Production & Operations Management
INFO 335-01

Total Quality Management

Cost of Quality

- Loss of Business!!
- Quality has dramatic cost implications of:
  - Quality control costs (to achieve high quality)
    - Prevention costs (planning, training)
    - Appraisal costs (inspection, testing, audits)
  - Quality failure costs (consequences of poor quality)
    - Internal failure costs (rework, scrap)
    - External failure costs (recalls, litigation, lost sales)

Early detection/prevention is less costly

(Maybe by a factor of 10)

TQM Philosophy Concepts

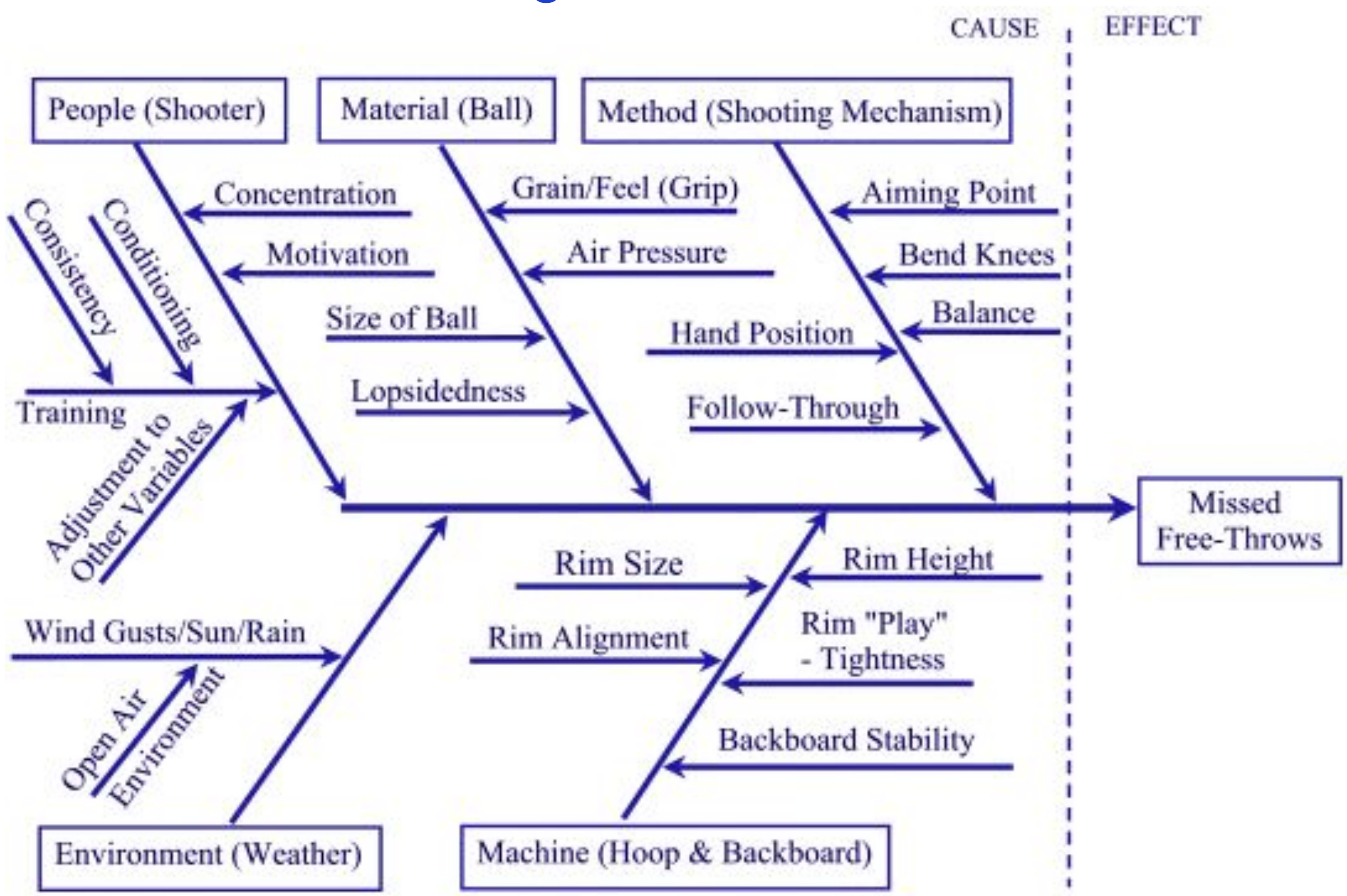
- **Focus on Customer**
  - Identify and meet customer needs
  - Stay tuned to changing needs, e.g. fashion styles
- **Continuous Improvement**
  - Continuous learning and problem solving, e.g. Kaizen, 6 sigma
  - Plan-Do-Study-Act (PDSA)
  - Benchmarking
  - SixSigma DMAIC (Define-Measure-Analyze-Improve-Control)

Tools of Quality Control

1. Cause-and-Effect Diagrams
2. Flowcharts
3. Checklists
4. Control Charts
5. Scatter Diagrams
6. Pareto Analysis
7. Histograms

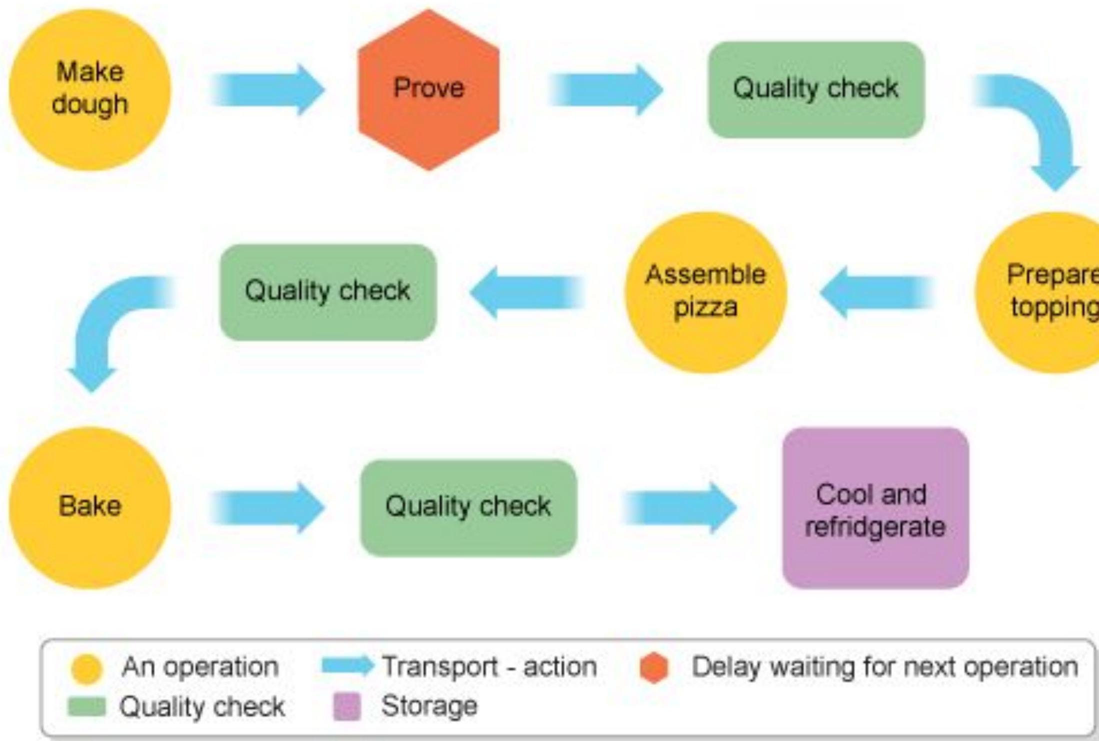
1. Cause-and-Effect Diagrams

- Called Fishbone Diagram



2. Flowcharts

- Schematic diagram
- Used to document the detailed steps in a process



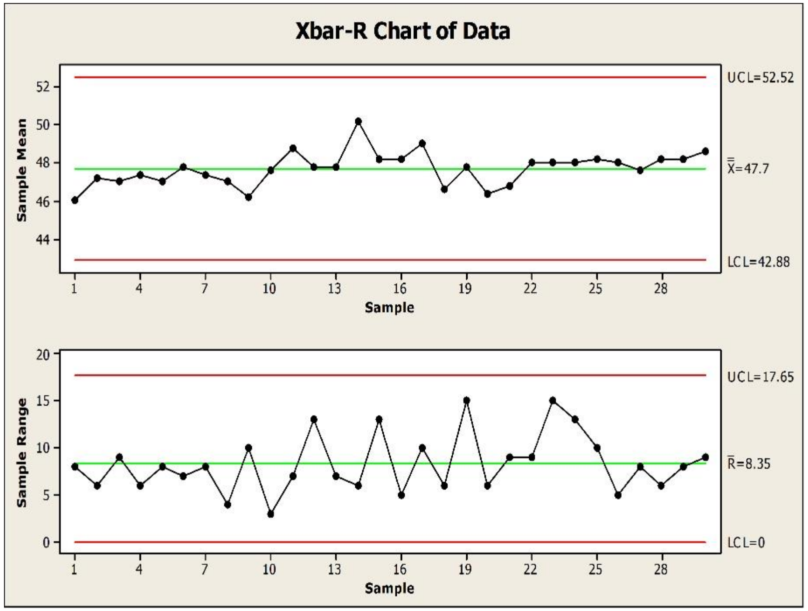
3. Checklist

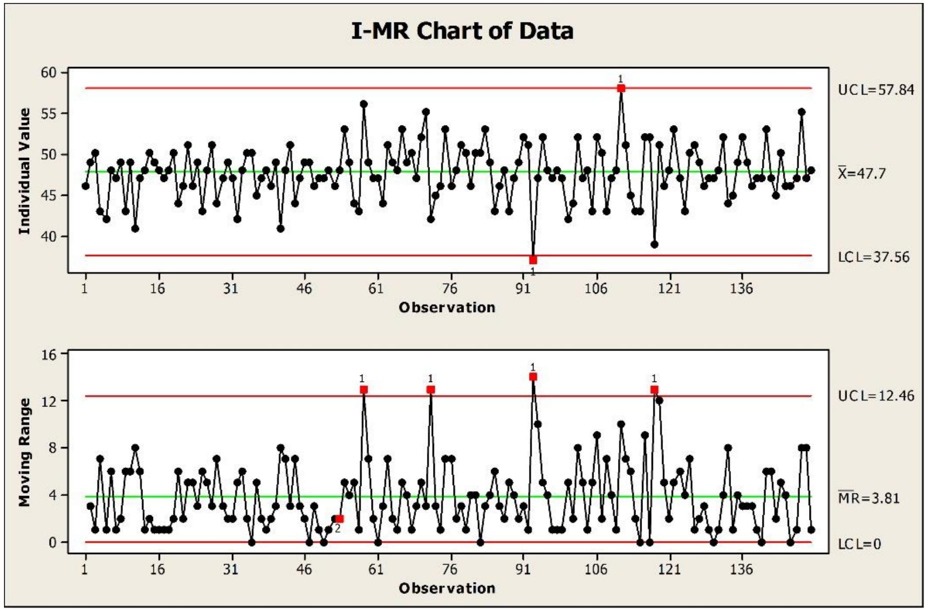
- Simple data check-off sheet
- Designed to identify type of quality problems at each work station; per shift, per machine, per operator

Defect Type	No. of Defects	Total
Broken zipper	✓✓✓	3
Ripped material	✓✓✓✓✓✓✓	7
Missing buttons	✓✓✓	3
Faded color	✓✓	2

4. Control Charts

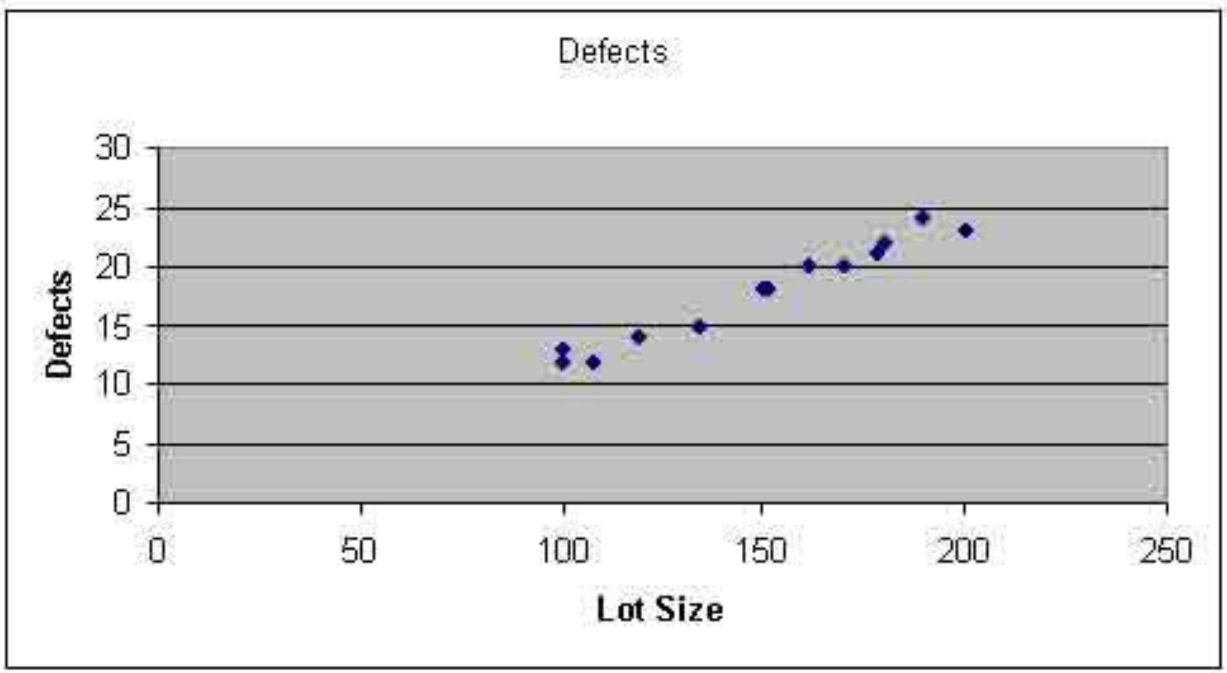
- The UCL and LCL are calculated limits used to show when a process is in or out of control i.e.; weight, width, or volume





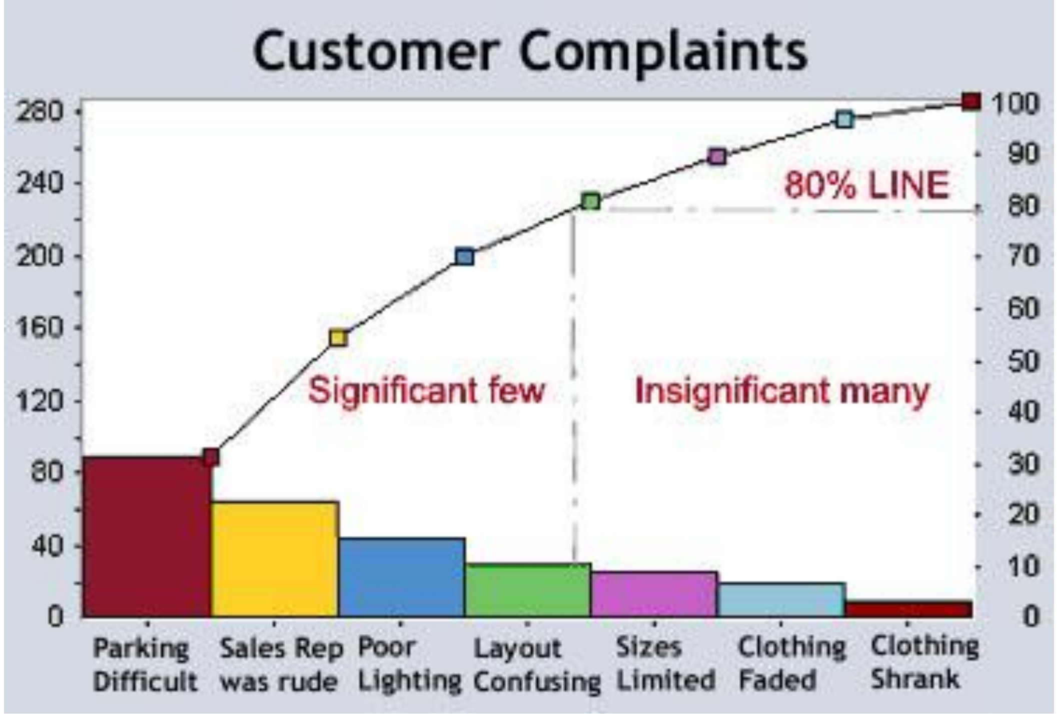
5. Scatter Diagrams

- A graph showing how two variables are related to one another
- The greater the degree of correlation, the more linear are the observations



6. Pareto Analysis

- Named after the 19th century Italian economist; often called the 80-20 Rule
  - Principle is that quality problems are the result of only a few problems i.e.; 80% of problems are caused by 20% of causes



7. Histograms

- A chart that shows the frequency distribution of observed values of a variable (i.e.; service time at a bank drive-up window)
- Displays whether the distribution is symmetrical (normal) or skewed

Quality Awards and Standards

- Malcolm Baldrige National Quality Award (MBNQA)
- The Deming Prize
- ISO 9000 Certification
- ISO 14000 Standards

Reliability – Critical to Quality

- Reliability is the probability that the product, service or part will function as expected
- No product is 100% certain to function properly
- Reliability is a **probability function** dependent on sub-parts or components

Reliability – Critical to Quality

- ***Example.*** Suppose a room has two lamps, but to have adequate light both lamps must work (success) when turned on. One lamp has a probability of working of .90, and the other has a probability of working of .80.

- What is the probability that the room will have adequate lighting?

Note: Here the product is the lighting system that has two component lamps.

Reliability – Critical to Quality

- ***Example.*** There are two lamps in a room. When turned on, one has probability of working of .90 and the other has probability of working of .80. Only a single lamp is needed to light the room for success.

- What is the probability that the room will have adequate lighting?

Note: Here the product is the lighting system that has two component lamps.

Reliability – Critical to Quality

- ***Example.*** Three lamps have probabilities of .90, .80, and .70 of lighting when turned on. Only one lighted lamp is needed for success.

- What is the probability that the room will have adequate lighting?

Note: Here the product is the lighting system that has three component lamps.

Reliability – Critical to Quality

- ***Determine the reliability of the system shown below.***

Reliability – Critical to Quality

- ***Example.*** A product designer must decide if a redundant component is cost-justified in a product. The product in question has a critical component with a probability of .98 of operating. Product failure would involve a cost of $20,000. For a cost of $100, a switch and backup component could be added that would automatically transfer the control to the backup component in the event of a failure. Should the backup component be added if its operating probability is also .98?