15.760: Cisco/MRP/ERP

1. Admin: Peapod, Questions/Feedback
2. What were the lessons of the Beer Game?
3. How does production control work in the beer game?
4. Explain the purpose and logic of MRP.
5. What is the function of Cisco’s ERP system?
Volatility Amplification in the Supply Chain: “The Bullwhip Effect”

How does production control work in the Beer Game?

Information lags
Delivery lags
Over- and underordering
Misperceptions of feedback
Lumpiness in ordering
Chain accumulations

SOLUTIONS:
Countercyclical Markets
Countercyclical Technologies
Collaborative channel mgmt.
(Cincinnati Milacron & Boeing)
Applying EOQ and Newsvendor models to set Reorder Points and Reorder Quantities 

\((s, S)\) (ROP, ROQ), (min, max)

\[ Q = \sqrt{\frac{2RS}{\text{CK}}} \]

\[ = \text{ROQ (REORDER QUANTITY)} \]

ROP=Reorder Point = Expected Demand During the order lead time + safety stock 

\[ = E\{\text{DDL}\} + SS \]

Prob \( \{\text{DDL} \leq \text{ROP}\} \) = \(\frac{\text{Cu}}{\text{Co}+\text{Cu}}\)

Cu=Cost of Underage \((r-c\) in newsvendor); Co=Cost of Overage \((c\) in newsvendor)

But, Co with nonperishables is \(c \times \text{cost of holding}\)

ROP=SS+E\{DDL\}; \( \text{DDL} = X_1 + X_2 + \ldots + X_L; \ E\{\text{DDL}\} = E\{L\} \times E\{X\} \)

i.e., DDL has a mean of Expected lead time x Expected avg demand/unit time

\[ \text{Variance}\{\text{DDL}\} \sim \text{Var}\{X\} \times E\{L\} + \text{Var}\{L\} \times E\{X^2\} \]
What is the Purpose and Logic of MRP?

- **Inventory Transactions**
- **Inventory Status**
- **Master Production Schedule**
- **MRP: (Explosion Offsets, Nets)**
- **Exception Report & Schedules**
- **Bill of Materials**
- **Forecasts**
- **Customer Orders**
- **Engineering Changes**
What is the Purpose and Logic of MRP?

• Coordination of Production and Inventory in large, multi-stage production systems
• Used for
  - Scheduling & re-scheduling
  - Capacity Planning
  - Supplier coordination (internal & external)
• Timely dissemination of information
• Time-phased production & procurement
  - with lead time offsets & BOM explosions
• Independent vs. Dependent demand
• Requires centralized information system; hence ERP
• Organizes large complex production and delivery coordination requirements
Criticisms of MRP

- Deterministic Model
- Push system
- Poor data ==> GIGO
- Self-fulfilling lead times
- Difficult/costly to install & maintain
- Centralized command & control mindset
Cisco’s End-to-End Integration for its Fulfillment Supply Chain

- New product development on-line with supply base
- Technology Supply Chain Design: Innovation through Acquisition
- Single enterprise information system
- Dynamic replenishment, direct fulfillment, merge in transit
- Customer orders through Cisco Connection online

Basic Design Principle: Arm’s length Relationship with Fulfillment Chain Partners
Cisco’s Strategy for Technology Supply Chain Design

1. Integrate technology around the router to be a communications network provider.
2. Leverage acquired technology with
   - sales muscle and reach
   - end-to-end IT
   - outsourced manufacturing
   - market growth
3. Leverage venture capital to supply R&D

Basic Design Principle: Acquisition Relationship with Technology Chain Partners
Volatility Amplification in the Supply Chain: "The Bullwhip Effect"

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Supply Chain Volatility Amplification: Machine Tools at the tip of the Bullwhip

“We are experiencing a 100-year flood.” J. Chambers, 4/16/01

LESSONS FROM A FRUIT FLY:  
**CISCO SYSTEMS**

1. KNOW YOUR LOCATION IN THE VALUE CHAIN
2. UNDERSTAND THE DYNAMICS OF VALUE CHAIN FLUCTUATIONS
3. THINK CAREFULLY ABOUT THE ROLE OF VERTICAL COLLABORATIVE RELATIONSHIPS
4. INFORMATION AND LOGISTICS SPEED DO NOT REPEAL BUSINESS CYCLES OR THE BULLWHIP.