

Lean Production and the Environment: Opportunities to Leverage a Business Trend to Promote Sustainability

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What is Lean Production?

- A production approach (philosophy & methods) developed by Toyota, adapted by others
- Lean thinking aims to produce *high quality products and services at the lowest cost with maximum customer responsiveness*
- Lean accomplishes this through the *systematic identification and elimination of waste*, with emphasis on *continuous improvement* and *employee involvement*
- Implemented in frequent rapid process improvement events (e.g., week-long *kaizen* events)

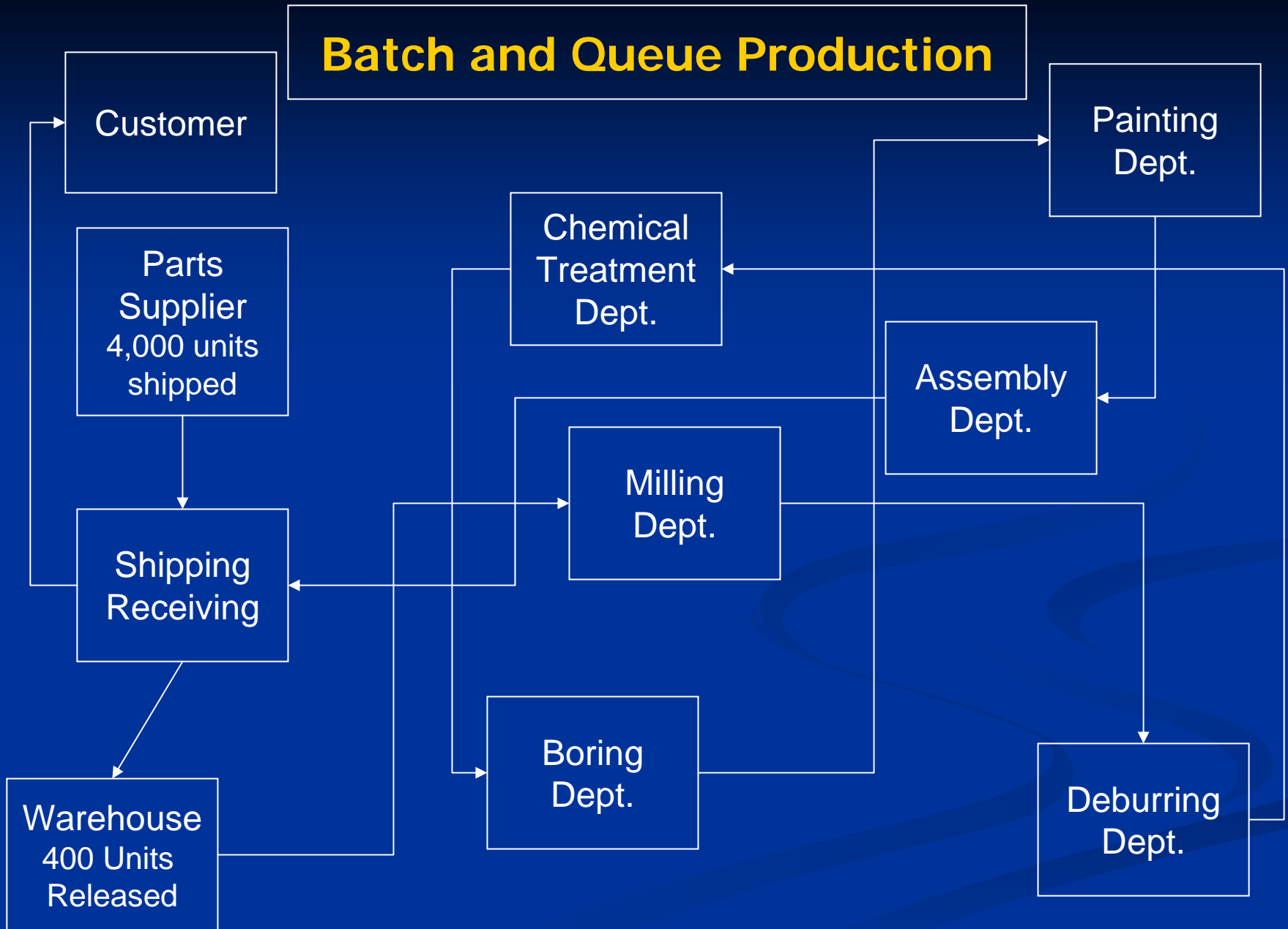
Lean Eliminates Waste (All Non-Value Added Activity)

Manufacturing Wastes	Service Wastes
Inventory	Backlog of Work
Defects	Errors in Documents
Overproduction	Doing Work Not Requested
Complexity	Unnecessary Steps
Waiting	Waiting
Movement	Unnecessary Motion
Transportation	Transport of Documents

Lean Production is Becoming More & More Widespread

- Lean is connected to competitive business drivers with substantial financial benefits.
- Originated in automotive & aerospace sectors, but is rapidly being adopted by other manufacturing sectors (appliances, construction, electronics, furniture, healthcare devices, metal fabrication, shipbuilding)
 - At least 30-40% of U.S. manufacturing firms are engaged in lean; 5% are pursuing it aggressively
- Growing interest & experience with lean in service sector (hospitals, banking, insurance) and government (U.S. Military, Iowa DNR, CT Dept. of Labor)

Batch and Queue Production

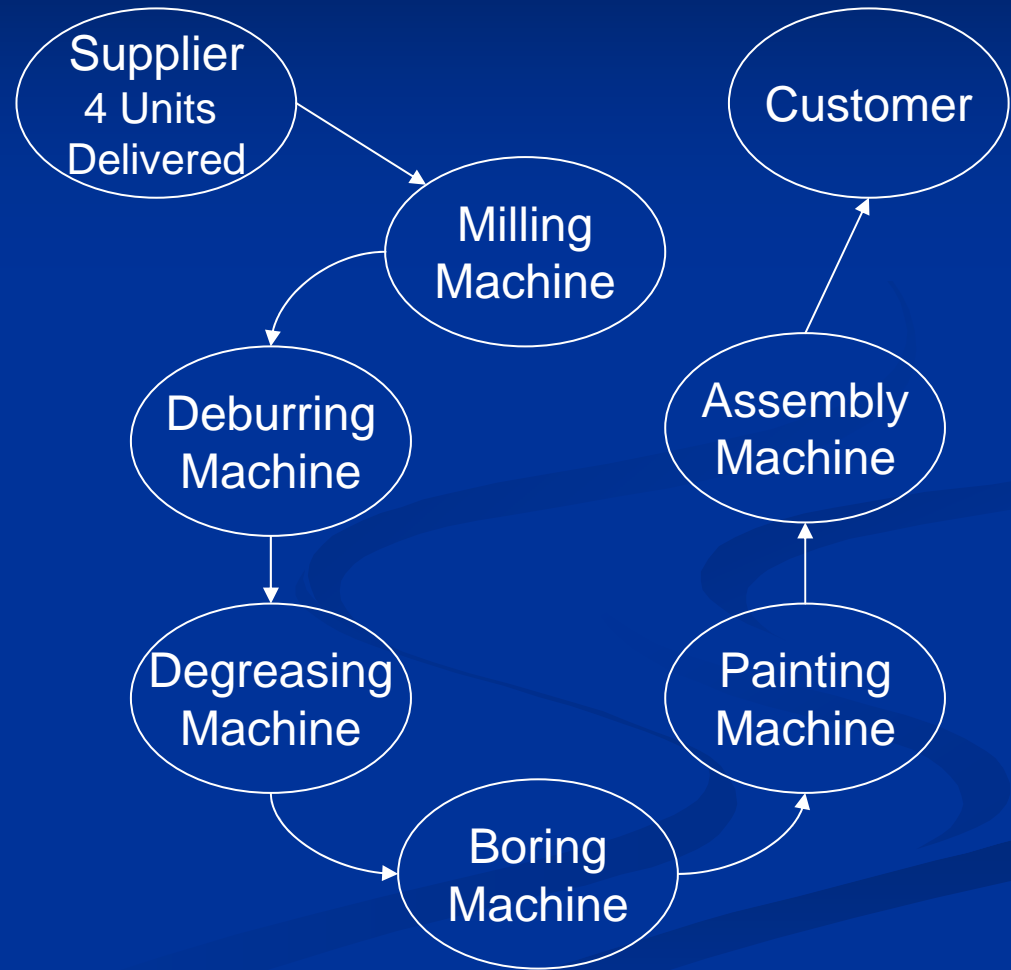


Lean Product-Aligned, Cellular, One-Piece Flow

“This is a factory
not a warehouse!”

Culture Change

- Continual Improvement
- Waste Elimination Culture
 - Metrics Driven
- Supply Chain Investment
 - Operations-Based
- Employee Involvement
- Whole System View



Lean significantly improves environmental performance.

- Resource productivity improvements of 30-70% are common in a short timeframe.
- Lean produces an operational & cultural environment highly conducive to waste minimization, pollution prevention, and sustainability.
 - Lean fosters a continual improvement, waste-elimination culture that involves workers in teams.
 - Focus on right-sized, simple operations/equipment
 - Long-term lean focus on product/process design to “deliver only what the customer wants”
- Environmental wastes are embedded in wastes targeted by lean—lean thus creates environmental “coattails.”

Lean Production's Environmental "Coattails"

- Less scrap, fewer defects, less spoilage = **reduced waste**
- Fewer defects, less overproduction, simpler products, right-sized equipment = **reduced use of raw materials**
- Less storage, inventory space needed = **reduced materials, land, and energy consumed**
- Less overproduction, lighting/heating/cooling unneeded space, oversized equipment = **less energy use**
- Less overprocessing, more efficient transport and movement = **lower emissions**
- Clean, orderly workplace w/ well-maintained equipment = **fewer accidents; leaks & spills are noticed quickly**

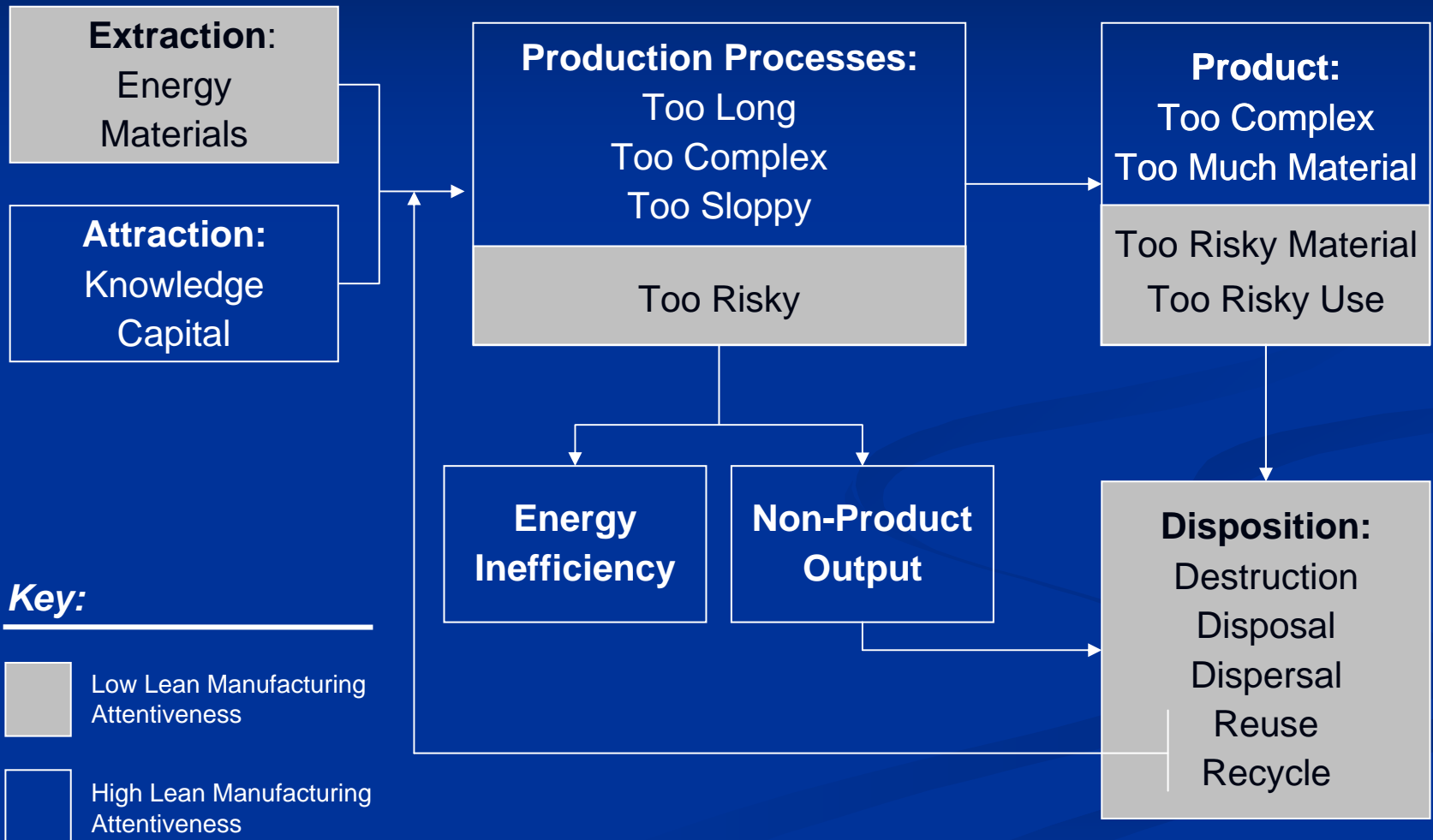
Examples of Environmental Improvements

- Goodrich Aerostructures:
 - Eliminated four 5,000 gallon tanks w/ methyl ethyl ketone, sulfuric acid, nitric acid, trichloroethane
 - Eliminated the potential for spills & need to address Clean Air Act risk management planning requirements
- General Motors/Saturn:
 - Reduced hazardous waste generation from 9.0 lbs per car in 1992 to 3.2 lbs per car in 1996
 - Receives over 95% of parts in reusable containers
- The Boeing Company:
 - 30 to 70% resource productivity improvements
 - 12% less chemical usage per plane

Lean can produce more environmental gains by addressing environmental “blind spots.”

- Hidden environmental waste (*muda*) is often buried in overhead and facility support costs
- Environmental and human health risks are often not considered in lean initiatives
- Understanding customer wants and needs related to environment can identify waste throughout the product lifecycle

Lean "Blind Spots": Risk and Lifecycle Impacts



Examples of Addressing Environmental Blind Spots

- Toyota Motor Company:
 - Generating competitive advantage by understanding customer preferences related to environment (hybrid synergy drive in Prius)
- Allsteel (furniture manufacturer, part of HNI Corp.):
 - Captured \$60 million contract from California under new environmental procurement guidelines by incorporating Design for Environment tools into lean product design
- Rockwell Collins (electronics manufacturer):
 - Prepared checklists for lean teams to reduce non-compliance risk and to encourage pollution prevention
 - *Kaizen* events targeting environmental challenges

Lean can result in regulatory “friction” around envi. processes.

- Regulatory friction (uncertainty, delay) from:
 - Uncertainty/confusion about how requirements apply & acceptable compliance strategies for cellular layout with flexible, right-sized equipment
 - Regulatory time frames are often poorly aligned with the operational time frames from lean implementation
- Key areas of regulatory friction:
 - Air permitting and ability to make rapid changes
 - Shifting to chemical point-of-use systems can raise compliance questions and uncertainty under RCRA

Environmental Regulatory Friction – Implications

- Varied responses among companies:
 - *Significant environmental and economic improvement opportunities are left on the table*
 - Lean implementation efforts can be delayed
 - Potential compliance issues could arise
- Efforts to address regulatory friction:
 - EPA pilot project with Baxter Healthcare (Mountain Home, AR facility) to adapt air permitting approaches to accommodate rapid change & mobile, right-sized equipment

Lessons Learned: Lean Can Help Meet Environmental Goals

- Culture and approaches used in lean and environmental management systems (EMSs) are compatible, but differ
- Significant environmental benefits come along for the ride on lean coattails
- Lean offers valuable “market opportunities” for pollution prevention (P2) expertise & tools
- Linking to operations-driven lean initiatives can help P2 “compete,” not just “pay”

Lessons Learned: Improving Environmental Benefits of Lean

- Lean can produce greater environmental gains by addressing its blind spots (risk, lifecycle impacts):
 - Involve environmental personnel in lean events
 - Integrate environmental considerations into lean tools
 - Use lean methods to target environmental endpoints
- Removing regulatory friction associated with lean through guidance and innovation could improve environmental performance
- Lean could be used to improve efficiency and effectiveness of envi. agency processes

What is EPA Doing on Lean?

- Formed a Lean & Environment Steering Committee with headquarters offices, regions, and states
- Working through existing EPA & state environmental programs (Design for Environment, Green Suppliers Network, Performance Track, etc.)
- Identifying agencies/organizations to work with to:
 - Share good “lean & environment” practices and success stories
 - Develop integrated lean/environmental tools
 - Identify environmental regulatory friction with lean
 - Apply lean techniques to governmental processes

For more information on lean and the environment...

- EPA's Lean & Environment website:
<http://www.epa.gov/innovation/lean.htm>
 - Includes the Shingo Prize winning report, *Lean Manufacturing and the Environment*
- Points of Contact:
 - Jennifer Tice, jennifer.tice@ross-assoc.com
 - EPA: Mitch Kidwell (kidwell.mitch@epa.gov) or José Labiosa (labiosa.jose@epa.gov)