

Applying Deming's Lessons to the Challenge of Environmental Sustainability

John W. Sutherland

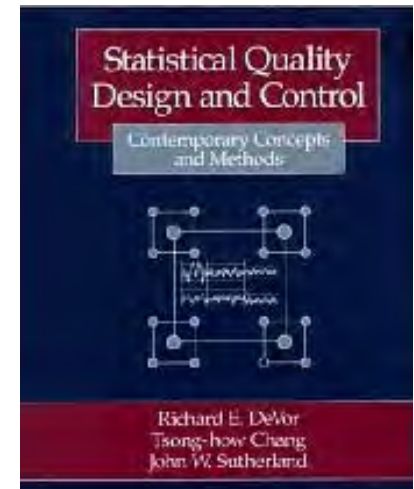
**Professor and Fehsenfeld Family Head
Environmental and Ecological Engineering**

Purdue University

jwsuther@purdue.edu

Sutherland Background

- ◆ Industry workshops on quality during the 1980s – covered teachings of Deming
- ◆ Textbook developed based on workshop notes – used by over 100 colleges and universities in the U.S. and abroad.
- ◆ 1990s – environmentally responsible manufacturing



Production/Quality History

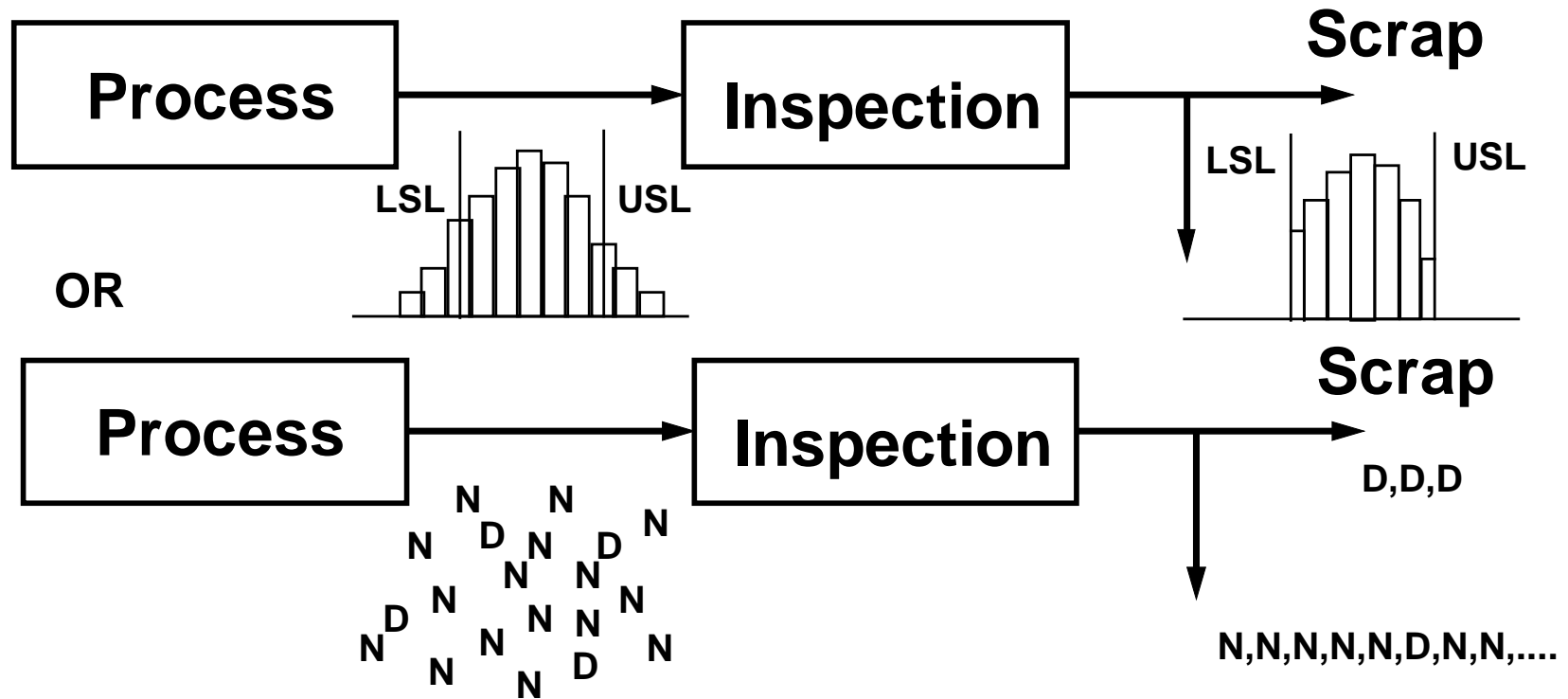
- ♦ **1700s – products made by craftsmen/artisans – individual is responsible for productivity and quality**
- ♦ **Eli Whitney – interchangeable parts → led to division of labor – a specialist to make each part**
- ♦ **F. W. Taylor (late 1800s) – Scientific Management – revolutionized production methods**
- ♦ **Before Taylor, production practices of companies equally bad. Companies that adopted Taylor's methods survived...**

What About Quality?

- ♦ **Taylor's methods helped manufacturing be more productive (work measurement, methods analysis, time standards, wage incentives, etc.)**
- ♦ **What about quality??**
- ♦ **Let's consider a company that has had complaints about the quality of its products... What do they do??**

A First Approach

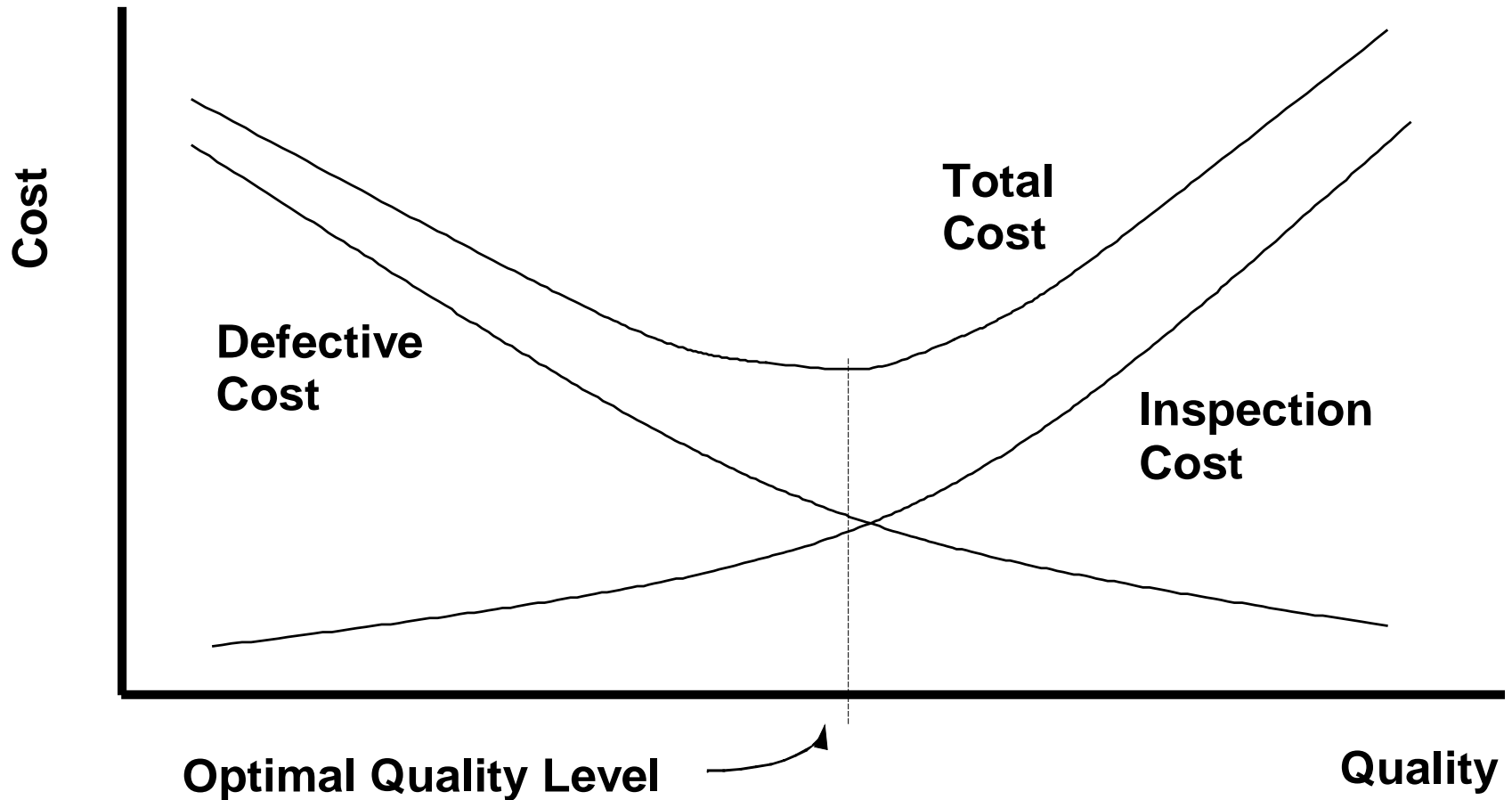
One approach: hire inspectors for 100% testing



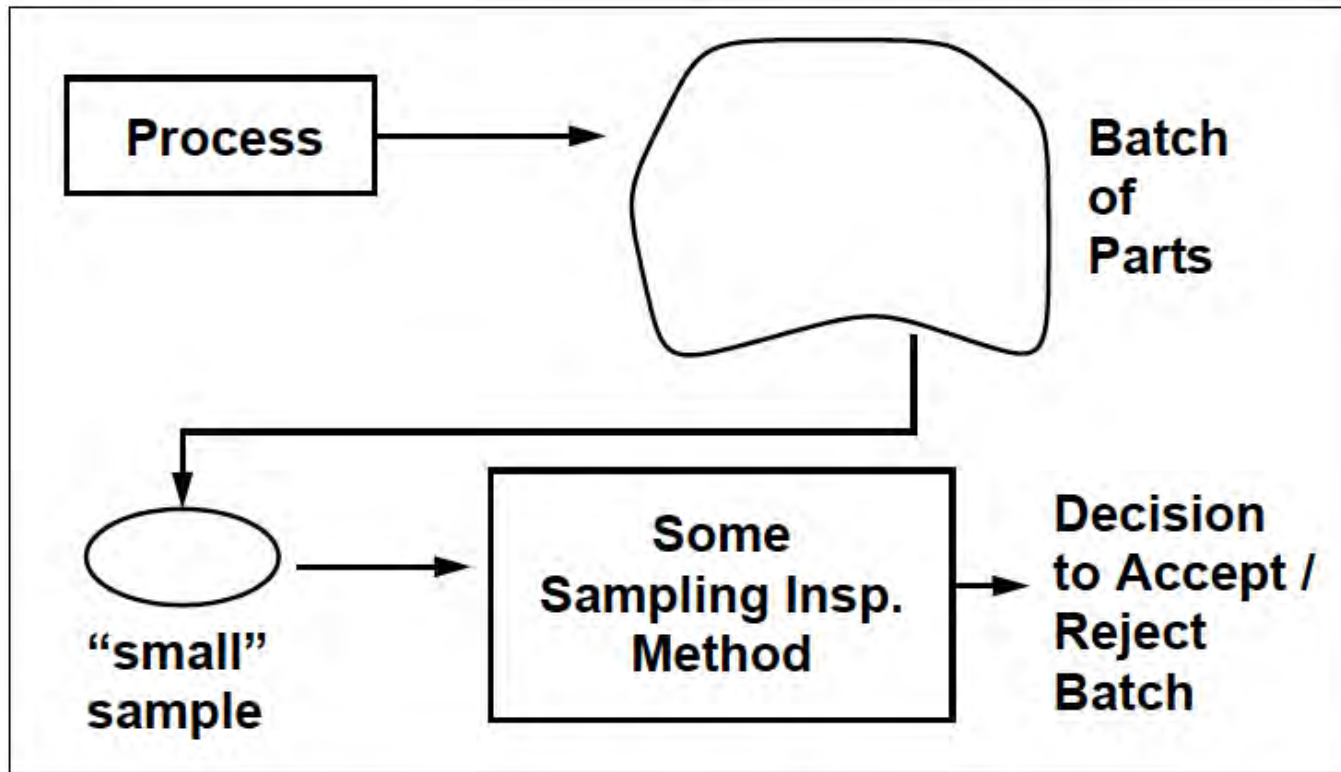
Traditional Approach

- ◆ This is the traditional approach to ensuring quality. Quality Assurance
- ◆ Focus is on keeping bad parts from leaving plant
- ◆ Generally,
 - If we want better quality – need to inspect more carefully. 100/200/400% inspection
 - For poor quality “out the door”: large warranty costs & lost customers

Quality and Cost



Sampling Inspection



- If 100% inspection too costly – can use sampling inspection. Rigorous statistics – but again, focus is on ensuring bad parts are caught

Background on W. E. Deming...

- ♦ Deming worked at Bell Labs (with Shewhart) on quality methods during the 1930s.
- ♦ At urging of U.S. Govt. Deming went to Japan after World War II to help them rebuild their manufacturing base. Japan was receptive to statistically based quality improvement.
- ♦ Popularized a new approach to quality mgmt
- ♦ Deming developed a plan for management to follow to enhance competitive position over the long run... referred to as his 14 Points (Obligations of Top Management)

Deming's 14 Points

1. **Create constancy of purpose (no short sighted thinking)**
2. **Adopt the new philosophy (never ending improvement)**
3. **Cease dependence on mass inspection for quality control**
4. **End the practice of awarding business on the basis of price tag**
5. **Improve constantly and forever the system of production and service**
6. **Institute more thorough, better job-related training**
7. **Institute leadership**
8. **Drive out fear so that everyone may work effectively for the company**

Deming's 14 Points

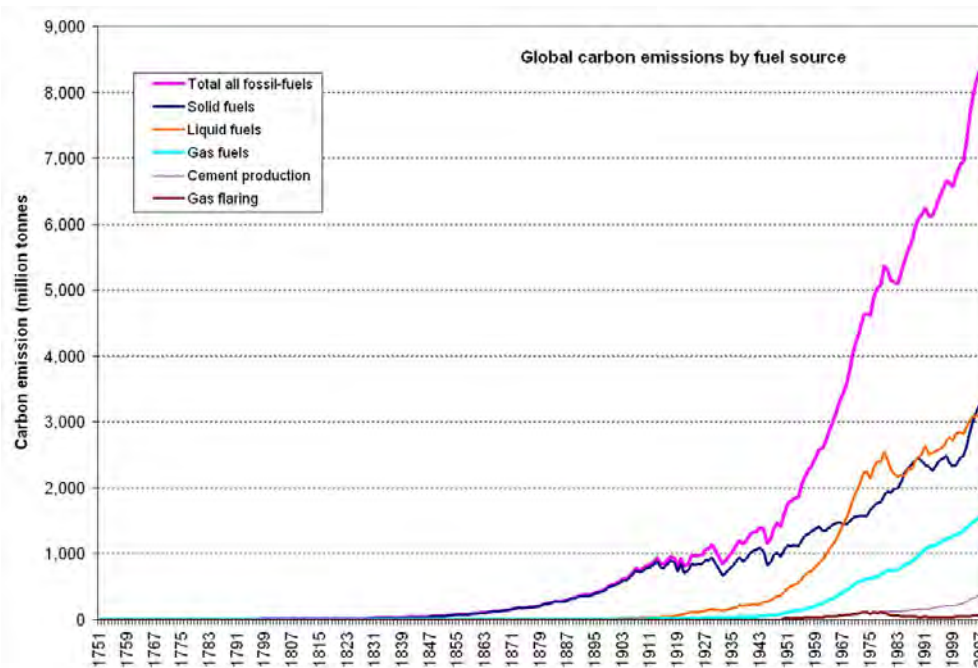
- 9. Break down barriers between departments**
- 10. Eliminate slogans, exhortations, and targets for the work force that ask for zero defects and new levels of productivity**
- 11. Eliminate work standards on the factory floor**
- 12. Remove barriers that rob employees at all levels of their right to pride of workmanship**
- 13. Institute a vigorous program of education and self-improvement**
- 14. Put everyone in the organization to work to accomplish the transformation**

Deming & Environmental Sustainability

- ◆ **Let's consider a few of Deming's points**
 - **Create constancy of purpose.**
 - **Cease dependence on mass inspection for quality control.**
 - **Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.**
 - **Adopt the new philosophy.**
- ◆ **Understand how these points offer insights into environmental sustainability**

- ◆ **Create constancy of purpose for the improvement of product or service.**
 - Deming was critical of shortsighted thinking (e.g., making weekly numbers and quarterly profits).
 - Must operate with belief that future exists.
- ◆ **Connection with sustainability?**
 - Long-term thinking: use energy and materials in a way so that future generations can meet their own needs.
 - What would Deming say about our current situation?

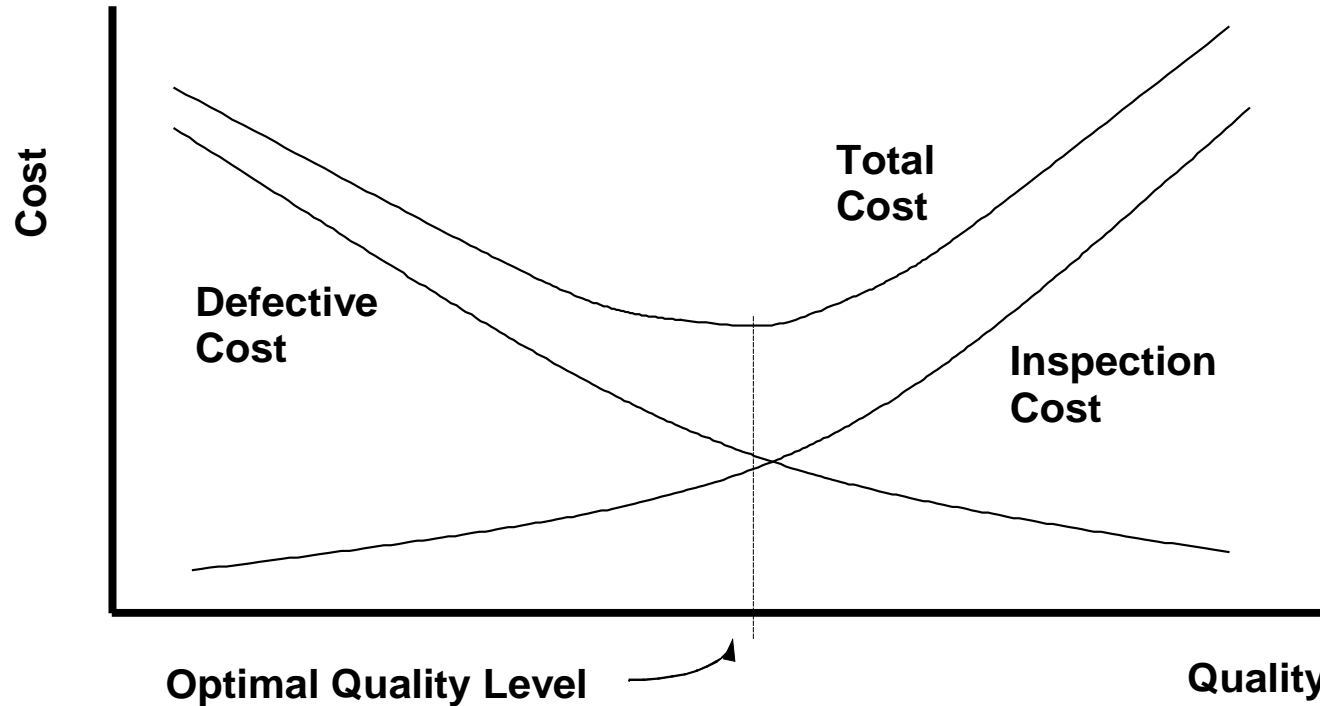
Are We Sustainable?



Boden, T.A., et al. 2010.

Globally, resource use and waste production are rising. Largely proportional to population size and GDP/capita... Economies of developing nations are growing quickly

Quality, Cost, & Productivity



This means that there is an optimal level of defective parts. Quality and Productivity are competing goals.

Fundamental Flaws with Paradigm

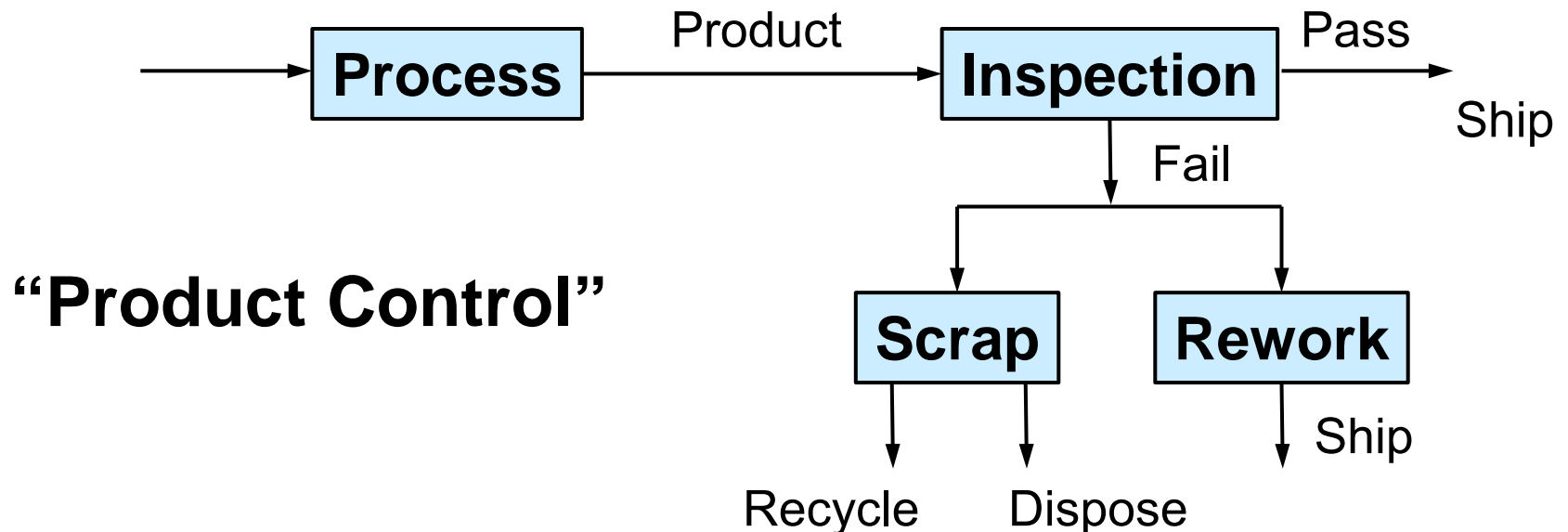
- ♦ **Focus is on product control**
 - **Emphasis: find and remove defective parts so that the customer never gets them.**
 - **The process is unaffected – the faults producing the defective products still exist**
- ♦ **We accept some level of defective parts as unavoidable.**

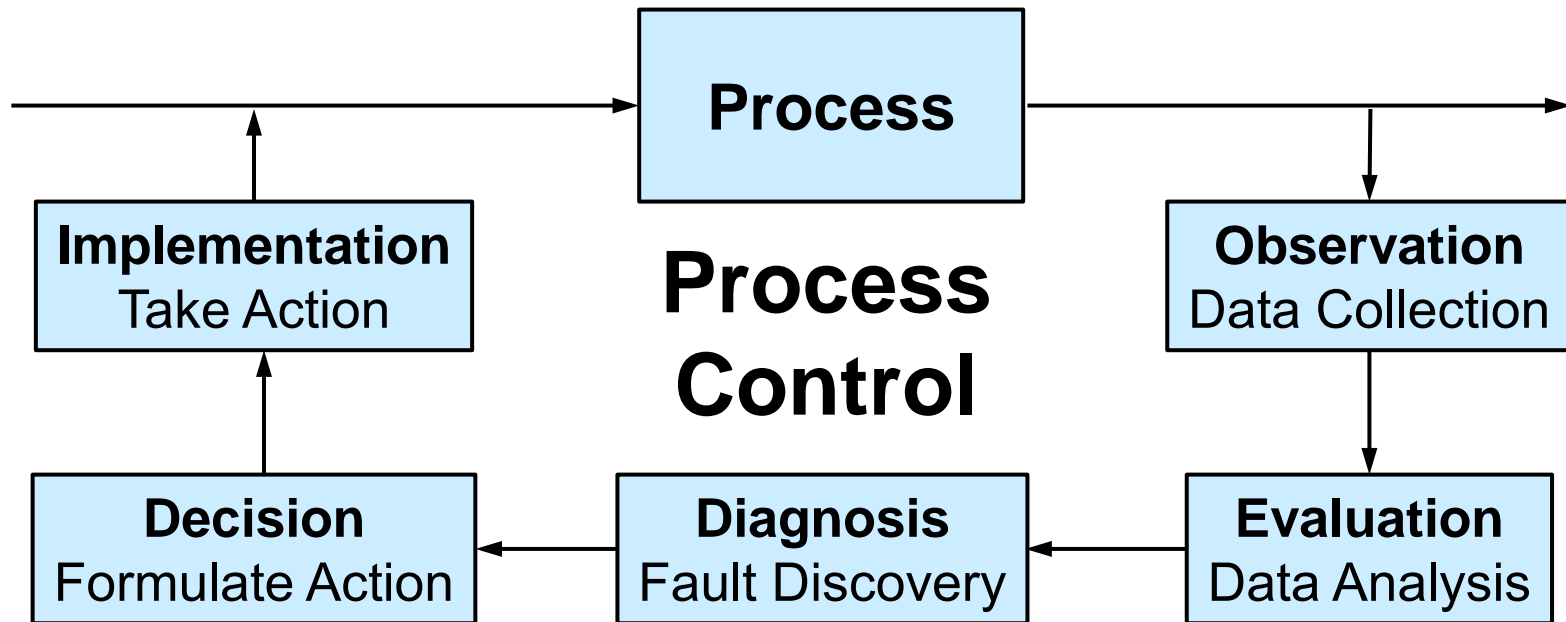
Deming Philosophy

- ◆ Deming's approach (new paradigm) – improve the process
- ◆ Attack root causes of problems
 - When root cause eliminated – defectives go away
 - Root causes negatively impact productivity and cost
 - What happens to productivity and cost when root causes removed??
- ◆ Termed "process control" – continuous, never-ending improvement

Product vs. Process Control

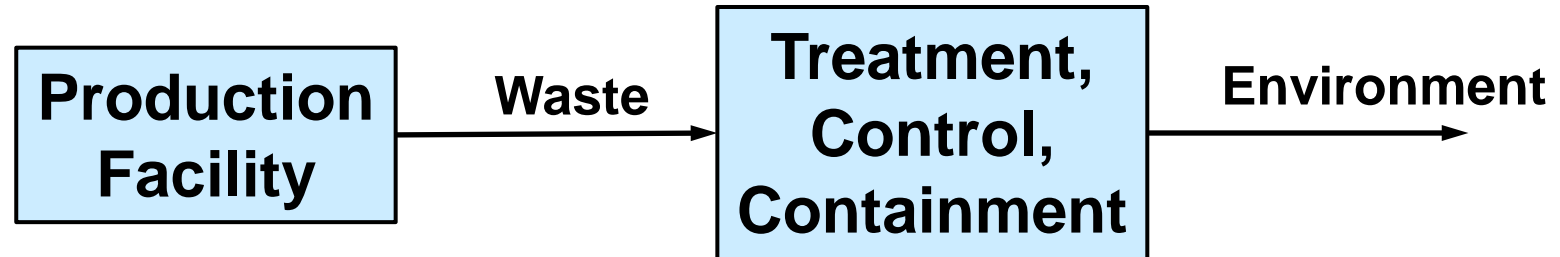
- ◆ Cease dependence on mass inspection for quality control.
 - Abandon defect detection and containment as a means of controlling quality and emphasize the importance of defect prevention





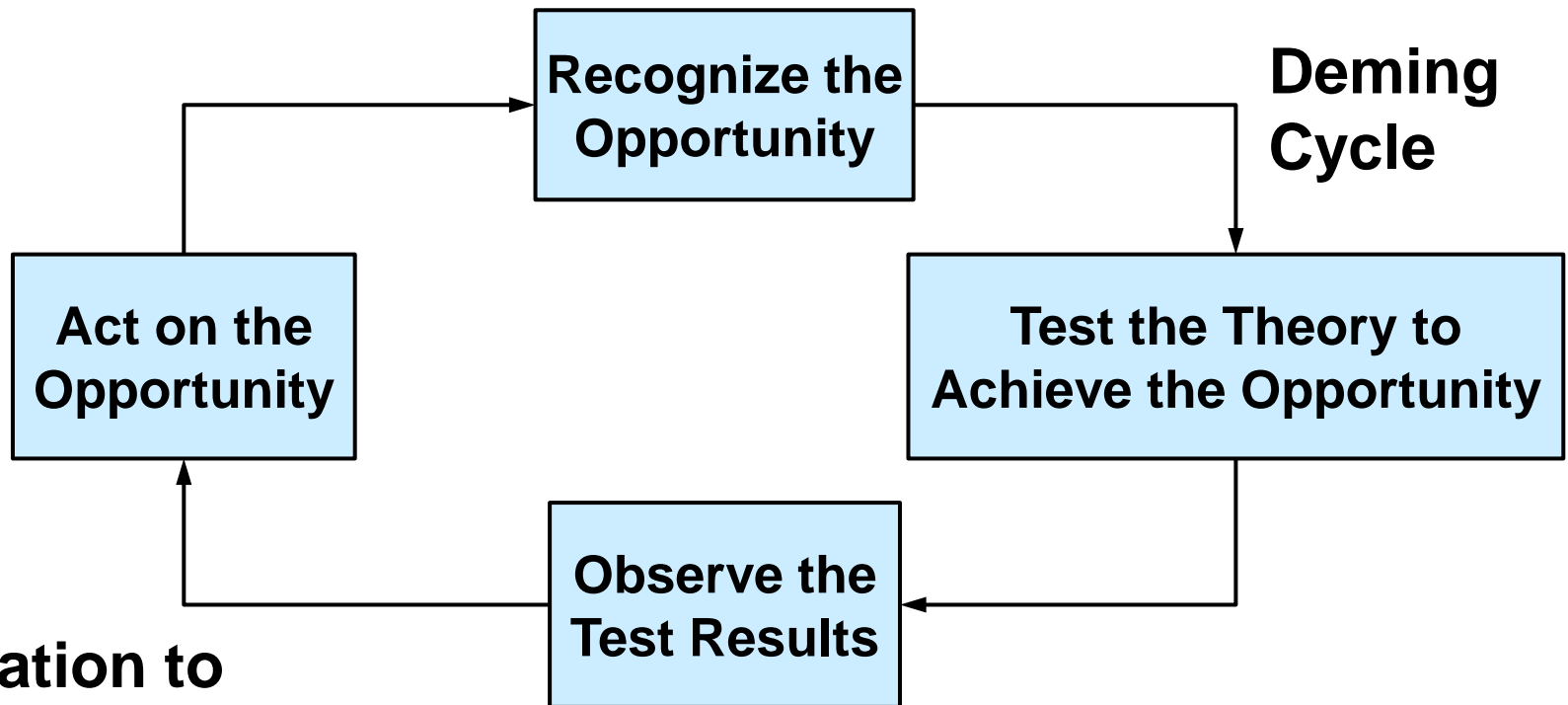
- ◆ **Process control seeks to identify and remove root causes of the problem.**
- ◆ **Focus is on preventing faults.**
- ◆ **Fault removal: quality AND productivity increase, cost goes down**

Traditional Environmental Engineering



- ◆ Is this product or process control?
- ◆ Environmental engineering is too often focused on containing, treating, controlling, and mitigating waste streams
- ◆ Need to do more to attack root causes of waste streams
- ◆ Need more attention on efficiently and effectively using resources

- ◆ Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
 - Key point here is that we should not adopt a short-term project mentality.



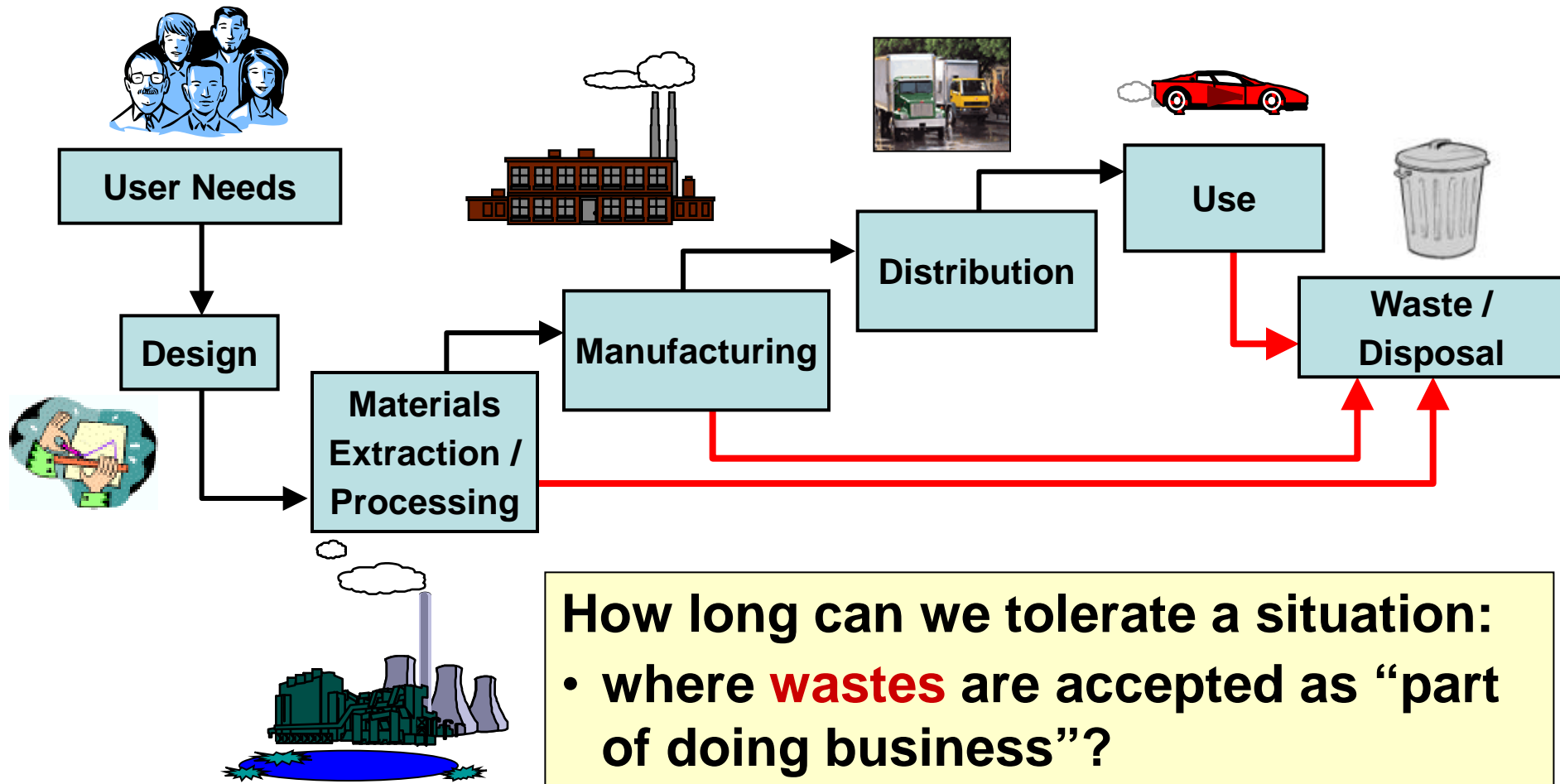
Adopt the New Philosophy

- ◆ **Discard old philosophy of accepting defective products as unavoidable.**
- ◆ **Abandon notion that quality need only be improved up to some plateau, beyond which improvement is not economically justified.**
- ◆ **Application to sustainability?**
 - **Reject philosophy that some waste is acceptable – need to constantly strive to use energy and materials better**
 - **Abandon notion that improvement beyond the regs. is not economically justified – waste is a source of inefficiency**

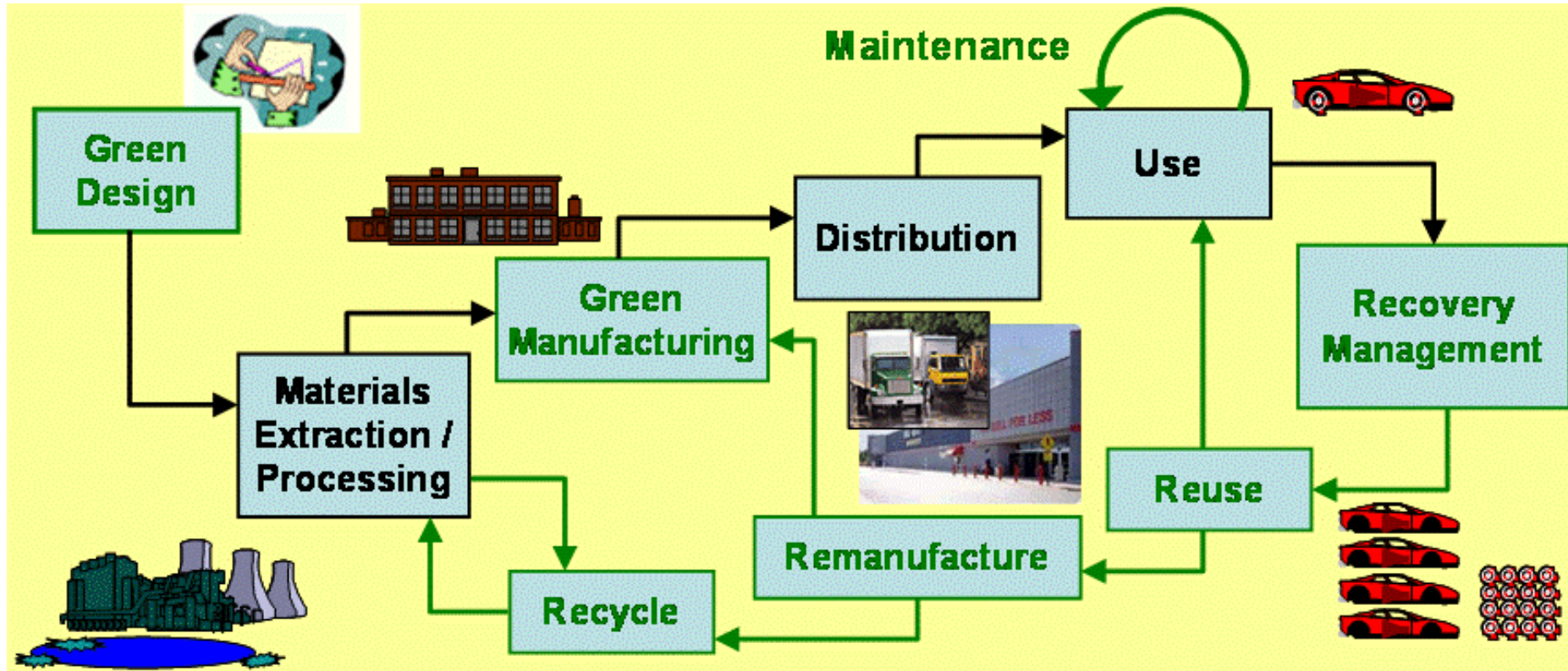
Putting it into Practice

- ◆ **Worked with Ford in the early 1990s**
- ◆ **Cutting Fluids – Machining**
 - **Traditional view – “required for production”**
 - Stated benefits: cooling & lubrication
 - **Costs**
 - Purchase, treatment/disposal, mist collectors, filters, pumps, housekeeping, etc.
 - Medical costs? Legal costs?
 - 15-20% of production costs
- ◆ **Worked with Ford on dry machining**
- ◆ **Attacked the root cause of the problem!**

Traditional Life Cycle



Closing Material Loops



New technologies to help close material/value loops

New business models that support this approach

Some Takeaways

- ♦ Deming does offers insights on Sustainability
- ♦ Innovate to avoid wastes – rather than contain/control/treat them
- ♦ Lean is green (use resources efficiently/effectively)
- ♦ Close material loops (remanf. and recycling)

Thank You!

John Sutherland
jwsuther@purdue.edu