Introduction to Quality & Productivity Improvement
QUALITY—the ability of a product or service to meet customer needs and satisfaction.
The Cost of Quality

In most companies the cost of quality, including customer complaints, product liability lawsuits, redoing defective work, products scrapped, etc., runs from 20% to 40% of sales revenues.

—J.M. Juran—“Juran on Planning for Quality”
Quality Myth #1

Rumor has it—that quality and productivity are incompatible—that you cannot have both.

If you push quality, production falls behind. If you push production, quality suffers.

This is the experience of managers who know not what quality is or how to achieve it.

—Yoshikasu Tsuda
Why is it that productivity increases as quality increases?

Less rework – not so much waste.

The Chain Reaction of Quality

Improve quality → Costs decrease because of less rework, fewer mistakes, fewer delays, snags; better use of machine and materials → Productivity improves

→ Capture the market with better quality and lower price → Stay in business → Provide jobs and more jobs

—Deming, Out of the Crisis
Quality improvement transfers wasted man-hours and machine-time into the manufacture of good product and better service.

What does Deming say about American Industry?

“You don’t have to change... survival is not mandatory.”

W. Edwards Deming
Mill Closures & Layoffs, 1989 - 2003

Status of U.S. Forest Products Industry

- Pulp, Paper & Paperboard Mills
- Employees Laid Off
How Do We Improve Quality?

Inspection—find and sort out bad product

Class exercise—read the following sentence

“Forest fires are the result of the thoughtlessness of man, combined with those factors of nature which allows a small flame to spread.”

Now go back and count the number of f’s in the sentence—but count only once. Write your answer on a piece of paper.
Inspection Exercise

How many f’s are there?

“Forest fires are the result of the thoughtlessness of man, combined with those factors of nature which allows a small flame to spread.”

Lesson—inspection doesn’t work very good!
How Do We Improve Quality?

You cannot inspect quality into a product

By the time product is inspected, its level of quality has already been established

To improve quality, you have to improve the process that produced it

Improve the Process

“You must focus on the process if you are to continually improve your ability to meet your customers’ needs and expectations. There is no substitute for knowing your process and improving on them.”

What’s this talk about customers?

1. What marketing suggested
2. What management approved
3. As designed by engineering
4. What was manufactured
5. As maintenance installed it
6. What the customer wanted
“The problem isn’t what we don’t know…

…but what we think we know.”

—Henry Hinck, Idaho Forest Industries
What is a Process?

- All work is process
- Processes can be identified, understood, measured, and improved
What is a Process?

- A process produces a product or service from a combination of
  - People
  - Machines & equipment
  - Materials
  - Methods
  - Environment
Tools for Improvement

- Checklists
- Simple tools for improvement
- Statistical Process Control (SPC)
  - Control charts
  - Lumber size control (SPC-LSA routine)
- Mill studies—controlled experiments
## Circular Saw Maintenance Checklist

<table>
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<tr>
<th>Daily</th>
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| - Sawteeth swage & sharpness | - Saw ___ speed  
  ___ plumb  
  ___ flat (log side)  
  ___ lead ¹  
  ___ shanks | - Carriage ___ frame  
  ___ trucks  
  ___ dogs |
| - Arbor bearings (heating) | - Saw collars ², ³ | - Mill foundation |
| - Drive belts | - Lug pins ² | - Husk |
| - Guide pins | - Carriage wheels | - Saw guide (position) ¹ |
| - Cleanup (debris, oil, etc.) | - Guide track | - Spreader |
| - Machinery guards in place | - Headblock-knee assembly | - Saw arbor (straightness) ², ³ |
| | - Drive and driven pulleys | - Track cleaners |
| | - Bolts (tightness) | - Pulleys & sprockets |
| | - Belt tension | - Bracing |
| | - Setworks (set) | - Hydraulic hoses |

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Machine Center __________________  Date ______  
Checked by _________________________  Initials ______  

1. Items to be checked after changing saws.  
2. Items to be checked after saw has been hung.  
3. Items to be checked after saw has been severely overheated.
Lumber Quality Control Checklists

Terry Brown, Oregon State Extension

1. Falling & Bucking
2. Yarding, Decking, Loading
3. Log Yard (Sort Yard)
4. Debarking
5. Long Log Bucking
6. Carriage & tracks
7. Bandmill, Headrig, Resaw
8. Edgers—fixed, selective, combination
9. Dropout Sorting/Green Lumber Making
10. Trimmers
11. Green Chain
12. Automatic Lumber Sorters
13. Rough Green Storage
14. Dry Kiln
15. Rough Dry Storage
16. Planer Mill
17. Lumber Degrade Evaluation
18. Finished Lumber Storage & Shipping
Simple Tools for Improvement

- Check sheet
- Pareto chart
- Cause & effect diagram
- Histogram
Check Sheets

Used to gather data on processing problems to determine what problems are occurring most frequently.
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Pareto Chart

- 80/20 rule
- Shows the relative importance of all the problems
- Helps choose a place to start solving problems
- Monitors success
- Identifies basic causes of a problem
Treating Plant

Unscheduled Maintenance

Frequency

Steam Leaks
Steam Traps
Fill Pump
Pressure Pumps
Heat Exchanger
Electrical
Boiler
Air Compressor
Tank Gauge
Unloading Pump
Cause & Effect (Fishbone) Diagram

- Used to identify, explore, and display possible causes of problem
- Possible causes grouped into major categories
- A detailed diagram looks like fishbones
- From the diagram, select the most likely causes for further study
Problem: Poor Drying Uniformity

Possible Causes:
- Air Circulation
  - Fans
  - Plenum Chamber
  - Baffles
- Lumber Uniformity
  - Mixing Thicknesses
  - Mixing Species & Grade
  - Lumber Sizing
- Vent System
  - Damaged Walls
  - Door Leaks
- Heating System
  - Condensate Return
- Kiln Structure
  - Steam Traps
Histograms

- Display large amounts of data that are difficult to interpret in tabular form
- Show the relative frequency of occurrence of the data values
- Reveal the centering (average tendency), variation & shape of the data
- Help answer “Is the process capable of meeting product specifications?”
Histogram

1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15 1.16 1.17 1.18 in.
Illustrations of Central Tendency

Unimodal

Bimodal

Illustrations of Variability

Small Variability

Large Variability

Illustrations of Skewness

Positively Skewed

Negatively Skewed
Mill Studies

- Work sampling
- Time & motion
- Productivity
- Volume recovery
- Grade yield
- Quality control