

Supply Chain Management

Prepared by Dr. Tarek Mohamed

MGM 660

Lecture 7



Coordination in a Supply Chain

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Course Agenda

Chapter 01

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1. Describe supply chain coordination and the bullwhip effect, and their impact on supply chain performance.
 2. Identify obstacles to coordination in a supply chain.
 3. Discuss managerial levers that help achieve coordination in a supply chain.
 4. Understand the different forms of collaborative planning, forecasting, and replenishment that are possible in a supply chain.
 5. Benefits of AI for supply chain coordination.

Lack of Supply Chain Coordination and the Bullwhip Effect

- **Supply chain coordination** – all stages of the chain take actions that are aligned and increase total supply chain surplus
- Requires that each stage share information and take into account the effects of its actions on the other stages
- **Lack of coordination results when:**
 - Objectives of different stages conflict
 - Information moving between stages is delayed or distorted

Common Coordination Practices Used by Companies

Company	Coordination Practice	Main Benefit
Walmart	Vendor-Managed Inventory (VMI)	Lower inventory and fewer stockouts
Toyota	Just-in-Time (JIT)	Reduced inventory and waste
Amazon	AI and real-time information sharing	Faster order fulfillment
Zara	Daily sales information sharing	Quick response to fashion trends
Dell	Build-to-Order production	Reduced inventory and product customization
Starbucks	Supplier collaboration	Consistent quality and supply
Apple	Global production coordination	Efficient worldwide product launches
Coca-Cola	Demand forecasting and distribution planning	Better product availability

Real-world examples of coordination in a supply chain across different companies and industries

- **Walmart**

- **Coordination Strategy: Vendor-Managed Inventory (VMI)**

- Walmart shares real-time sales and inventory data with suppliers.
- Suppliers monitor inventory levels and replenish products automatically.
- This coordination reduces stockouts, lowers inventory costs, and improves product availability.
- **Example:** Procter & Gamble receives Walmart's sales data and schedules production and deliveries accordingly.

- **Toyota**

- **Coordination Strategy: Just-in-Time (JIT) Production**

- Toyota coordinates closely with suppliers to deliver parts exactly when needed.
- Suppliers, manufacturers, and logistics providers work together using synchronized production schedules.
- This minimizes inventory while maintaining smooth production.

Real-world examples of coordination in a supply chain across different companies and industries

Amazon

Coordination Strategy: AI and Real-Time Data Sharing

- Amazon coordinates warehouses, suppliers, transportation providers, and delivery stations using AI.
- Customer orders automatically trigger inventory updates, warehouse picking, and delivery planning.
- This enables fast and reliable order fulfillment.

Zara

Coordination Strategy: Fast Fashion Supply Chain

- Zara shares customer sales data with designers and manufacturers every day.
- Production schedules are adjusted quickly based on demand.
- Stores receive new products within days instead of months.

This close coordination allows Zara to respond rapidly to changing fashion trends.

Real-world examples of coordination in a supply chain across different companies and industries

Dell Technologies

Coordination Strategy: Build-to-Order Manufacturing

- Customers place customized orders online.
- Dell immediately coordinates with component suppliers to obtain the required parts.
- Manufacturing begins only after the order is confirmed.
- Logistics partners coordinate deliveries directly to customers.

Starbucks

Coordination Strategy: Supplier Collaboration

- Starbucks coordinates with coffee farmers, exporters, processors, and distribution centers.
- Demand forecasts are shared throughout the supply chain.
- This helps maintain consistent quality and product availability worldwide.

Bullwhip Effect

- The **Bullwhip Effect** is a supply chain phenomenon in which **small changes in customer demand at the retail level cause increasingly larger fluctuations in demand and inventory as you move upstream**
(From **retailer** → **wholesaler** → **distributor** → **manufacturer** → **supplier**).
- **The Bullwhip Effect** is the amplification of demand variability as orders move up the supply chain from customers to suppliers, leading to excessive inventory, stockouts, and increased costs.
- The bullwhip effect moves a supply chain away from the efficient frontier by increasing cost and decreasing responsiveness.
- 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
- Results from a loss of supply chain coordination

Example

Imagine customers buy **100 bottles of water** this week instead of the usual **90**.

- **Retailer** orders **120 bottles** to avoid running out.
- **Wholesaler** interprets this as higher demand and orders **150 bottles**.
- **Manufacturer** expects demand to continue rising and produces **200 bottles**.
- **Supplier** purchases even more raw materials.

Although customer demand increased by only **10 bottles**, the production and ordering increased much more, creating excess inventory and higher costs.

- Panic buying or shortage gaming.

Causes of the Bullwhip Effect

- Lack of communication and information sharing.
- Demand forecasting errors.
- Bulk ordering (order batching).
- Price fluctuations and promotions.
- Panic buying or shortage gaming.

Effects

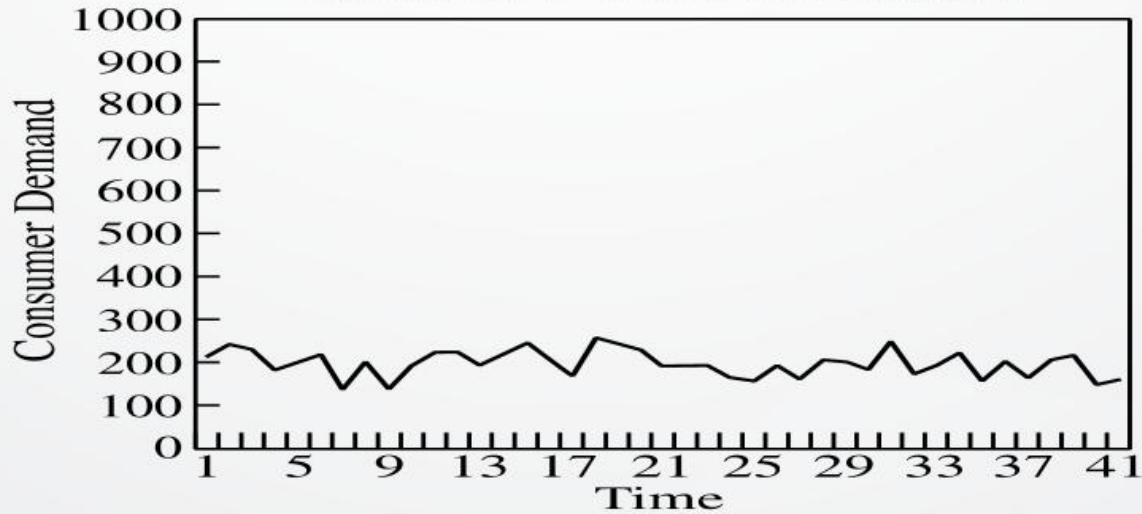
- Excess inventory.
- Stock shortages.
- Increased warehousing costs.
- Higher transportation costs.
- Poor customer service and reduced profitability.

Ways to Reduce the Bullwhip Effect

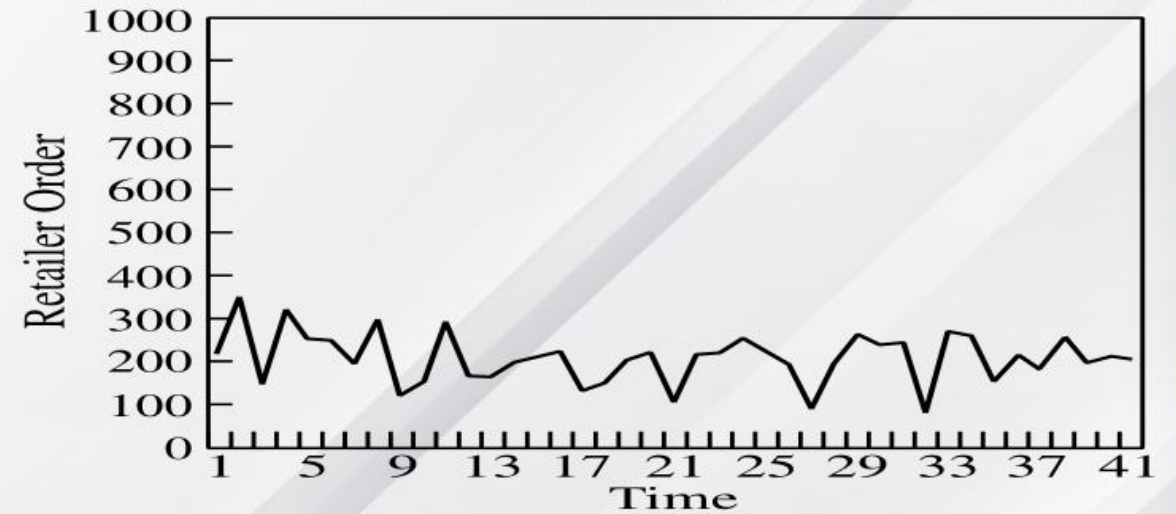
- Share real-time demand information across the supply chain.
- Improve demand forecasting.
- Reduce order batching by ordering more frequently.
- Stabilize prices and avoid excessive promotions.
- Strengthen collaboration among supply chain partners.

Demand at Different Stages

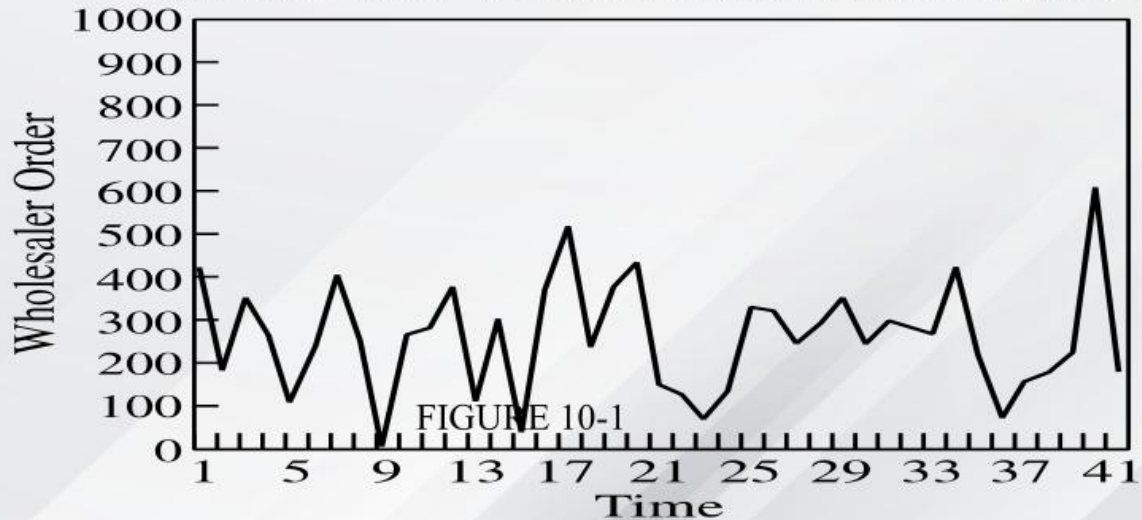
Consumer Sales at Retailer



Retailer's Orders to Wholesaler



Wholesaler's Orders to Manufacturer



Manufacturer's Orders with Supplier



FIGURE 10-1

- Lack of coordination increases variability and hurts supply chain surplus
- **Impact on costs**
 - Manufacturing cost
 - Inventory cost
 - Replenishment lead time
 - Transportation cost
 - Labor cost for shipping and receiving
 - Level of product availability
 - Relationships across the supply chain

The Effect on Performance

Performance Measure

Impact of the Lack of Coordination

Manufacturing cost

Increases

Inventory cost

Increases

Replenishment lead time

Increases

Transportation cost

Increases

Shipping and receiving cost

Increases

Level of product availability

Decreases

Profitability

Decreases

Key Point

The lack of coordination hurts both responsiveness and cost in a supply chain by making it more expensive to provide a given level of product availability.

Obstacles to Coordination in a Supply Chain

- Incentive Obstacles
- Information Processing Obstacles
- Operational Obstacles
- Pricing Obstacles
- Behavioral Obstacles

Incentive Obstacles

- **An incentive obstacle** occurs when each member of the supply chain (supplier, manufacturer, distributor, retailer, or salesperson) is rewarded based on its own performance rather than the performance of the entire supply chain.
- Occur when incentives offered to different stages or participants in a supply chain lead to actions that increase variability and reduce total supply chain profits
 - Local optimization within functions or stages of a supply chain
 - Sales force incentives
- As a result, each participant makes decisions that maximize its own benefit, even if those decisions harm the overall supply chain.

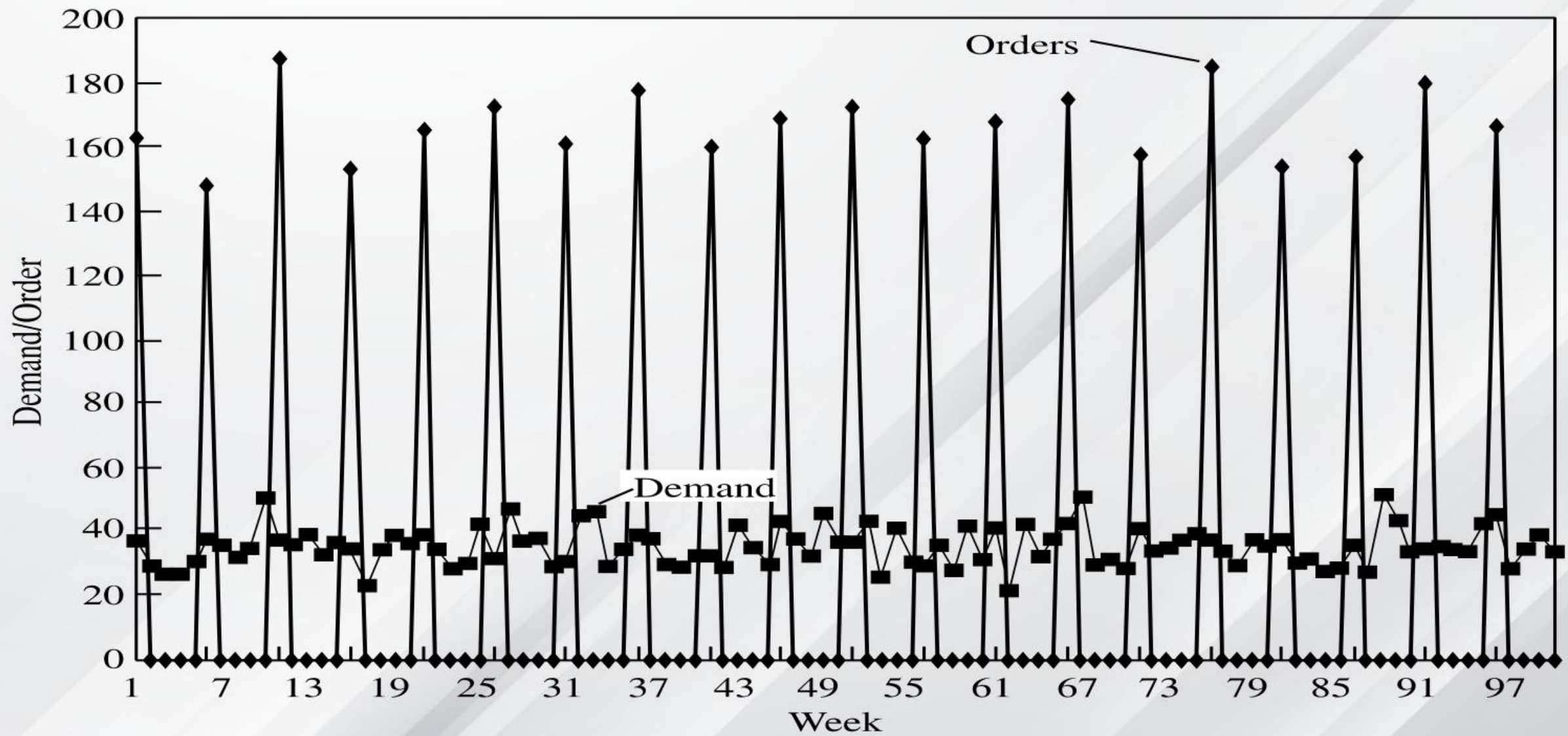
Information Processing Obstacles

- 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 and not customer demand
 - Lack of information sharing

Operational Obstacles

- Occur when placing and filling orders lead to an increase in variability
 - Ordering in large lots
 - Large replenishment lead times
 - Rationing and shortage gaming

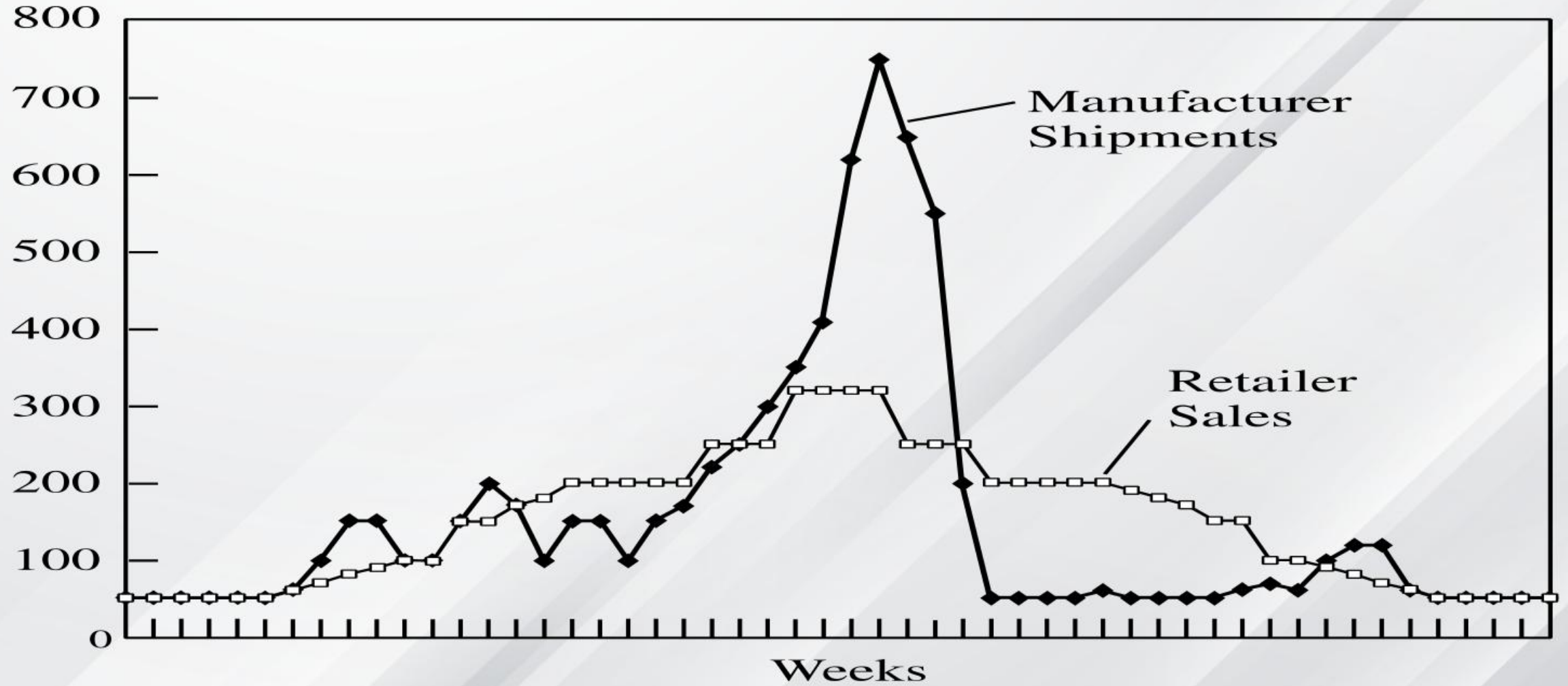
Operational Obstacles



Pricing Obstacles

- When pricing policies for a product lead to an increase in variability of orders placed
 - Lot-size based quantity decisions
 - Price fluctuations

Pricing Obstacles



- **Problems in learning within organizations that contribute to information distortion**
 1. Each stage of the supply chain views its actions locally and is unable to see the impact of its actions on other stages
 2. Different stages of the supply chain react to the current local situation rather than trying to identify the root causes
 3. Different stages of the supply chain blame one another for the fluctuations
 4. No stage of the supply chain learns from its actions over time
 5. A lack of trust among supply chain partners causes them to be opportunistic at the expense of overall supply chain performance

Managerial Levers to Achieve Coordination

- Aligning goals and incentives
- Improving information accuracy
- Improving operational performance
- Designing pricing strategies to stabilize orders
- Building strategic partnerships and trust
- Cooperation and trust within the supply chain help improve performance for a variety of reasons
- Supply chain coordination improves if all stages of the chain take actions that are aligned and together increase total supply chain surplus

Aligning Goals and Incentives

- **Align goals and incentives so that every participant in supply chain activities works to maximize total supply chain profits**
- Align goals across the supply chain
- Align incentives across functions
- Pricing for coordination
- Alter sales force incentives from sell-in (to the retailer) to sell-through (by the retailer)

- Sharing customer demand data
- Implementing collaborative forecasting and planning
- Designing single-stage control of replenishment
 - Continuous replenishment programs (CRP)
 - Vendor managed inventory (VMI)

Key Point

Demand planning at each stage in a supply chain based on the stream of orders received from its down- stream stage results in a magnification of fluctuation in orders as one moves up the supply chain from the retailer to the manufacturer.

It is better for the entire supply chain to forecast based on end customer demand.

Improving Operational Performance

- Reducing replenishment lead time
- Reducing lot sizes
- Rationing based on past sales and sharing information to limit gaming

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
 - Stabilizing pricing
 - Building strategic partnerships and trust

Continuous Replenishment and Vendor-Managed Inventories

- A single point of replenishment
- CRP – wholesaler or manufacturer replenishes based on POS data
- VMI – manufacturer or supplier is responsible for all decisions regarding inventory
- Substitutes

Collaborative Planning, Forecasting, and Replenishment (CPFR)

- **Sellers and buyers in a supply chain may collaborate along any or all of the following**
 1. Strategy and planning
 2. Demand and supply management
 3. Execution
 4. Analysis

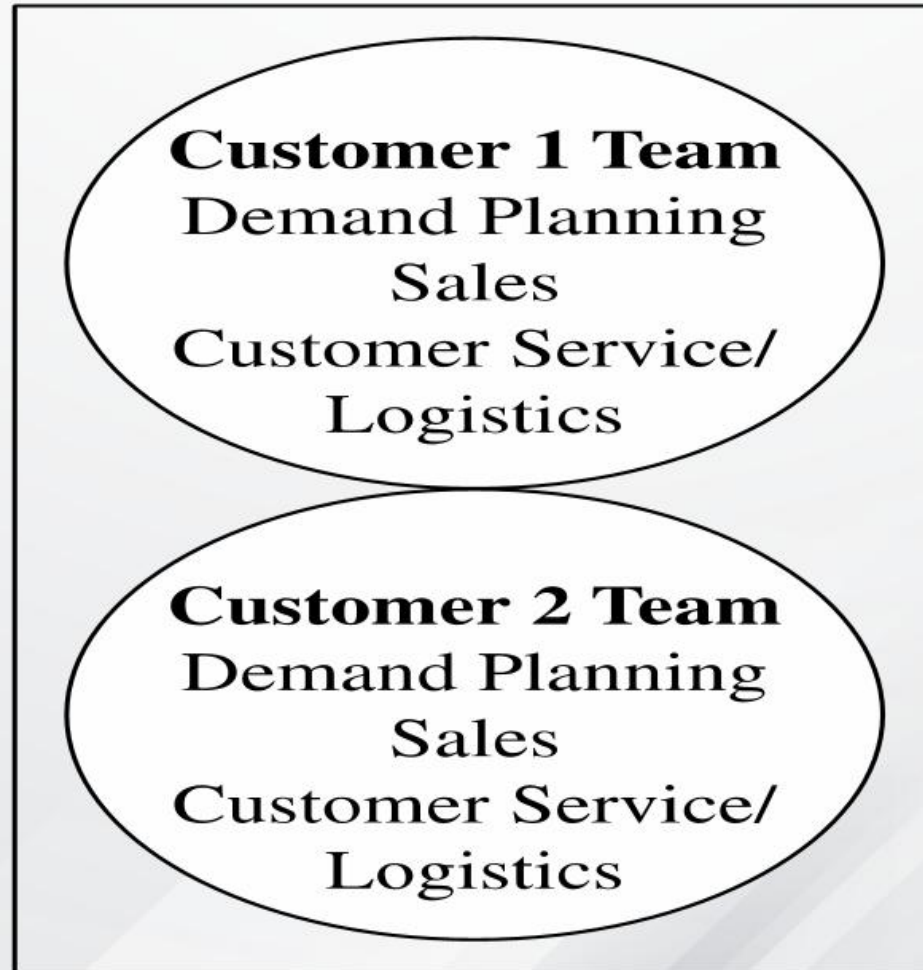
Common CPFR Scenarios

CPFR Scenario	Where Applied in Supply Chain	Industries Where Applied
Retail event collaboration	Highly promoted channels or categories	All industries other than those that practice EDLP
DC replenishment collaboration	Retail DC or distributor DC	Drugstores, hardware, grocery
Store replenishment collaboration	Direct store delivery or retail DC-to-store delivery	Mass merchants, club stores
Collaborative assortment planning	Apparel and seasonal goods	Department stores, specialty retail

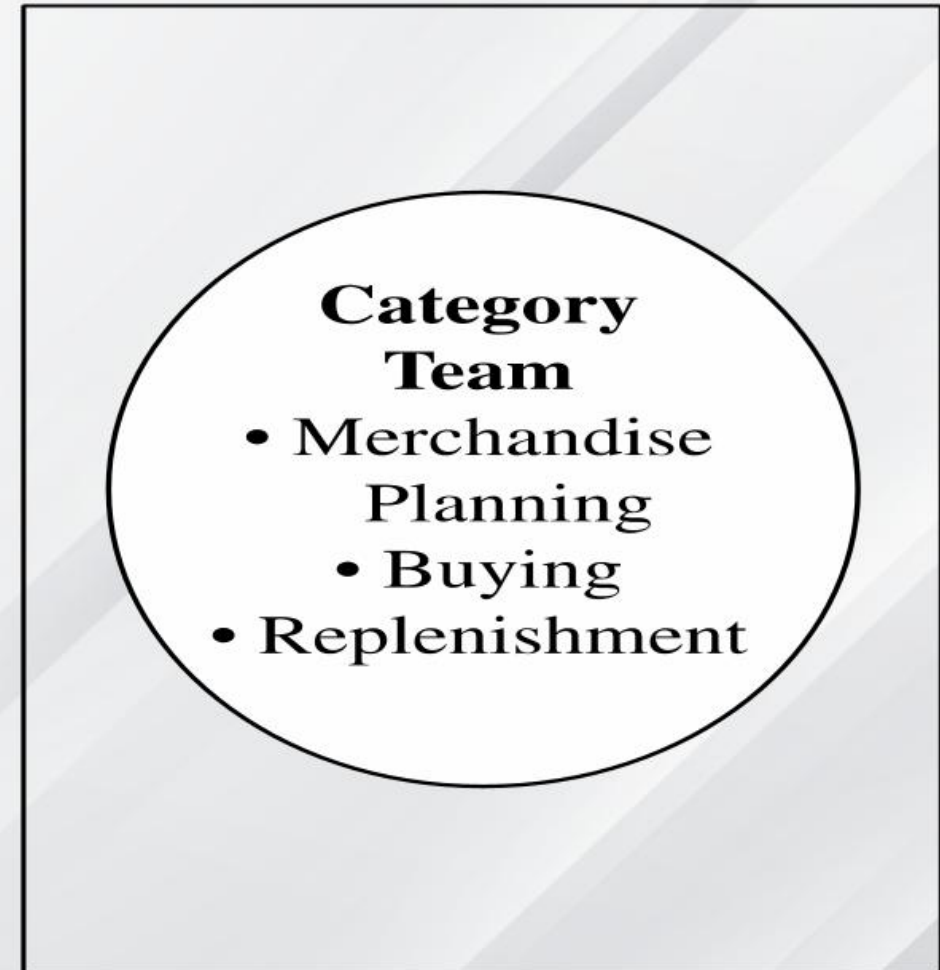
Collaborative Planning, Forecasting, and Replenishment (CPFR)

- Retail event collaboration
- DC replenishment collaboration
- Store replenishment collaboration
- Collaborative assortment planning
- Organizational and technology requirements for successful CPFR
- Risks and hurdles for a CPFR implementation

Collaborative Planning, Forecasting, and Replenishment (CPFR)



Manufacturer Organization



Retailer Organization

- Quantify the bullwhip effect
- Get top management commitment for coordination
- Devote resources to coordination
- Focus on communication with other stages
- Try to achieve coordination in the entire supply chain network
- Use technology to improve connectivity in the supply chain
- Share the benefits of coordination equitably

Relationship Between AI and Supply Chain Coordination

AI Capability

Demand Forecasting

How It Improves Supply Chain Coordination

AI analyzes historical sales, market trends, weather, and customer behavior to generate more accurate demand forecasts, enabling all partners to coordinate production and inventory.

Real-Time Data Sharing

AI processes data from IoT devices, ERP systems, and cloud platforms, providing real-time visibility across the supply chain.

Inventory Optimization

AI recommends optimal inventory levels at different locations, reducing shortages and excess inventory while improving coordination between suppliers and retailers.

Production Planning

AI aligns production schedules with actual demand and supplier capacity, improving coordination among manufacturers and suppliers.

Transportation Optimization

AI selects the best delivery routes, shipment schedules, and carriers, improving coordination between warehouses, logistics providers, and customers.

Risk Management

AI predicts supply disruptions, delays, and shortages, allowing supply chain partners to coordinate contingency plans.

Supplier Collaboration

AI evaluates supplier performance and recommends the most reliable suppliers, strengthening long-term collaboration.

Automated Decision-Making

AI automates routine procurement and replenishment decisions, reducing delays and improving response time.

Benefits of AI for Supply Chain Coordination

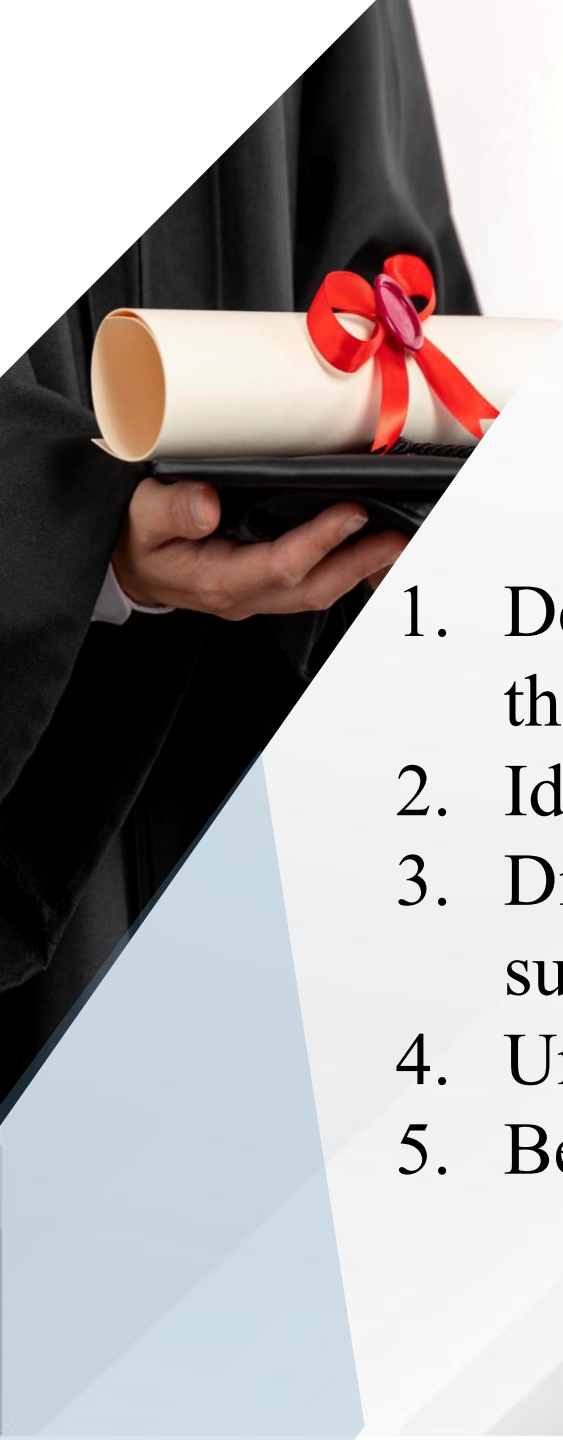
- Improves information sharing among supply chain partners.
- Reduces the **Bullwhip Effect** through better demand visibility.
- Enhances collaboration between suppliers, manufacturers, distributors, and retailers.
- Increases supply chain visibility and transparency.
- Improves responsiveness to changes in demand.
- Reduces inventory and operating costs.
- Improves customer service and product availability.
- Enables faster and more accurate decision-making.

Example

A **global retailer** uses **AI** to analyze sales data from all its stores in real time.

- The **AI** system predicts increased demand for a product.
- Suppliers receive automatic notifications to increase raw material supply.
- Manufacturers adjust production schedules.
- Distribution centers prepare additional inventory.
- Logistics providers optimize delivery routes.
- Retail stores receive products before stockouts occur.

As a result, all supply chain members coordinate their activities based on the same **AI**-generated information, improving efficiency and customer satisfaction.



Summary of Learning Objectives

1. Describe supply chain coordination and the bullwhip effect, and their impact on supply chain performance
2. Identify obstacles to coordination in a supply chain
3. Discuss managerial levers that help achieve coordination in a supply chain
4. Understand the different forms of CPFR possible in a supply chain
5. Benefits of AI for supply chain coordination

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Thank You