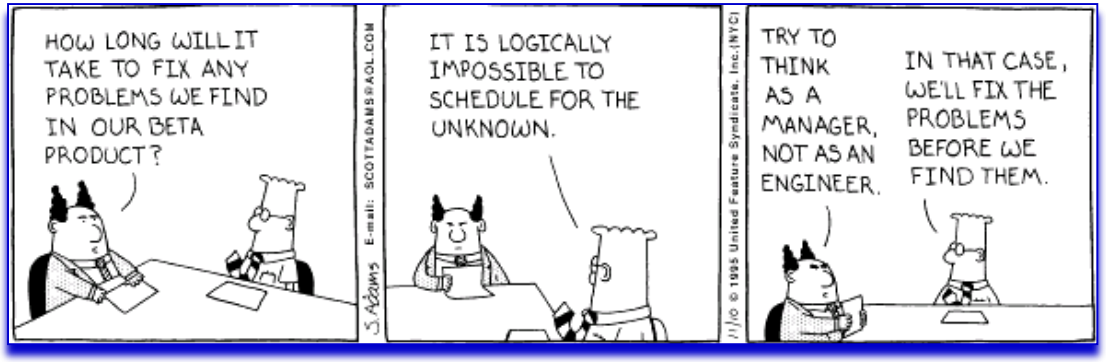
What Is Project Quality Management?

- Project quality management ensures that the project will satisfy the needs for which it was undertaken.

- Processes include:
  - **Quality Planning**: identifying which quality standards are relevant to the project and how to satisfy them
  - **Quality Assurance**: periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards
  - **Quality Control**: monitoring specific project results to ensure that they comply with the relevant quality standards

Quality Planning

- Implies the ability to anticipate situations and prepare actions to bring about the desired outcome



- Important to prevent defects by:
  - Selecting proper materials
  - Training and indoctrinating people in quality
  - Planning a process that ensures the appropriate outcome

Quality Assurance

- **Quality assurance** includes all the activities related to satisfying the relevant quality standards for a project
  - Another goal of quality assurance is continuous quality improvement
- **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
  - Performed by in-house auditors or third parties

Quality Control

- Although one of the main goals of QC is to improve quality, its main outcomes are:
  - ***Acceptance decisions-*** are the products/services acceptable or should they be rejected and rework is then necessary
  - ***Rework*** – action taken to bring rejected items into compliance with products specs. Can be very expensive
  - ***Process adjustments*** – correct or prevent further quality problems based on quality control measurements (purchase faster server if response time is too slow)
- There are Seven Basic Tools of Quality that help in performing quality control

The Cost of Quality

- Total cost to produce the product or service of the project according to the quality standards.
- The cost of quality is the cost of conformance plus the cost of nonconformance
  - Conformance means delivering products that meet requirements and fitness for use.
  - Cost of nonconformance means taking responsibility for failures or not meeting quality expectations.
- There is no free lunch!

Cost of Quality

- Prevention costs
  - Keeping defects out of the hands of customers
  - Includes things like quality planning, training, design reviews

- Appraisal costs
  - Expended to examine the product or process and make certain the requirements are being met
  - Like inspection and testing, buying test equipment

Cost of Quality

- Failure costs
  - What it costs when things don't go according to plan
  - 2 types

- Internal failure cost
  - product is still in the control of the organization
  - Include corrective action, rework, scrapping and downtime

- External failure cost
  - Product has reached the customer
  - Include inspections at the customer site, returns, and customer service costs

Plan Quality

- What quality standard?
- How to achieve that?
  - Training
  - Walkthroughs
  - Reviews
  - Quality audits
- How to make things better – process improvement?
- Who is responsible for what?
- Project managers are ultimately responsible for quality management on their projects

How Do you Measure Quality of IT Systems?

- No. of bugs
- Performance
  - Response time
  - Volume of data and transactions system should be capable of handling
- Usability
- Reliability
  - The ability of a product or service to perform as expected under normal conditions
- Availability
  - Mean time between failure (MTBF), mean time to recover (MTTR)

Perform Quality Assurance

- Determining whether standards are being met
- Identifying improvements
  - E.g. recommend certain practices or equipment
- Focus on the process

Tools Used in Quality Assurance

- Benchmarking
  - comparing specific project practices or product characteristics to those of other projects or products within or outside the performing organization.
- Quality audit
  - See if you are complying with the standards and procedures
  - Can be done by internal staff (e.g. from QA department) or outsider
  - Can be scheduled or ad-hoc

Perform Quality Control

- Looks at specific measurements to see if project and its processes are in control
- Study the product/result

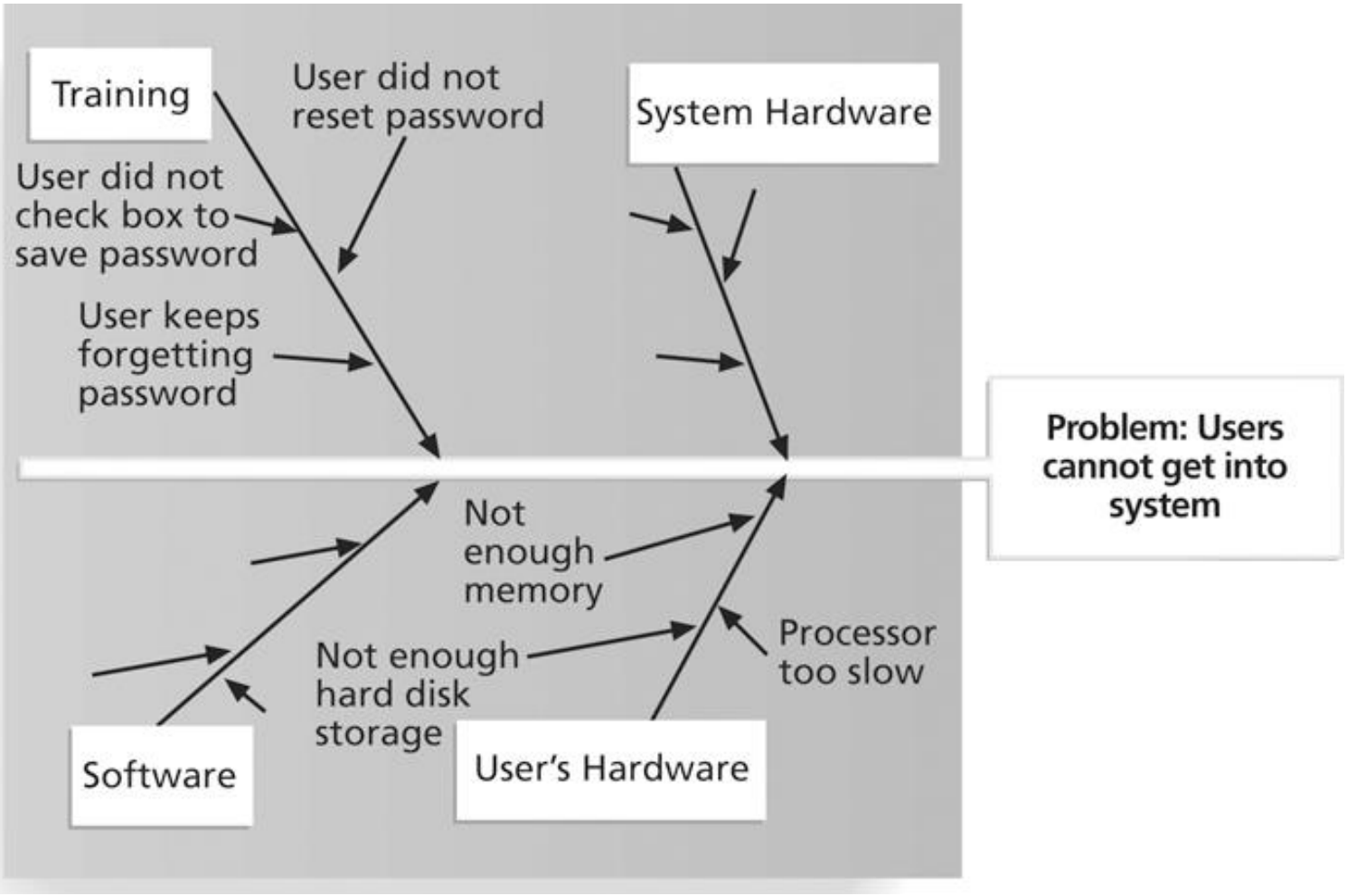
Basic Tools of Quality

- Cause & Effect Diagram
- Control Chart
- Run Chart
- Scatter Diagram
- Histogram
- Pareto Diagram
- Flowchart

Cause-and-Effect Diagrams

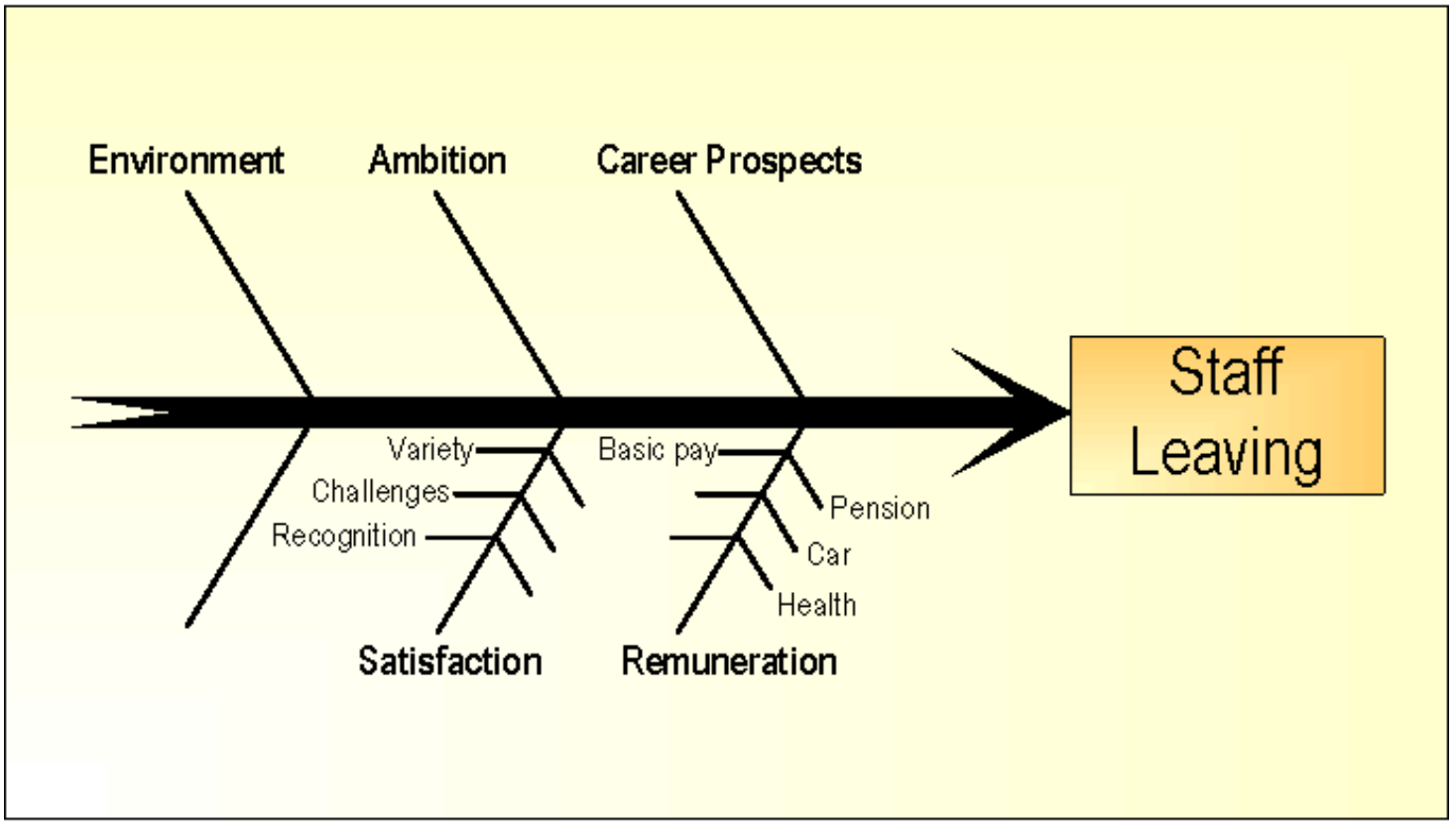
- Cause-and-effect diagrams trace complaints about quality problems back to the responsible production operations.
- They help you find the root cause of a problem.
- Also known as fishbone or Ishikawa diagrams.

Figure 1: Sample Cause-and-Effect Diagram



Sample Cause-and-Effect Diagram

- Possible causes of staff leaving before the end of a project
  - They may include environment, ambition, career prospects, satisfaction (variety, challenges, recognition), remuneration (basic pay, benefits - car, health, pension).



Quality Control Charts

- A control chart is a graphic display of data that illustrates the results of a process over time.
- The main use of control charts is to prevent defects, rather than to detect or reject them.
- Quality control charts allow you to determine whether a process is in control or out of control.

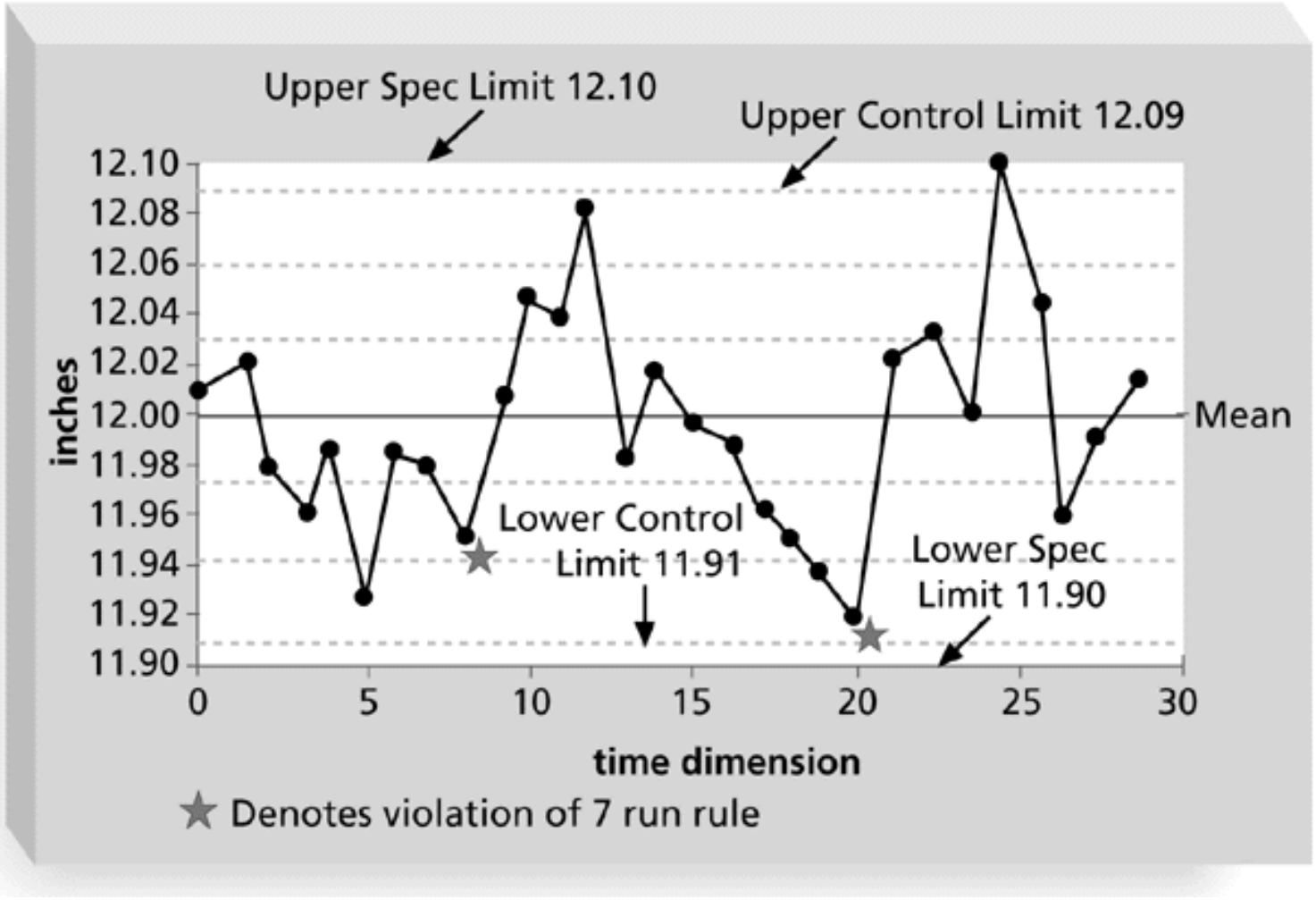
The Seven Run Rule

- You can use quality control charts and the seven run rule to look for patterns in data.

- The seven run rule states that if
  - seven data points in a row are all below the mean, above the mean, or are all increasing or decreasing

  - then the process needs to be examined for nonrandom problems

Figure 2: Sample Quality Control Chart

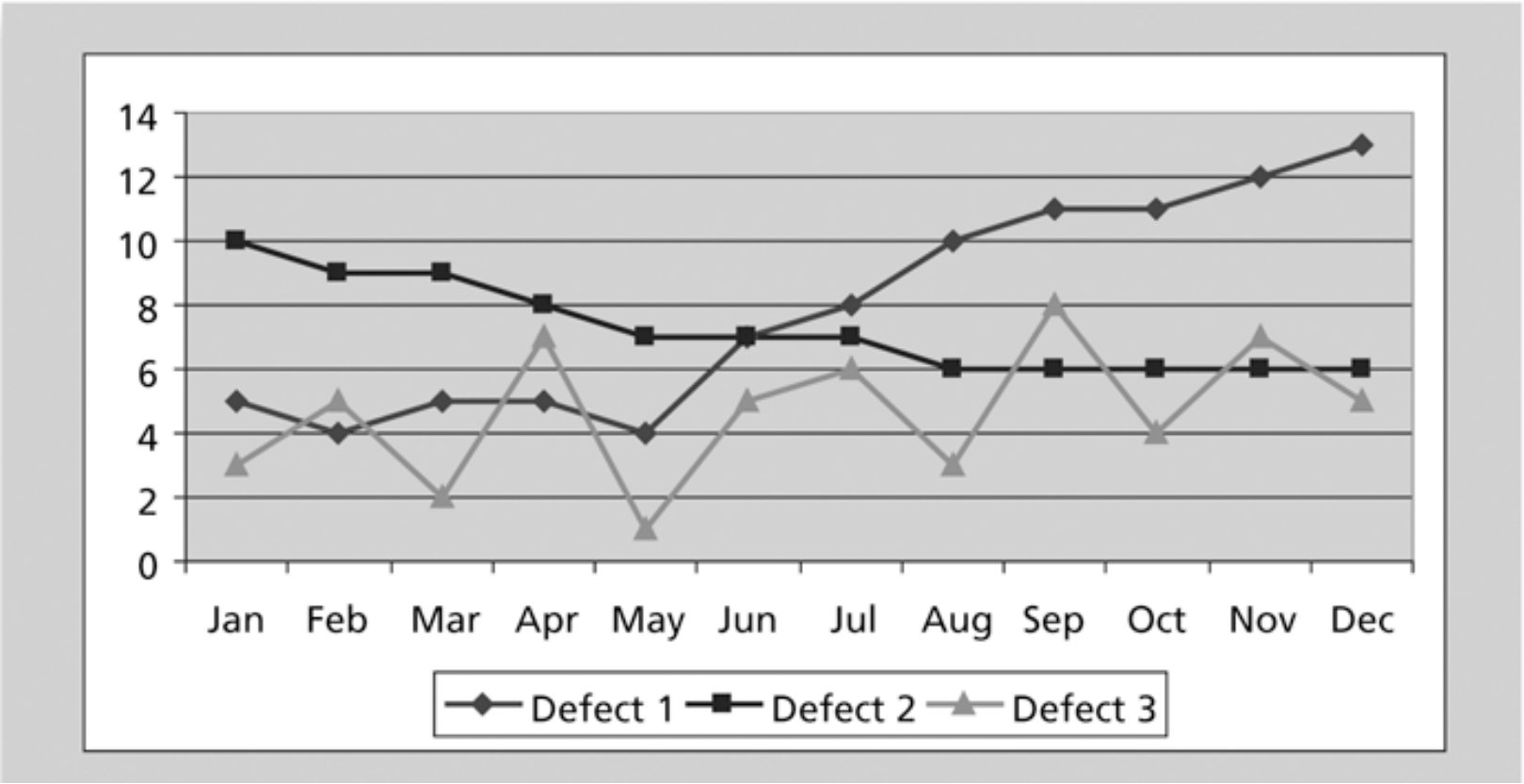


The rule violations indicate that a calibration device may need adjustment

Run Chart

- A run chart displays the history and pattern of variation of a process over time.
- It is a line chart that shows data points plotted in the order in which they occur.
- Can be used to perform trend analysis to forecast future outcomes based on historical patterns.

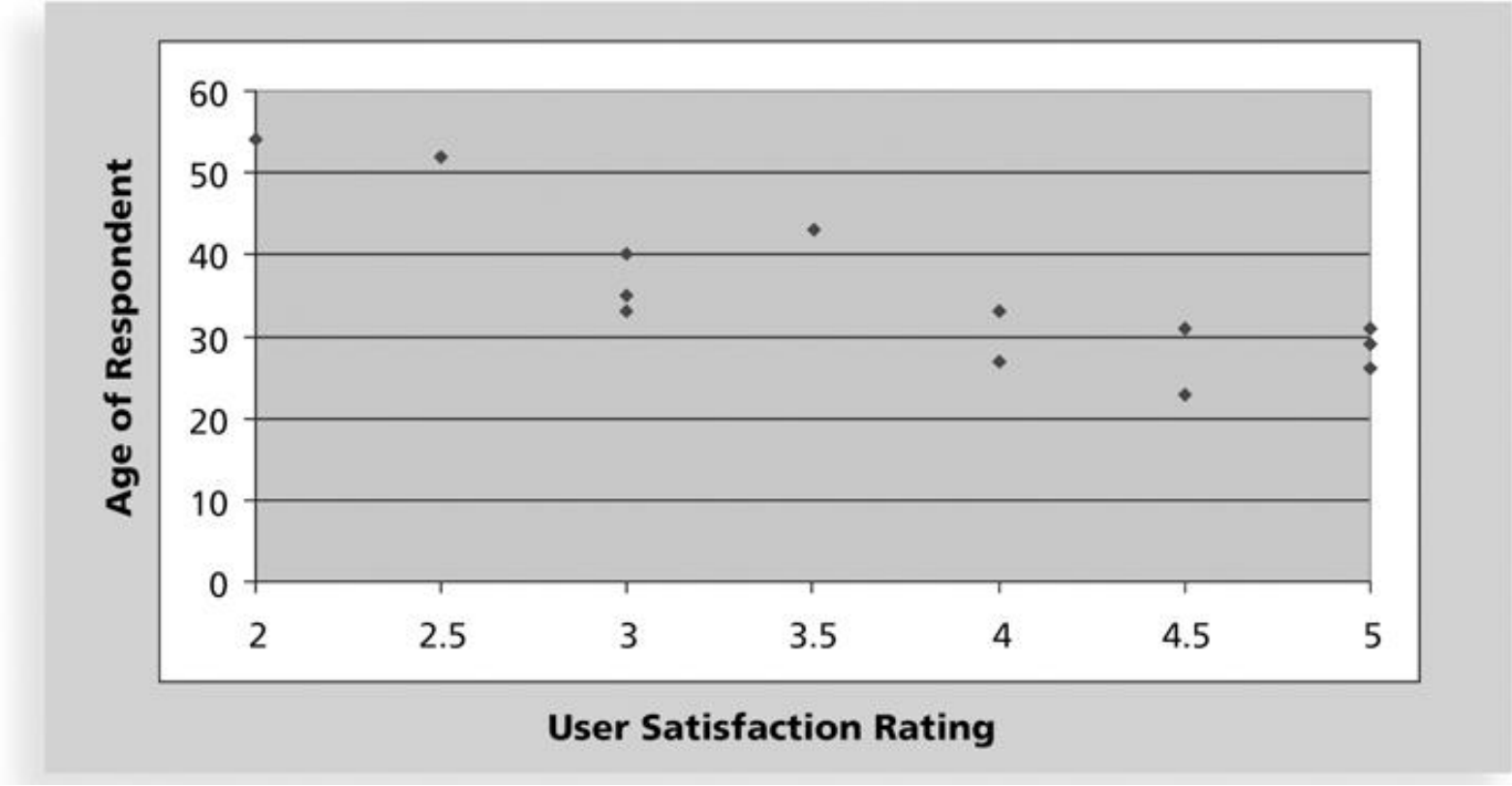
Figure 3: Sample Run Chart



Scatter Diagram

- A scatter diagram helps to show if there is a relationship between two variables.
- The closer data points are to a diagonal line, the more closely the two variables are related.

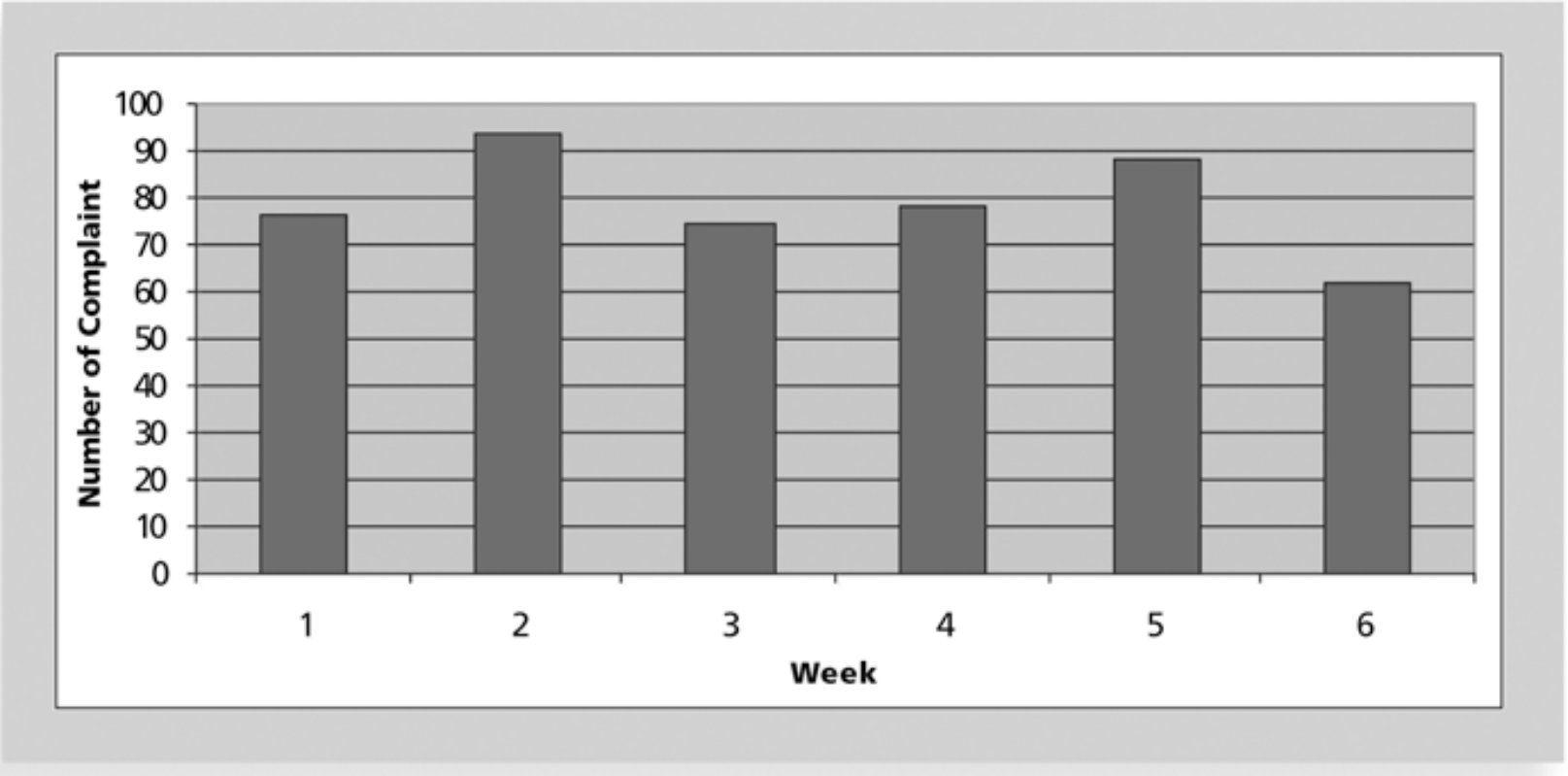
Figure 4: Sample Scatter Diagram



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.

Figure 5: Sample Histogram

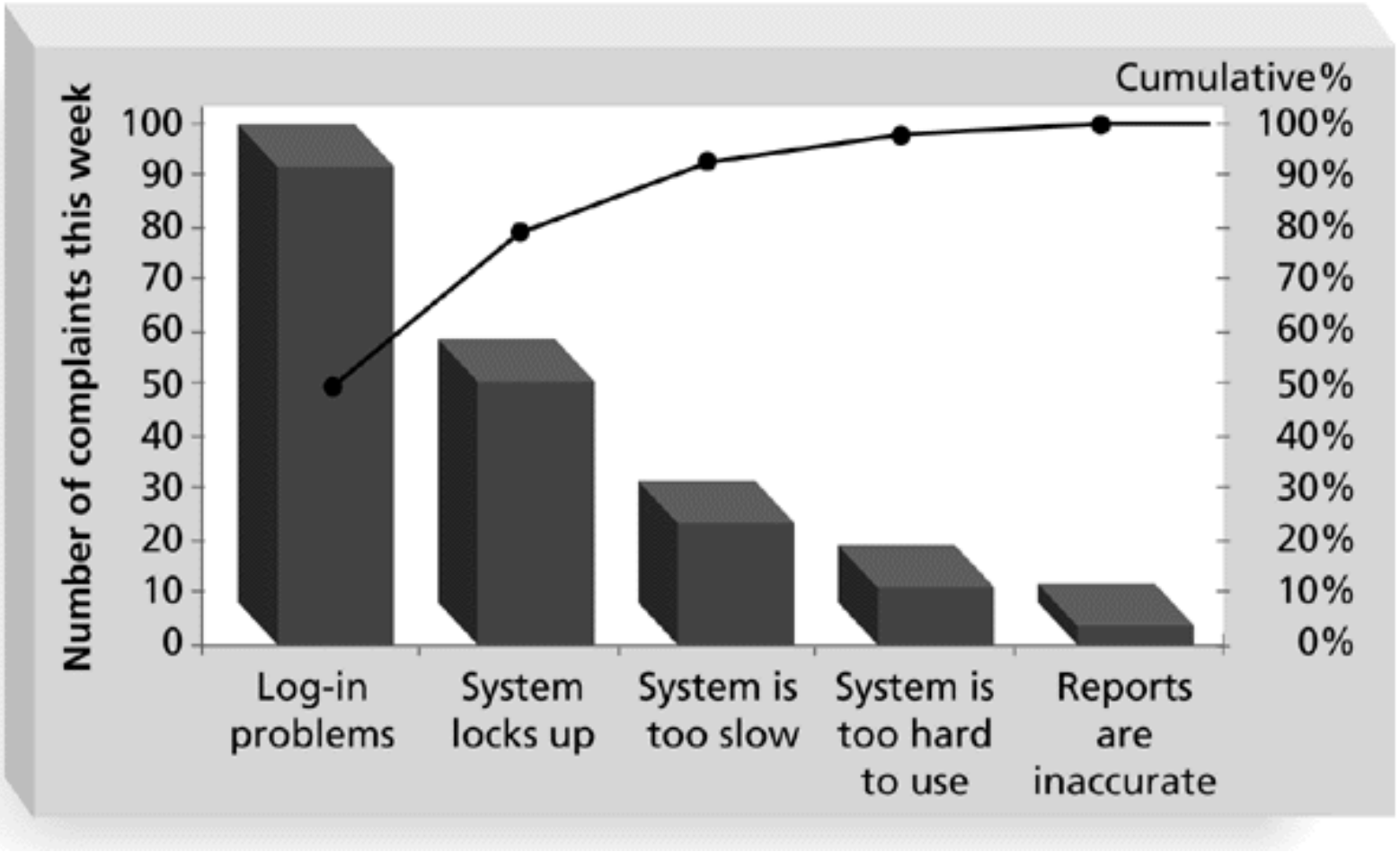


Pareto Charts

- A Pareto chart is a histogram that can help you identify and prioritize problem areas.
- Pareto analysis is also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes.

- In the following chart, Log-in Problems accou
  55% of the complaints and together with Syst
  accounts for about 80%
  - Fixing these two problems can greatly reduce the v
    compalints
  - Small problems should be investigated before addr
    case the user is in error

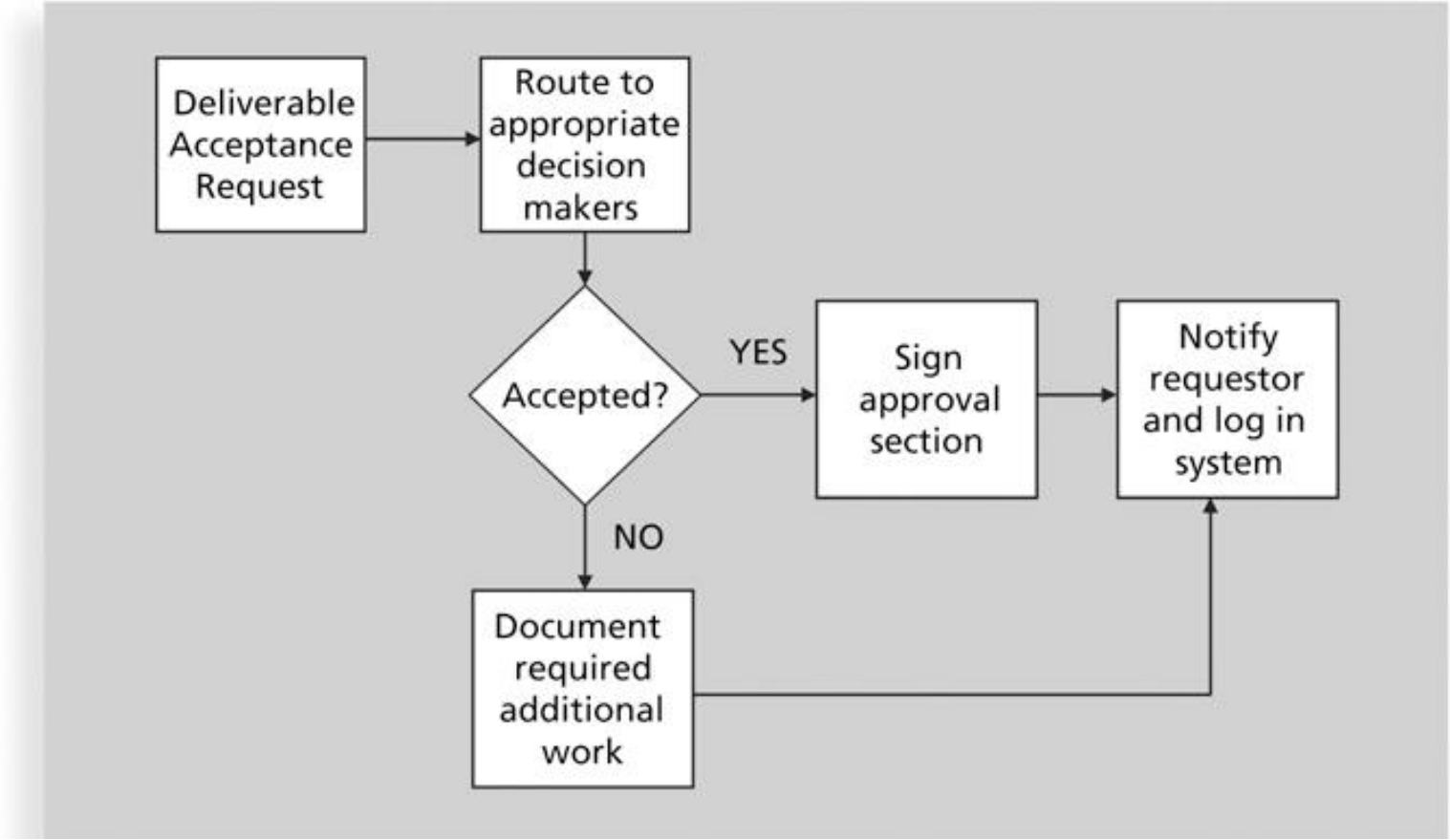
Figure 6: Sample Pareto Chart



Flowcharts

- Flowcharts are graphic displays of the logic and flow of processes that help you analyze how problems occur and how processes can be improved.
- They show activities, decision points, and the order of how information is processed.

Figure 7: Sample Flowchart



Other Quality Management Concepts & Approaches: Statistical Sampling

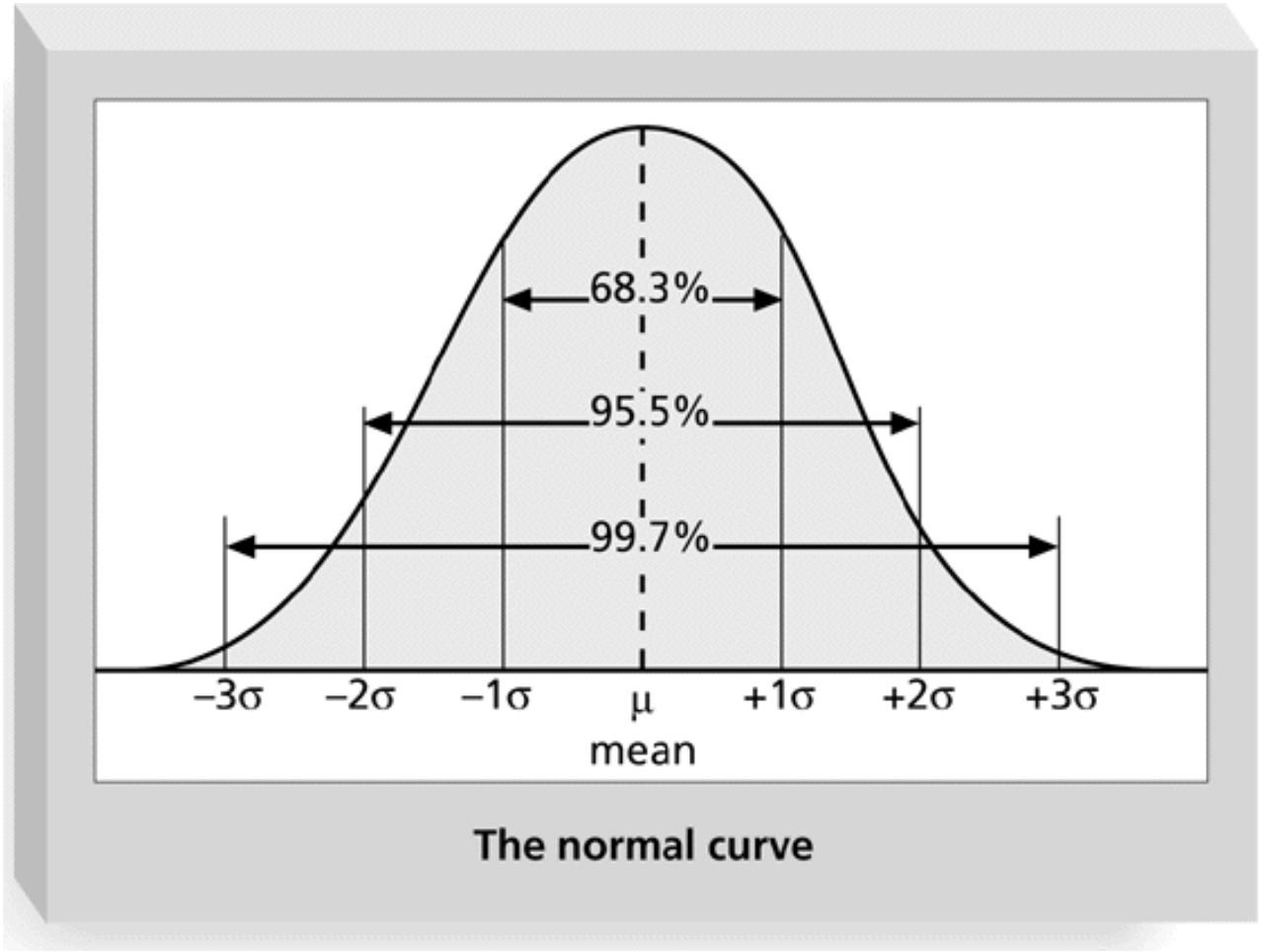
- Statistical sampling involves choosing part of a population of interest for inspection.

- The size of a sample depends on how representative you want the sample to be.

Standard Deviation

- = sigma (σ)
- If I just tell you the average mark is 70, do you know anything about the mark distribution?
- Standard deviation measures how much variation exists in a distribution of data
- Small
  - data clusters closely around the middle
  - little variability among the data
- Large
  - Data is spread out around the middle
  - Greater variability

Figure 8: Normal Distribution and Standard Deviation



Normal Distribution and Standard Deviation

Specification Range (in +/- Sigmas)	*% 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**

Six Sigma

- Improve quality by reducing variation
- Aims to eliminate defects

Motorola – Adoption of Six Sigma

- Motorola, Inc. pioneered the adoption of Six Sigma in the 1980s
- Why? To stay in business among Japanese competitors.
- Chairman set a goal of 10 times improvement in defect reduction every two years (i.e. 100 times in 4 years).
- Result: excellent growth and profitability in 1980s and 1990s.
- Estimated to have saved about $14 billion.

ISO Standards

- ISO 9000 is a family of standards for quality management systems that include:
  - procedures
  - keeping records
  - checking output
  - monitoring and reviewing processes
  - facilitating continual improvement

- See www.iso.org for more information