15.561A: Information Systems: From Technology Infrastructure to the Networked Corporation

15.566: Information Technology as an Integrating Force in Manufacturing

Class #7: INFORMATION TECHNOLOGY IN LOGISTICS AND OPERATIONS

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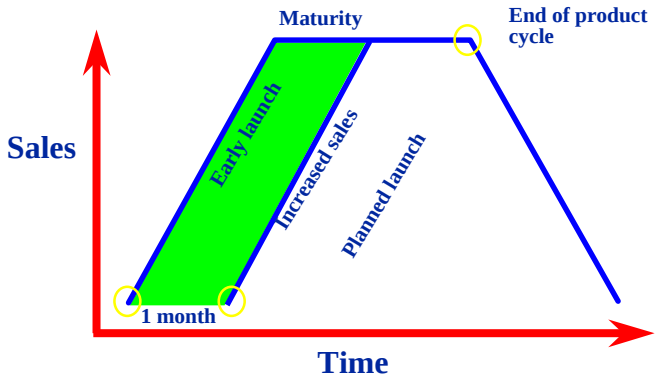
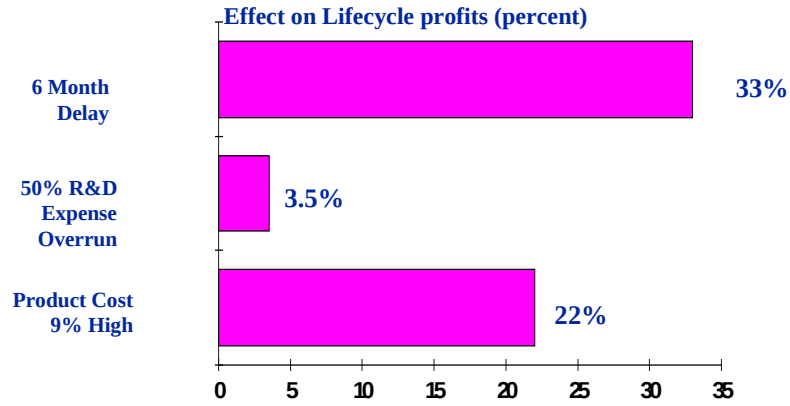
SPEEDING PRODUCT DESIGN CYCLE IS CRITICAL

How important is time to market?



A one-month savings in development time translates into one additional month of mature sales.

THE VALUE OF SPEED



Price-Eroding Market
5 Year Life

Source: McKinsey & Co.

TRADITIONAL DESIGN CYCLE

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- **Marketing requests product**
  - specifies product characteristics: functionality, cost, volume
- **Engineering designs product**
- **Product Development Lab**
  - produce prototype
- **Pilot Lab**
  - limited quantities
  - learn how to manufacture
- **Commercial scale production**

TRADITIONAL DESIGN CYCLE (Cont'd)

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  - specifies product characteristics: functionality, cost, volume
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PROBLEMS IN TRADITIONAL DESIGN

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- Complexity
- Cost
- Quality problems and design errors
- Proliferation of parts, problems in management of materials and inventories

IMPROVING THE DESIGN/MANUFACTURING PROCESS

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- **Technology Solutions**
  - CAD (Computer-Aided Design)
  - CAM (Computer-Aided Manufacturing)
  - Electronic File Transfer
  - CIM (Computer Integrated Manufacturing)
  - FMS
- **Organizational Solutions**
  - Manufacturing Cells
  - DFM (Design for Manufacturing)
  - Cross-functional teams
  - Concurrent Engineering

DESIGN FOR MANUFACTURING

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- **Goals**
  - Design a product that is right the first time
  - Improve manufacturability
  - Overlap design, development and manufacturing
- **Obstacles**
  - Asymmetry of design-manufacturing relationship
  - Functional Organizational Structure
  - Paper-based systems
  - Hardware and Software incompatibility
  - Data incompatibility
  - Sequential and Compartmentalized Design Process
  - Poor Communication
  - Physical Distance
  - Cultural Differences
  - Incentive/Reward Systems

PROMOTING DFM

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- Inhibitors → facilitators
  - asymmetrical relationship → symmetrical
  - different perspectives → common goals
  - rewards by function → rewards by objectives
  - communication obstacles → common culture
  - uncoordinated processes → tight coordination
- Technologies
  - CAD
  - direct file transfer CAD → CAM
  - database of materials, components, subassemblies, process capabilities available to designers
  - Computer-Aided Education and Instruction (CAD/CAI)
  - Standards, Networks, Infrastructure

PROMOTING DFM (Cont'd)

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- Organizational solutions
  - rotate design engineers to manufacturing
  - involve manufacturing early in design cycle
  - promote cross-functional teams
  - provide incentives and rewards
  - reduce physical distance
- Cultural solutions
  - education on importance of DFM
  - improve organizational status of manufacturing
  - attract high quality people in manufacturing
- DFM projects can have high technology risk
  - typically large size
  - typically low organizational experience
  - typically high degree of integration

DFM SUMMARY

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- **Key issue: integrate the organizational components involved in design**
  - **create cross-functional teams, taskforces**
  - **involve manufacturing, design, marketing**
  - **involve customers, suppliers**
- **Product function analysis**
  - **engineer the function**
  - **reduce number of parts**
  - **example: Volvo dashboards**
- **Design for easiness to manufacture**
  - **fit existing machines, capabilities**
  - **reduce number of parts**
  - **reuse existing parts and component assemblies**
  - **modular components to maximize reuse**
  - **"jigless manufacturing"**

THE SEVEN ELEMENTS OF "QUICK RESPONSE" SYSTEMS

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- **1. Effective Information Architecture across channel**
  - **Product identification and tracking, such as bar-coding or shipping container marking**
  - **Data and/or Image transfer**
    - EDI, RF transmissions, email, fax, digital camera, videoconferencing
- **2. Shortened Product Development Cycles**
  - **CAD, component databases, Electronic file transfer**
- **3. Effective Use of Test-marketing Information**
- **4. Effective Forecasting and Replenishment**
  - **Getting the suppliers involved!**

THE SEVEN ELEMENTS OF "QUICK RESPONSE" SYSTEMS (Cont'd)

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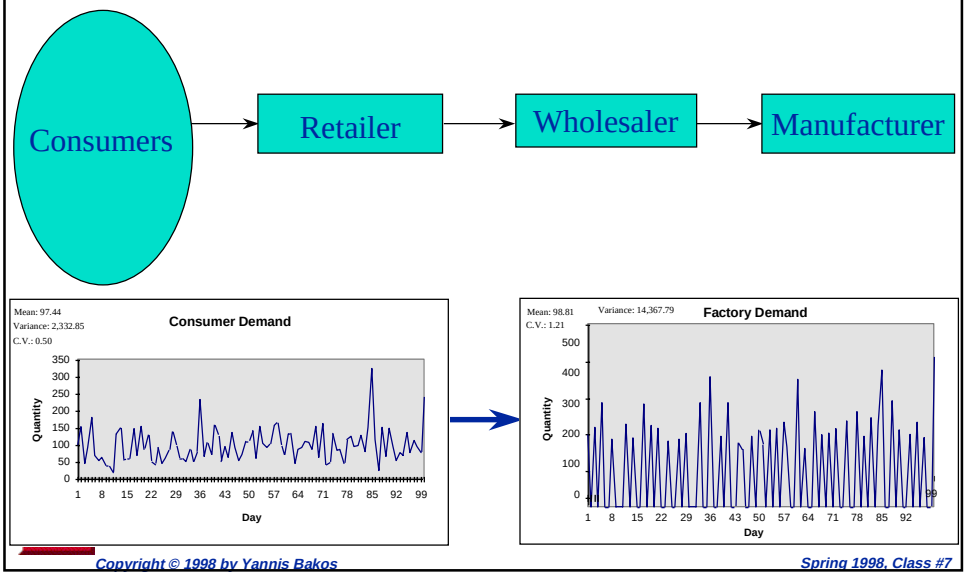
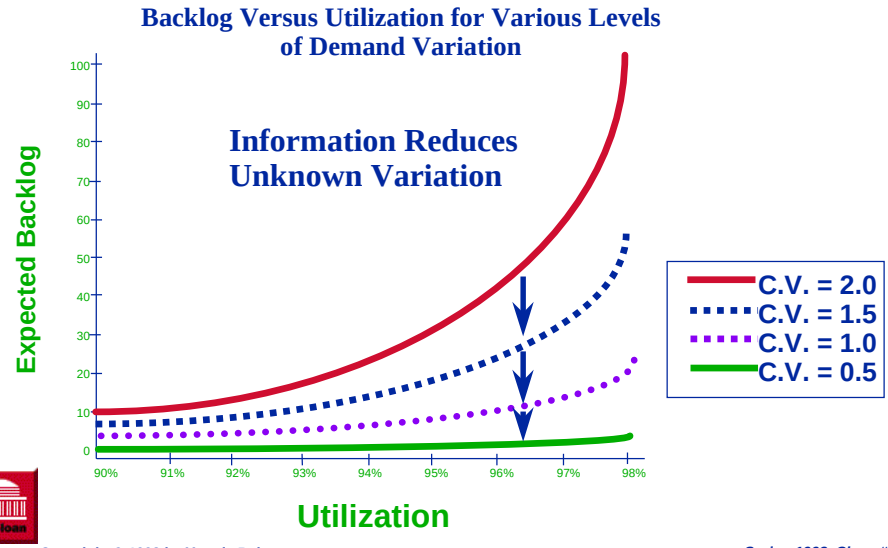
- **5. Rapid Order Fulfillment**
  - Effective inventory management and shipping systems
- **6. Short-Cycle Manufacturing**
  - Manufacturing Cells
  - FMS (Flexible Manufacturing Systems) and single-unit lot sizes
- **7. Transformation of Corporate Culture**

THE BULLWHIP EFFECT



THE VALUE OF INFORMATION



LOGISTICS

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- The process by which companies move materials, parts and products to customers
- Logistics as a competitive strategy
  - companies can use excellence in logistics to support competitive strategies based on price, delivery and customer support
- Where do the costs come from?
  - Handling and financing high inventories and buffer stocks
  - Lost sales

LOGISTICS (Cont'd)

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- A lot easier to get cost out of supply chain than out of manufacturing!
  - A complex process
  - Many cooks spoil the broth
  - Lots of "invisible" costs
- Improving Logistics
  - Reengineer the Supply Chain
  - Rethink strategy (e.g., promotional vs. EDLP pricing in the grocery industry)
  - Use the Specialists: FedEx, Ryder, etc.
- Big Payoffs
  - National Semiconductor
  - Laura Ashley, Benneton, Liz Clairborne, The Limited
  - Dell, Compaq
  - Desert Storm

LOGISTICS (Cont'd)

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- Tools and buzzwords
  - IT for coordination (planning and communication)
  - OR models
  - Activity Based Costing (ABC)
  - EDI and other electronic links with customers and suppliers
  - Cross-Docking
  - Build-to-Order
  - "Pull" systems
- Results
  - 10% to 70% reduction in logistics costs