Evolution of Manufacturing

- Machine that changed the world - 1991. Introduced Lean Production
- First major move--from craft to mass production
  Second major change-- from mass to lean production
- Primary enablers of mass production
  - Interchangeability of parts
    Ford required that all suppliers use the same gauging system to measure critical dimensions on parts.
  - Moving assembly line
Ford’s Process in 1903

- Craft production of automobiles
  - Ford - 1903 person produced cars at one station.
    Gathered parts and tools
    Repaired tools as necessary
    Fitted parts together
    Assembled entire car
    Checked everything

- Ford - 1908 had each assembler move from car to car doing one task.

- Ford - 1913 introduced the moving assembly line.
  Reduced the time to make a car from 13 hours to just 1.5 hours.

Ford’s Mass Production

- Ford was heavily influenced by Frederick Taylor.
- By 1915 every worker stood at the line and did one small task
- Turnover rate reached 380%.
- Problem solving was assigned to foreman, engineers, and other specialized workers.
- Ford was highly vertically integrated. Brought every function required to make a car in-house.
- Major separation of managers and employees. What did this mean??
Toyota Production System Elements

- Reduced setup times
- Small lot production
- Employee Involvement and Empowerment
- Quality at the source
- Equipment Maintenance
- Production Smoothing
- Pull production
- Supplier involvement

Is this all about reducing inventory? If not, what else is going on?

America’s Fall From Grace

- U. S. engineers did not see manufacturing as a place to take a job.
- Most manufacturing organizations were being managed by accounting and financial people.
- The financial people were professionals, the manufacturing people were blue-collar people (up from the ranks).
- Japanese producers slowly began to take away market share in autos, steel, electronics and other industries.

American managers used the threat of Japan to keep wages down.
Modern Developments

- MRP
- CAD - enables designers to design a part or product and test its features and compatibility with other parts via computer.
- CAM - software that translates design requirements (from CAD) into instructions for controlling production machinery.
- FMS - aim to achieve high-variety output at low cost. Usually computer-controlled, automated equipment.
- EDI - computer-to-computer exchange of information, usually meaning two companies (production schedules, order placement, etc.)

Quality Movement

- Inspection
- SPC
  - Acceptable quality limits
  - Collecting data over time via charts
- Continuous Improvement
  - Deming, Juran, Feigenbaum
- When Japan managers were embracing Deming’s 14 points, American industry was embracing the Whiz Kids. Who were they?
- Japan’s use of Quality Circles and their death in the U. S.
By the 1980’s Japan’s lead in quality had become obvious

Superior skills and processes had come via thousands of incremental improvements called Kaizen.

Ishikawa and his seven problem- analysis/solving tools.

Taguchi - goal should be to continuously reduce process variation. Design of experiments and concept of a robust design.

QFD - methodology for determining customer requirements and translating them into specifications that could be used by all functional parts of the organization to understand and take action on.