

# Outline Chapter 17: Supply Chain Coordination

---

- ◆ Supply Chain Coordination and the Bullwhip Effect
- ◆ Effect on Performance from Lack of Coordination
- ◆ The Problem: Obstacles to Coordination in a Supply Chain
- ◆ The Potential Solutions: Managerial Levers to Achieve Coordination
- ◆ Achieving Coordination in Practice
  - Continuous Replenishment (CRP) and Vendor-Managed Inventories (VMI)
  - Collaborative Planning, Forecasting, and Replenishment (CPFR)

# Supply Chain Coordination and the Bullwhip Effect



- ◆ **Supply chain coordination:** all stages in the supply chain take actions together (usually results in greater total supply chain profits)
  - requires that each stage take into account the effects of its actions on the other stages
  
- ◆ **Lack of coordination results when:**
  - The objectives of different stages are conflicting  
and / or
  - Information moving between stages is distorted
  
- ◆ **Bullwhip Effect:** The distortion of demand information as it is transmitted up the demand chain

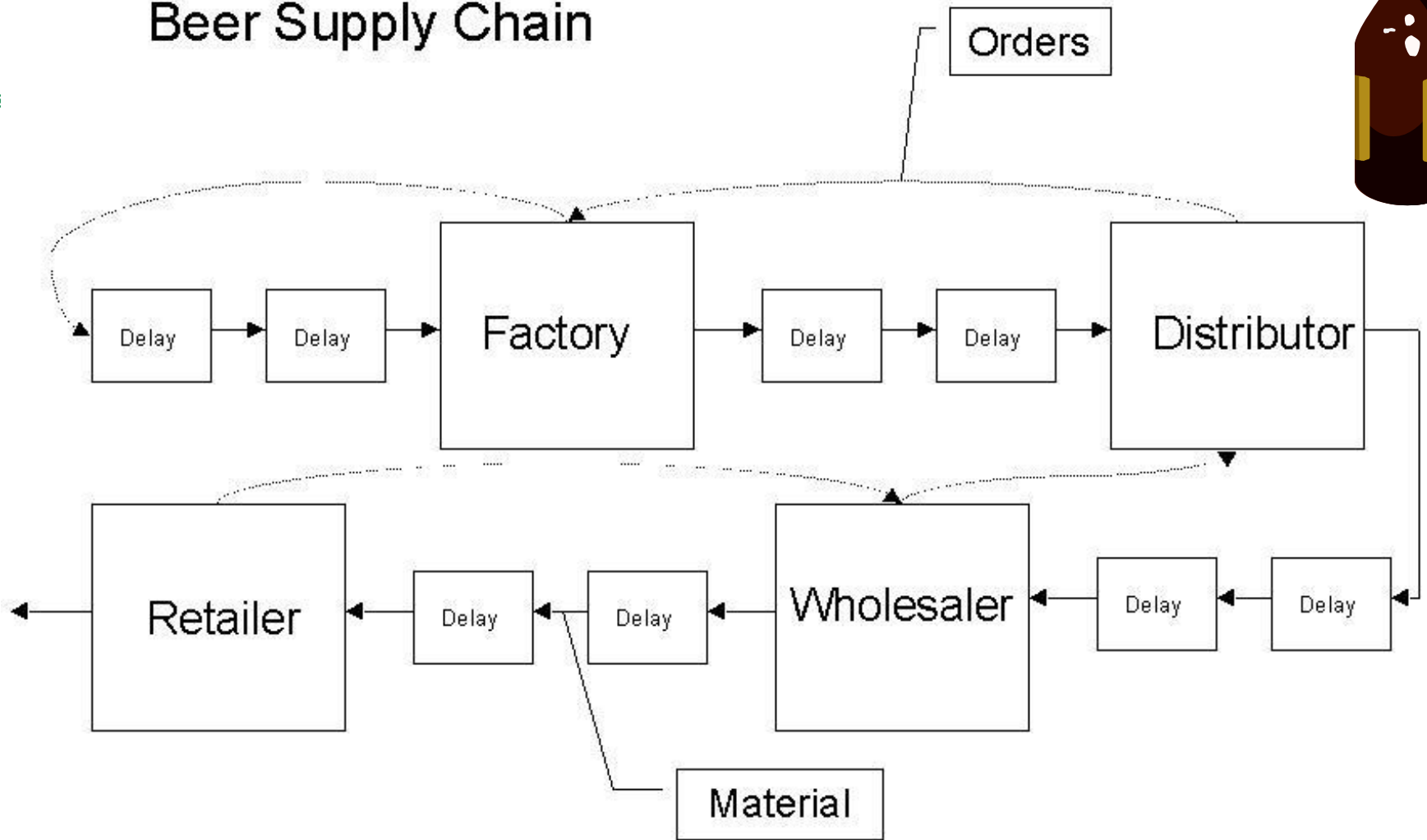
# The Beer Game: a B-school Tradition

---



- ◆ A Team consists of 4 positions: Retailer, Wholesaler, Distributor and Factory
  - Every position can see its inventory now, and expected deliveries for the next 2 periods.
- ◆ Everyone is trying to minimize their costs, both as a player **and as a team**
  - Inventory costs (\$1 holding cost per period)
  - Stock-out costs (\$2 fee per period shorted)
- ◆ Obstacles
  - No advance knowledge of orders
  - No knowledge of what the other positions see for demand
  - No communication between team positions allowed!
  - You can't cancel backorders
  - There is a 2 period lead-time between each stage
- ◆ See the “getting started” document

# Beer Supply Chain



# The Beer Game: Details

---



- ◆ You have two decisions each period –1) How much to **ship**?  
2) How much to **order** (or **make** if you are the factory) ?
  - You will be prevented from shipping more than is demanded (current demand plus backordered demand) - No pushing of product is allowed!
  - Game will not allow to ship more than you have in inventory
  - You cannot cancel an order once placed. (Also, there is no visibility to your past orders. If you wish to record this, you must do so *on paper*)
- ◆ You must click on “Submit Button” to enter decision
- ◆ One everyone has entered all information, the game master (professor) will then advance the clock to the next period
- ◆ Once that happens, you must ask for a status update
  - **Refresh** your web browser to make sure you are in the right period

# The Beer Game: Interface



- ◆ Sample of Retailer screen- left part is for decision, right part provides information:

Update the current status of the Retailer.

[Retailer Status](#) [Retailer Graph](#)

Retailer Decision Form.

How many cases do you want to ship?

How many cases do you want to order?

To submit your decision, press this button:

Retailer Decision

Status Report: Retailer-1    Period = 19

Current Demand = 15

Backorder = 99

Current Shipment = 0

On Hand = 28

Due Next Period = 0

Due In Two Periods = 40

Current Order Release = 0

Inventory Cost = 69

Backorder Cost = 1646

Total Cost = 1715

22:20:27 11-01-2003

# Interface Intricacies



- ◆ Once you enter these and click on the button, if you refresh, you will then see them reflected, with your on-hand updated.
- ◆ At the *start* of a new period the “Current Order” and “Current Shipment” are at 0.
- ◆ You can re-enter decisions (until the clock is advanced)
- ◆ See the **Before** and **After** screens (just below)

Status Report: Factory-2    Period = 25

Current Demand = 10  
Backorder = 15

Current Shipment = 0

On Hand = 21

Due Next Period = 10  
Due In Two Periods = 0

Current Order Release = 0

Inventory Cost = 209  
Backorder Cost = 1100  
Total Cost = 1309  
23:35:18 11-11-2004

Status Report: Factory-2    Period = 25

Current Demand = 10  
Backorder = 15

Current Shipment = 21  
On Hand (after shipment is sent) = 0

Due Next Period = 10  
Due In Two Periods = 0

Current Order Release = 11

Inventory Cost = 209  
Backorder Cost = 1100  
Total Cost = 1309  
11:46:15 11-12-2004

# Final Points to Remember

---



- ◆ You can see what your supplier will ship to you, but unless you are the factory (where you can make as much beer as you want), you may not get shipped what you want!
  - » If your supplier shorts you, then it appears as their back-order (and costs them!)
- ◆ The “back-order” displayed is from your direct customers. It never goes away until you satisfy that demand.
  - You should try to get rid of it, as it costs you money!

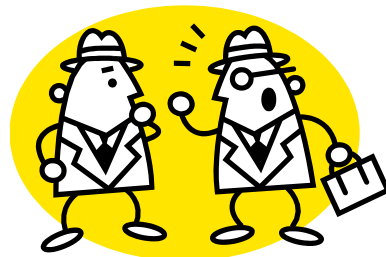


# Beer Game Debrief

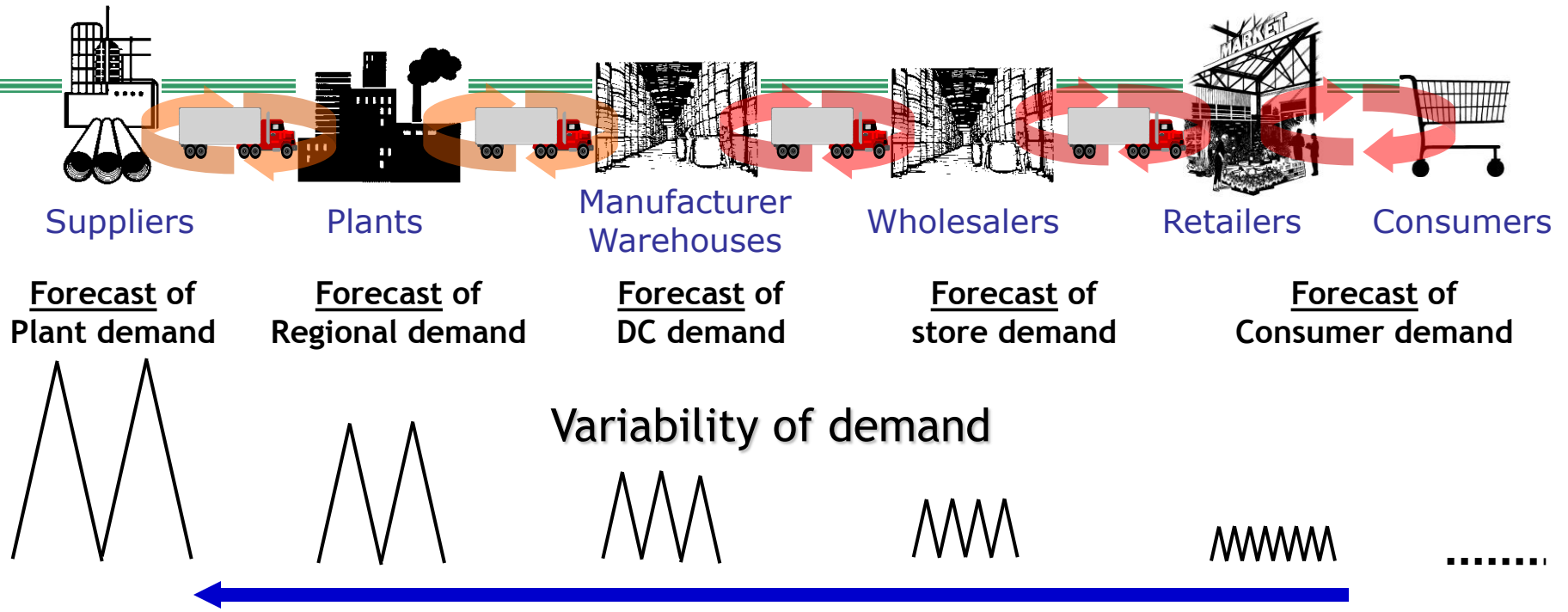
---



- ◆ Did the system perform as you wished?
  - Did you ever have too much or too little inventory?
  - Were you ever surprised by the amount ordered by your client or by the amount delivered from your supplier? Was it ever too high? Strangly low?
- ◆ What is realistic and what is unrealistic about the game?
- ◆ What are ways we might improve the performance of this supply chain?



# Bullwhip Effect



- ◆ Fluctuations in orders increase as they move up the supply chain from retailers to wholesalers to manufacturers to suppliers
- ◆ Distorts demand information within the supply chain
  - different stages have different estimates of what demand looks like
- ◆ Results in a loss of supply chain coordination

# The Effect of Lack of Coordination on Performance

---

The **bullwhip effect** reduces supply chain profitability by making it more expensive to provide to a given level of product availability

- Manufacturing cost (increases)
- Inventory cost (increases)
- Replenishment lead time (increases)
- Transportation cost (increases)
- Labor cost for shipping and receiving (increases)
- Level of product availability (decreases)
- Waste within the supply chain (increases)
- Relationships across the supply chain (worsens)
- Profitability (decreases)

# The Problem: Obstacles to Coordination in a Supply Chain

---

1. Incentive Obstacles
2. Information Processing Obstacles
3. Operational Obstacles
4. Pricing Obstacles
5. Behavioral Obstacles

# 1. Incentive Obstacles

---

- ◆ When incentives offered to different stages or participants in a supply chain lead to actions that increase variability and reduce total supply chain profits – misalignment of total supply chain objectives and individual objectives
- ◆ Local optimization within functions or stages of a supply chain
- ◆ Sales force incentives (e.g. Pharmaceutical sales)

## 2. Information Processing Obstacles

---

- ◆ When demand information is distorted as it moves between different stages of the supply chain, leading to increased variability in orders within the supply chain
- ◆ Forecasting based on orders, not customer demand
  - As we have seen, forecasting demand based on orders magnifies demand fluctuations moving up the supply chain from retailer to manufacturer
- ◆ Lack of information sharing

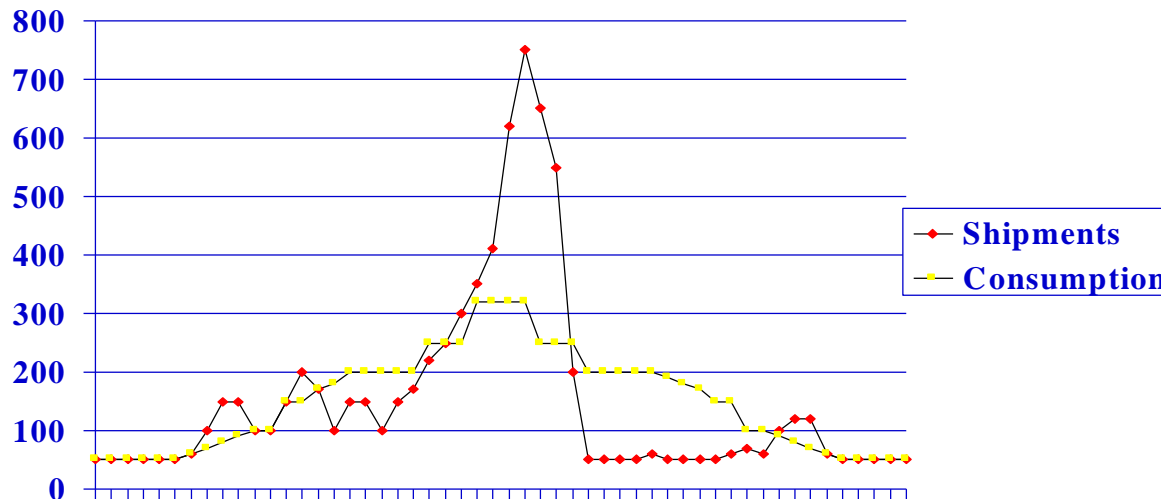
# 3. Operational Obstacles

---

- ◆ Actions taken in the course of placing and filling orders that lead to an increase in variability
- ◆ Ordering in large lots (much larger than dictated by demand)
- ◆ Large replenishment lead times
- ◆ Rationing and shortage gaming (common in the computer industry because of periodic cycles of component shortages and surpluses)

# 4. Pricing Obstacles

- ◆ When pricing policies for a product lead to an increase in variability of orders placed
- ◆ Lot-size based quantity decisions
- ◆ Price fluctuations (resulting in forward buying)





# 5. Behavioral Obstacles

---

- ◆ Problems in learning, often related to communication in the supply chain and how the supply chain is structured
- ◆ Each supply chain stage views its actions locally and is unable to see its impact on other stages
- ◆ Different stages react to the current local situation rather than trying to identify the root causes
- ◆ Based on local analysis, different stages blame each other for the fluctuations, with successive stages becoming enemies rather than partners
- ◆ No stage learns from its actions over time because the most significant consequences of the actions of any one stage occur elsewhere, resulting in a vicious cycle of actions and blame
- ◆ Lack of trust results in opportunism, duplication of effort, and lack of information sharing

# Potential Solutions: Managerial Levers to Achieve Coordination

---

1. Aligning Goals and Incentives
2. Improving Information Accuracy
3. Improving Operational Performance
4. Designing Pricing Strategies to Stabilize Orders
5. Building Strategic Partnerships and Trust

# Aligning Goals and Incentives

---

- ◆ Align incentives so that each participant has an incentive to do the things that will maximize total supply chain profits
- ◆ Align incentives across functions
- ◆ Pricing for coordination
- ◆ Alter sales force incentives from sell-in (to the retailer) to sell-through (by the retailer)

# Improving Information Accuracy

---

- ◆ Sharing point of sale (POS) data
- ◆ Collaborative forecasting and planning
- ◆ Single stage control of replenishment
  - We will discuss this later in:
    - Continuous replenishment programs (CRP)
    - Vendor managed inventory (VMI)

# Improving Operational Performance

---

- ◆ Reducing replenishment lead time
  - Reduces uncertainty in demand
  - EDI is useful
- ◆ Reducing lot sizes
  - Computer-assisted ordering, B2B exchanges
  - Shipping in LTL sizes by combining shipments
  - Technology and other methods to simplify receiving
  - Changing customer ordering behavior
- ◆ Rationing based on past sales and sharing information to limit gaming
  - “Turn-and-earn”
  - Information sharing

# Designing Pricing Strategies to Stabilize Orders

---

- ◆ Encouraging retailers to order in smaller lots and reduce forward buying
- ◆ Moving from lot size-based to volume-based quantity discounts (consider total purchases over a specified time period)
- ◆ Stabilizing pricing
  - Eliminate promotions (everyday low pricing, EDLP)
  - Limit quantity purchased during a promotion
  - Tie promotion payments to sell-through rather than amount purchased
- ◆ Building strategic partnerships and trust – easier to implement these approaches if there is trust

# Building Strategic Partnerships and Trust in a Supply Chain

---

- ◆ Designing a Relationship with Cooperation and Trust
- ◆ Managing Supply Chain Relationships for Cooperation and Trust
- ◆ Move to a trust-based relationship
  - Supply chain relationships are based on power or trust
  - Ultimately, trust-based relationships better than power-based
- ◆ Cooperation and trust work because:
  - Alignment of incentives and goals
  - Actions to achieve coordination are easier to implement
  - Supply chain productivity improves by reducing duplication or allocation of effort to appropriate stage
  - Greater information sharing results

# Achieving Coordination in Practice

---

- ◆ Quantify the bullwhip effect
- ◆ Get top management commitment
  - And then devote resources to coordination
- ◆ Focus on communication with other stages
  - Use information technology wisely
- ◆ Try to achieve coordination in the entire supply chain network
  - However, before attempting to change the world, may help to start simple (DC vs. Retail CPFR, pilot studies, etc)
- ◆ Share the benefits of coordination equitably
- ◆ Some examples follow....



# Continuous Replenishment and Vendor-Managed Inventories

---

- ◆ Over-arching idea: Remove inventory distortions by having a single point of replenishment
- ◆ Continuous RePlenishment, CRP – wholesaler, manufacturer or 3<sup>rd</sup> party replenishes based on POS data
- ◆ A type of CRP is VMI – where the manufacturer/supplier is responsible for all decisions regarding inventory
  - Positives: less stockpiling of intermediate inventories, manufacturer may know more about the product and consumer demand patterns than retailer, e.g. MGM DVDs at Wal-Mart
  - Cons: Requires the manufacturer to have sophisticated IT and/or logistical support, as manufacturers will ignore other brands that may be near perfect substitutes, overall inventory levels may be higher

# Collaborative Planning, Forecasting, and Replenishment (CPFR)

---

- ◆ While they may still act individually (unlike CRP/VMI)...  
Sellers and buyers in a supply chain can still collaborate along any or all of the following:
  - Strategy and planning
  - Demand and supply management
  - Execution
  - Analysis
- ◆ Example: Henkel (German detergent) supplied into Grupo Eroski (supermarkets in Spain)
- ◆ Common scenarios: Retail event collaboration, assortment planning (especially for fashion/seasonal goods) DC and/or store replenishment
- ◆ Risks and Hurdles for a CPFR implementation

# Summary of Learning Objectives

---

- ◆ What is supply chain coordination and the bullwhip effect, and how does the bullwhip effect hurt supply chain performance?
- ◆ What are obstacles to coordination in the supply chain?
- ◆ What are the potential solutions to addressing these obstacles?
- ◆ What are some ways companies can do this in practice?