

Quality Attributes in Service

- Benchmark
 - “best” level of quality achievement one company or companies seek to achieve
- Timeliness
 - how quickly a service is provided



“quickest, friendliest, most accurate service available.”

Cost of Quality

- Cost of Achieving Good Quality
 - Prevention costs
 - costs incurred during product design
 - Appraisal costs
 - costs of measuring, testing, and analyzing
- Cost of Poor Quality
 - Internal failure costs
 - include scrap, rework, process failure, downtime, and price reductions
 - External failure costs
 - include complaints, returns, warranty claims, liability, and lost sales

Prevention Costs

- Quality planning costs
 - costs of developing and implementing quality management program
- Product-design costs
 - costs of designing products with quality characteristics
- Process costs
 - costs expended to make sure productive process conforms to quality specifications
- Training costs
 - costs of developing and putting on quality training programs for employees and management
- Information costs
 - costs of acquiring and maintaining data related to quality, and development of reports on quality performance

Appraisal Costs

- Inspection and testing
 - costs of testing and inspecting materials, parts, and product at various stages and at the end of a process
- Test equipment costs
 - costs of maintaining equipment used in testing quality characteristics of products
- Operator costs
 - costs of time spent by operators to gather data for testing product quality, to make equipment adjustments to maintain quality, and to stop work to assess quality

Internal Failure Costs

- *Scrap costs*
 - costs of poor-quality products that must be discarded, including labor, material, and indirect costs
- *Rework costs*
 - costs of fixing defective products to conform to quality specifications
- *Process failure costs*
 - costs of determining why production process is producing poor-quality products
- *Process downtime costs*
 - costs of shutting down productive process to fix problem
- *Price-downgrading costs*
 - costs of discounting poor-quality products—that is, selling products as “seconds”

External Failure Costs

- Customer complaint costs
 - costs of investigating and satisfactorily responding to a customer complaint resulting from a poor-quality product
- Product return costs
 - costs of handling and replacing poor-quality products returned by customer
- Warranty claims costs
 - costs of complying with product warranties
- Product liability costs
 - litigation costs resulting from product liability and customer injury
- Lost sales costs
 - costs incurred because customers are dissatisfied with poor quality products and do not make additional purchases

Measuring and Reporting Quality Costs

- **Index numbers**
 - ratios that measure quality costs against a base value
 - **labor index**
 - ratio of quality cost to labor hours
 - **cost index**
 - ratio of quality cost to manufacturing cost
 - **sales index**
 - ratio of quality cost to sales
 - **production index**
 - ratio of quality cost to units of final product

Quality–Cost Relationship

- **Cost of quality**
 - Difference between price of nonconformance and conformance
 - Cost of doing things wrong
 - 20 to 35% of revenues
 - Cost of doing things right
 - 3 to 4% of revenues
 - Profitability
 - In the long run, quality is free

Quality Management and Productivity

- **Productivity**
 - ratio of output to input
- **Yield:** a measure of productivity

Yield=(total input)(% good units) + (total input)(1-%good units)(% reworked)

or

$$Y=(I)(\%G)+(I)(1-\%G)(\%R)$$

Product Cost

$$\text{Product Cost} = \frac{(K_d)(I) + (K_r)(R)}{Y}$$

where:

K_d = direct manufacturing cost per unit

I = input

K_r = rework cost per unit

R = reworked units

Y = yield

Computing Product Yield for Multistage Processes

$$Y = (I)(\%g_1)(\%g_2) \dots (\%g_n)$$

where:

I = input of items to the production process that will result in finished products

g_i = good-quality, work-in-process products at stage i

Quality–Productivity Ratio

QPR

- productivity index that includes productivity and quality costs

$$\text{QPR} = \frac{\text{(non-defective units)}}{\text{(input) (processing cost) + (defective units) (reworked cost)}}$$

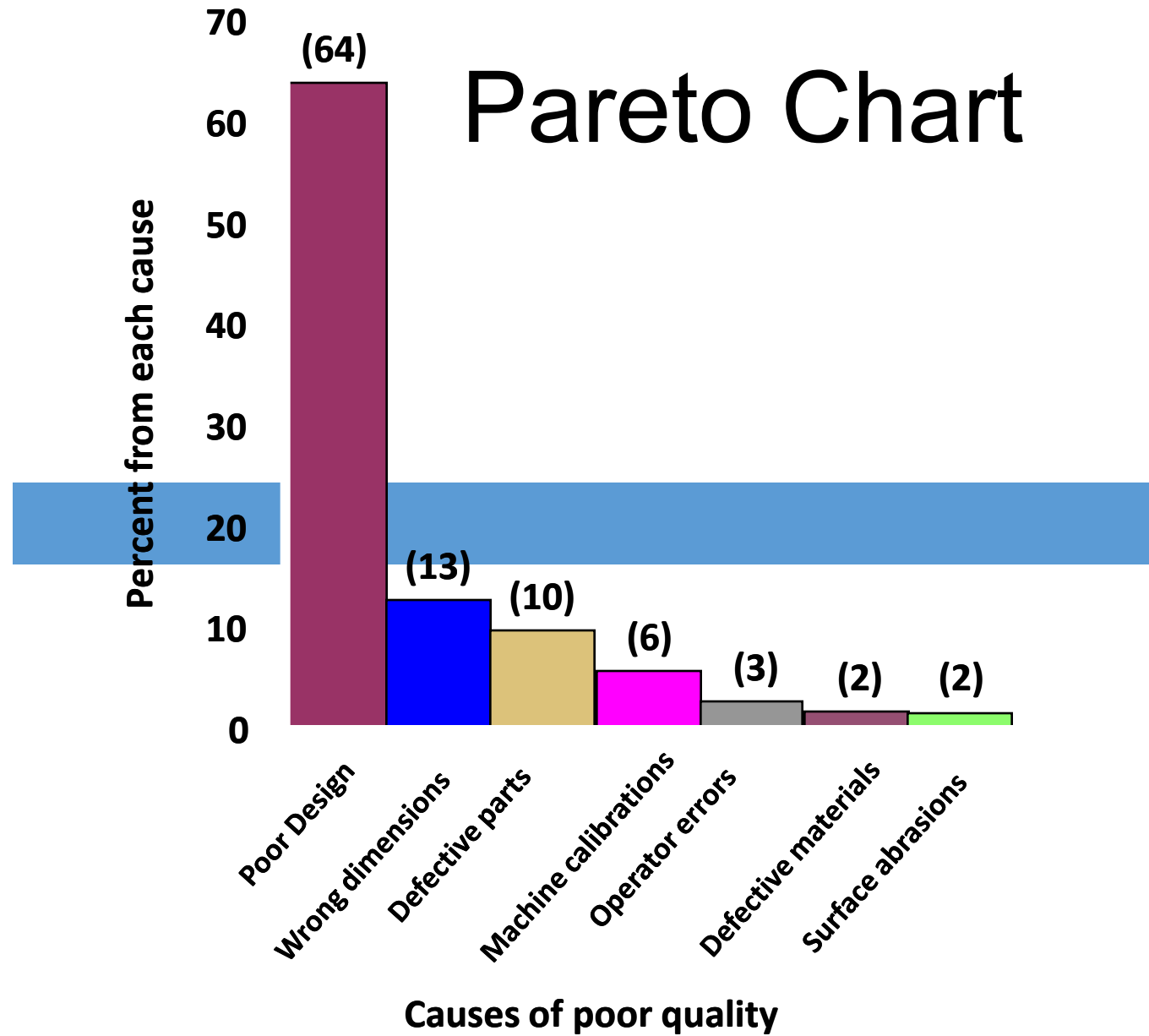
Seven Quality Control Tools

- Pareto Analysis
- Flow Chart
- Check Sheet
- Histogram
- Scatter Diagram
- SPC Chart
- Cause-and-Effect Diagram

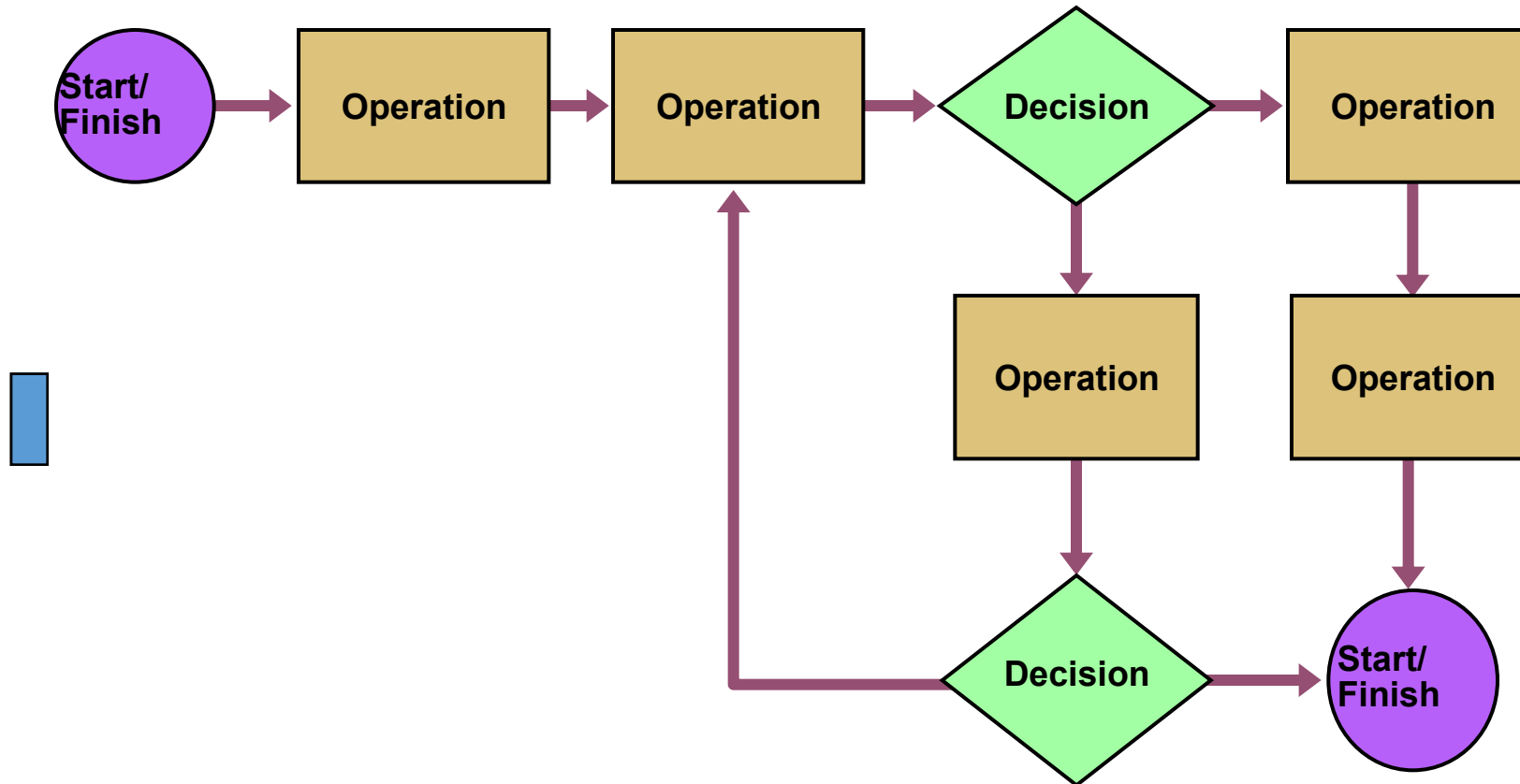
Pareto Analysis

CAUSE	NUMBER OF DEFECTS	PERCENTAGE
Poor design	80	64 %
Wrong part dimensions	16	13
Defective parts	12	10
Incorrect machine calibration	7	6
Operator errors	4	3
Defective material	3	2
Surface abrasions	3	2
	<hr/> 125	<hr/> 100 %

Pareto Chart



Flow Chart



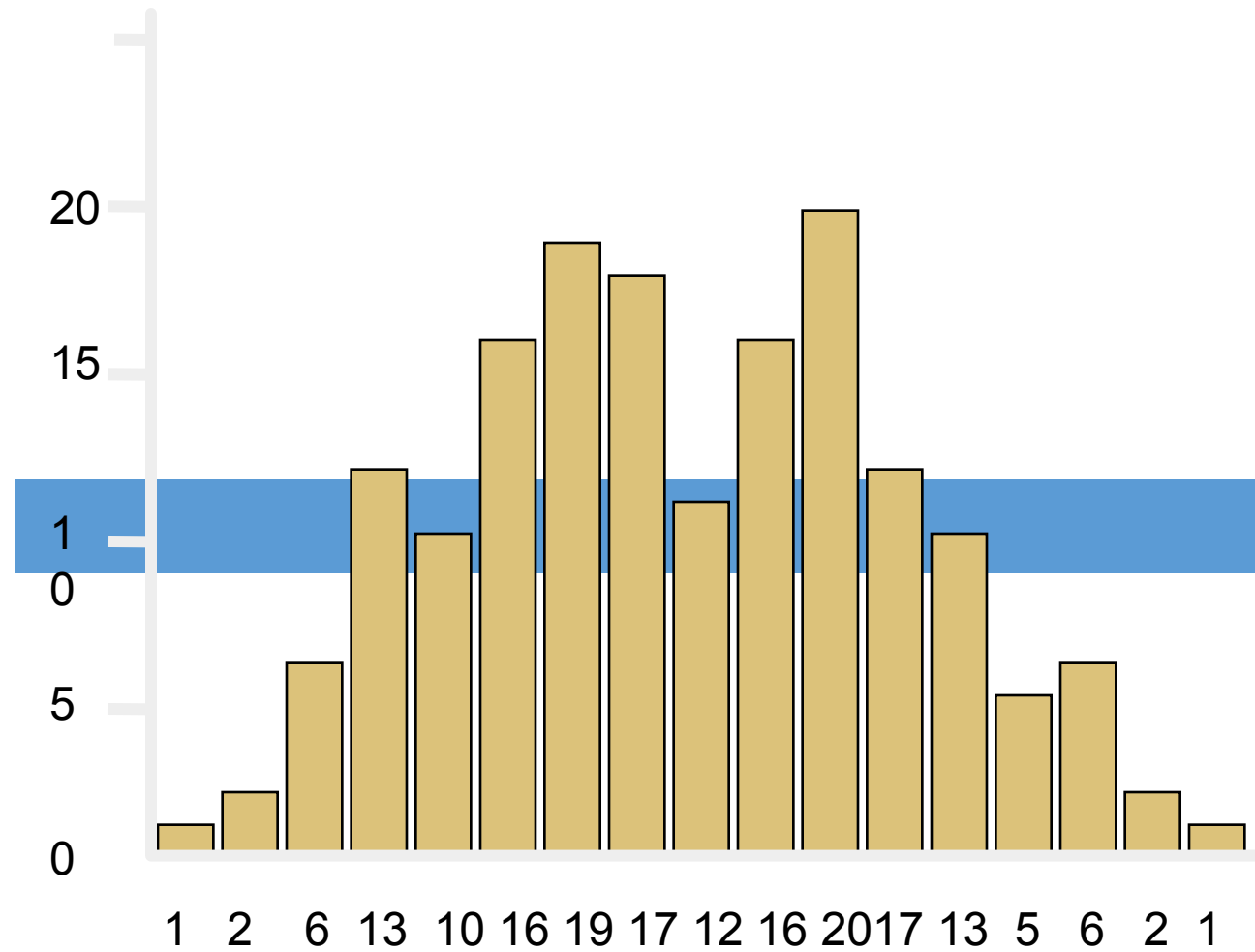
Check Sheet

COMPONENTS REPLACED BY LAB
TIME PERIOD: 22 Feb to 27 Feb 2002
REPAIR TECHNICIAN: Bob

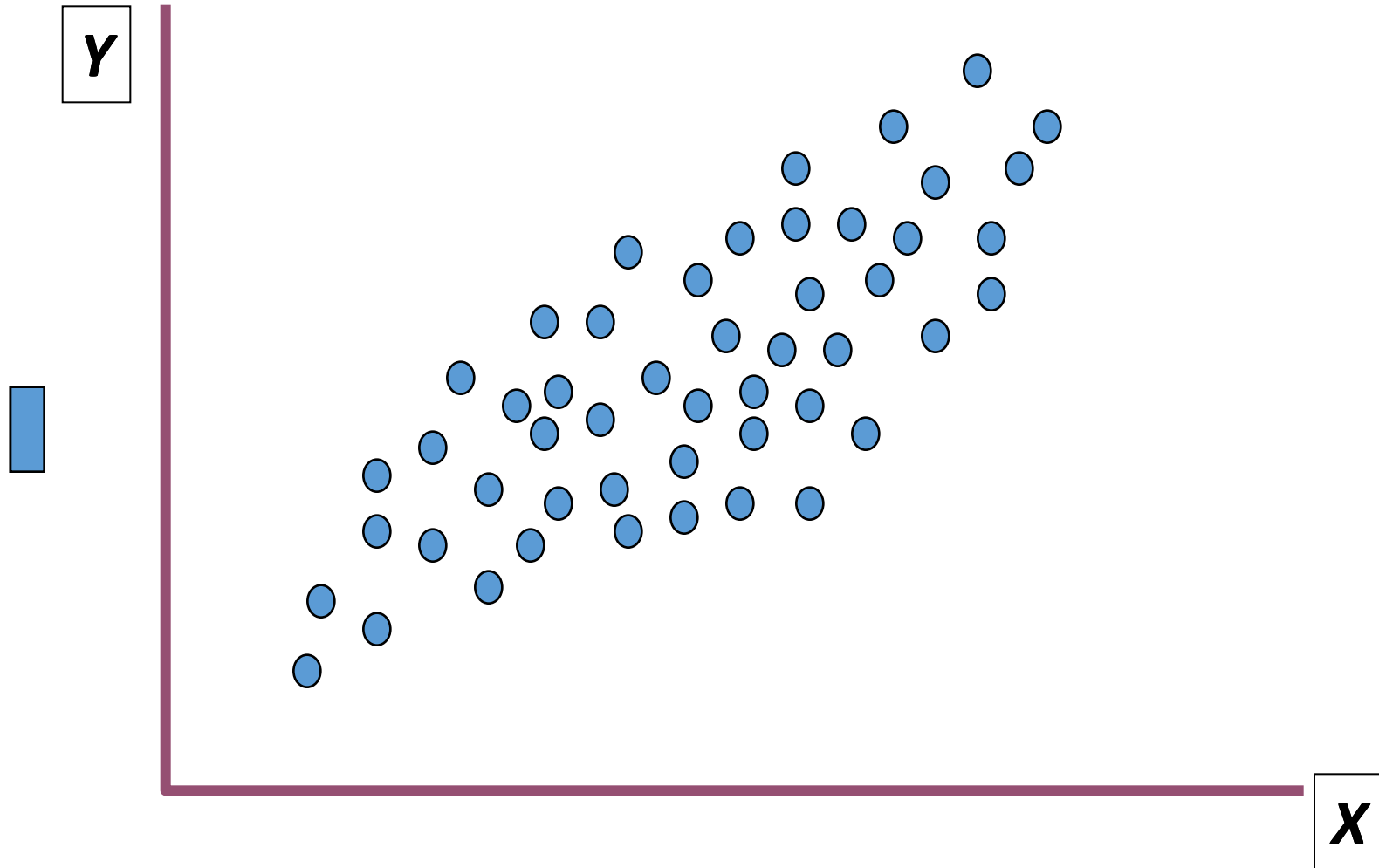
TV SET MODEL 1013

Integrated Circuits	
Capacitors	
Resistors	
Transformers	
Commands	
CRT	

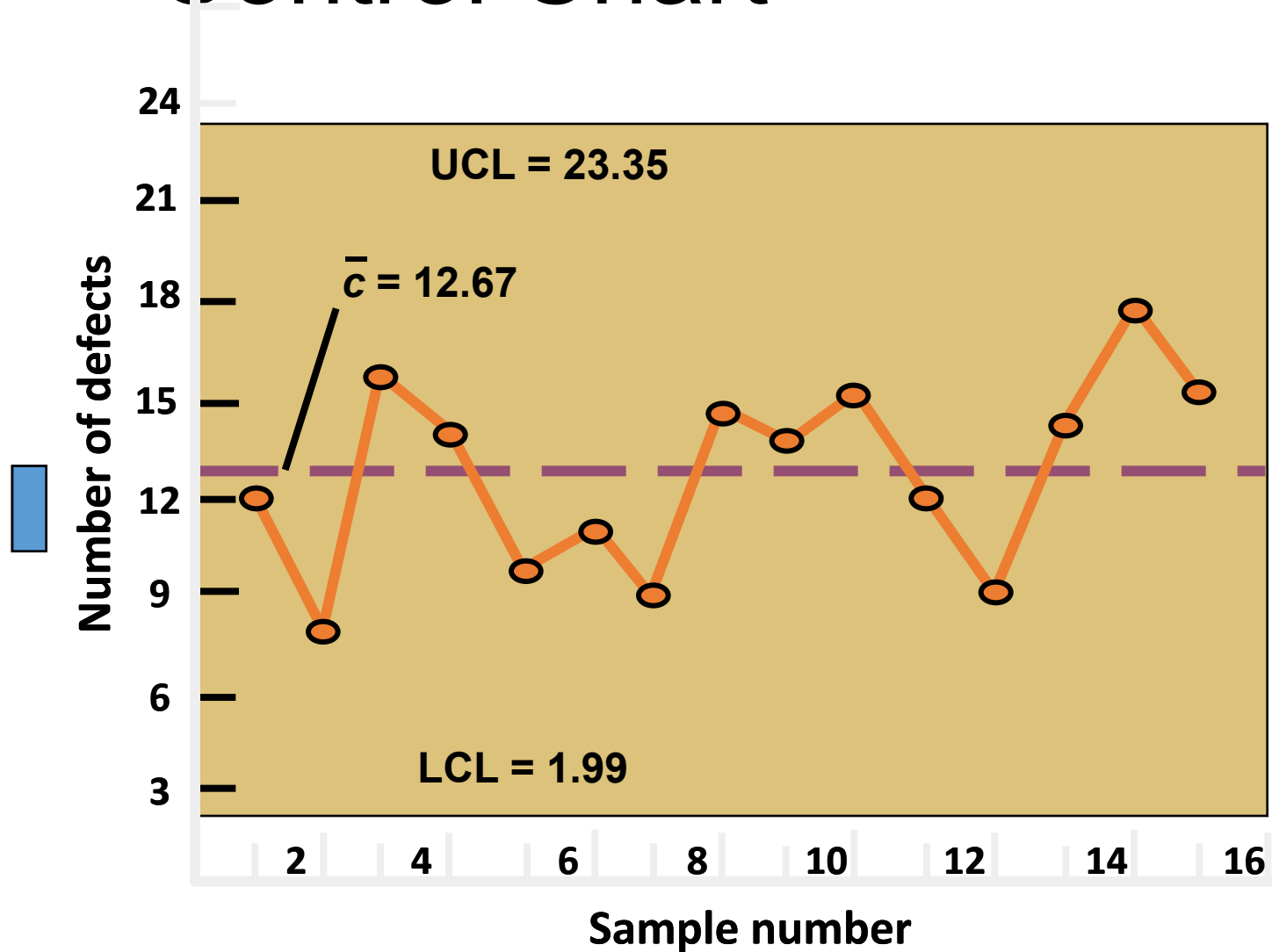
Histogram



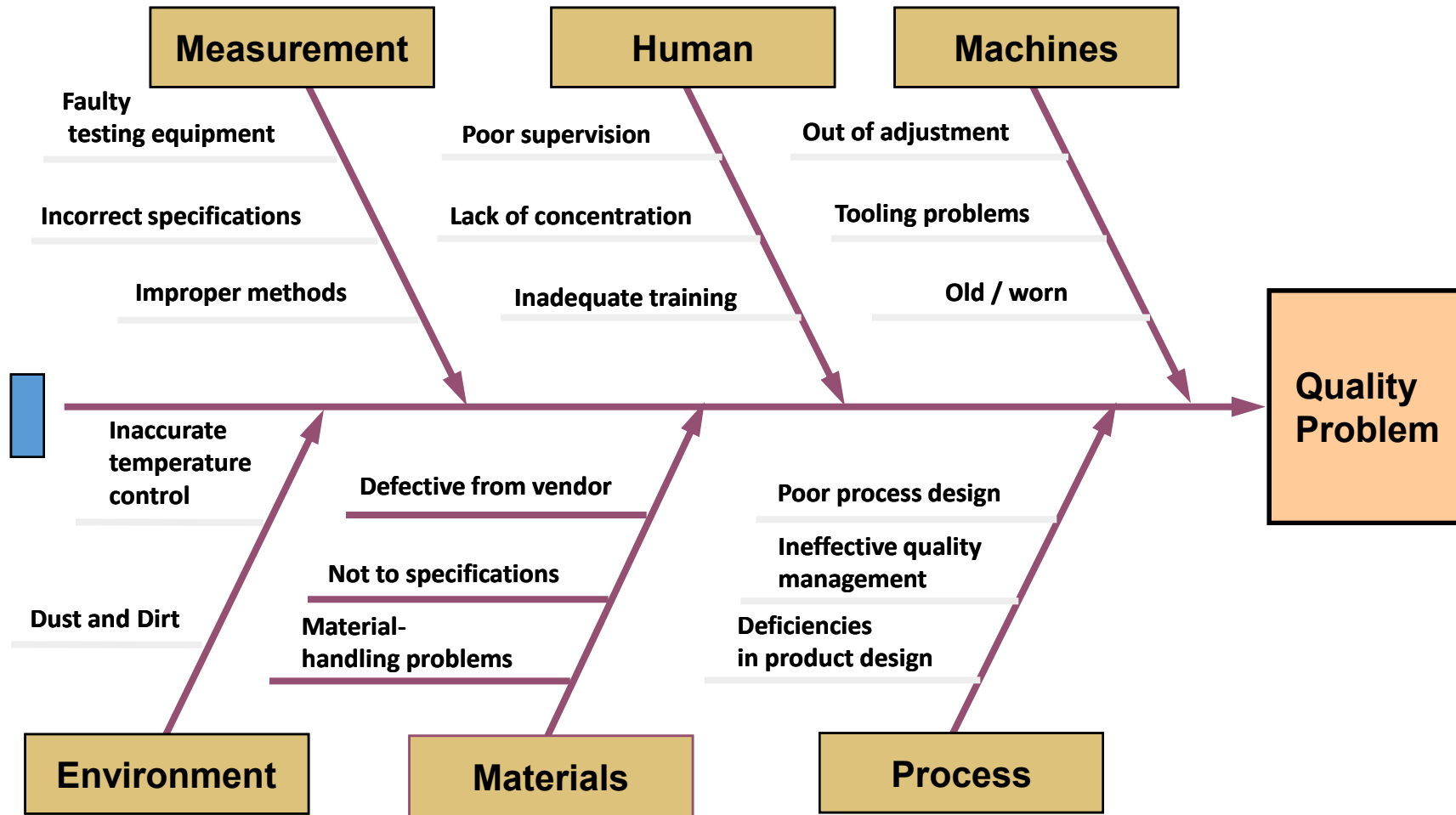
Scatter Diagram



Control Chart



Cause-and-Effect Diagram



Baldrige Award

- Created in 1987 to stimulate growth of quality management in the United States
- Categories
 - Leadership
 - Information and analysis
 - Strategic planning
 - Human resource
 - Focus
 - Process management
 - Business results
 - Customer and market focus

Other Awards for Quality

- National individual awards

- Armand V. Feigenbaum Medal
- Deming Medal
- E. Jack Lancaster Medal
- Edwards Medal
- Shewart Medal
- Ishikawa Medal

- International awards

- European Quality Award
- Canadian Quality Award
- Australian Business Excellence Award
- Deming Prize from Japan

American Customer Satisfaction Index (ACSI)

- Measures customer satisfaction
- Established in 1994
- Web site: www.acsi.org
 - Examples (in 2003)
 - Amazon.com scored 88 (highest in service)
 - Dell scored of 78 (highest in computer industry)
 - Cadillac scored 87 (highest in car industry)

ISO 9000

- A set of procedures and policies for international quality certification of suppliers
- Standards
 - ISO 9000:2000
 - *Quality Management Systems—Fundamentals and Vocabulary*
 - defines fundamental terms and definitions used in ISO 9000 family
 - ISO 9001:2000
 - *Quality Management Systems—Requirements*
 - standard to assess ability to achieve customer satisfaction
 - ISO 9004:2000
 - *Quality Management Systems—Guidelines for Performance Improvements*
 - guidance to a company for continual improvement of its quality-management system

Implications of ISO 9000 for U.S. Companies

- Many overseas companies will not do business with a supplier unless it has ISO 9000 certification
- ISO 9000 accreditation
- ISO registrars
- A total commitment to quality is required throughout an organization

