Sloan Management Review

The Bullwhip Effect
in Supply Chains

Team 7

2006.08.17

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Agenda

➢ What is bullwhip effect.
➢ The major reasons of the bullwhip effect.
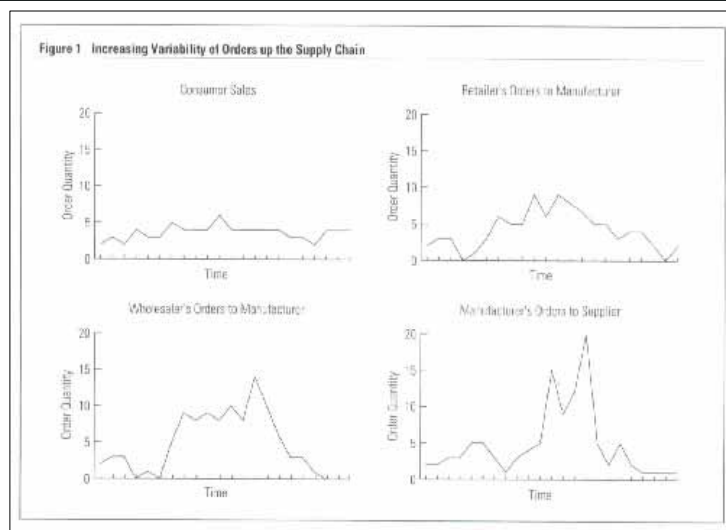➢ How to counteract bullwhip effect.

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What is bullwhip effect

➢ Distorted information from one end of a supply chain to the other can lead to tremendous inefficiencies.

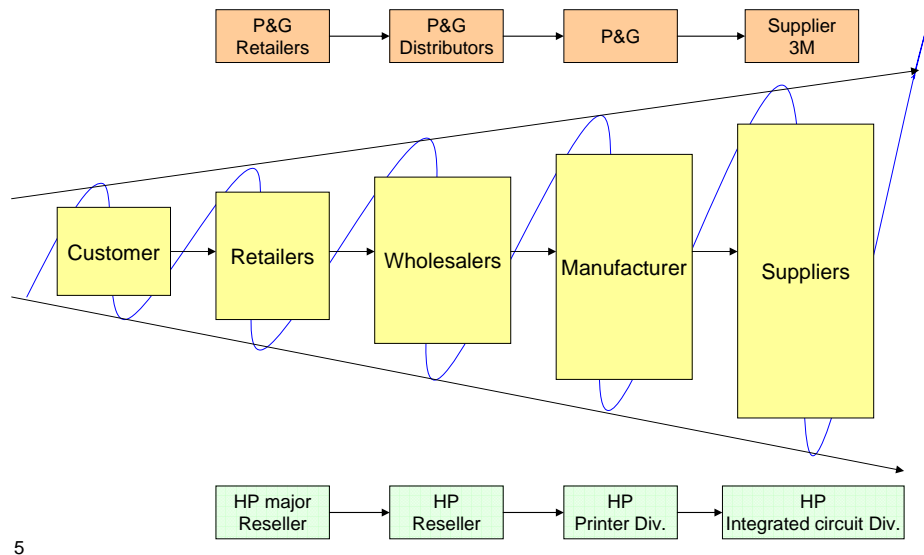➢ The demand order variabilities in the supply chain were amplified as they moved up the supply chain.

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What is bullwhip effect

Figure 1 Increasing Variability of Orders up the Supply Chain

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What is bullwhip effect

P&G Retailers	→	P&G Distributors	→	P&G	→	Supplier 3M

Customer	→	Retailers	→	Wholesalers	→	Manufacturer	→	Suppliers

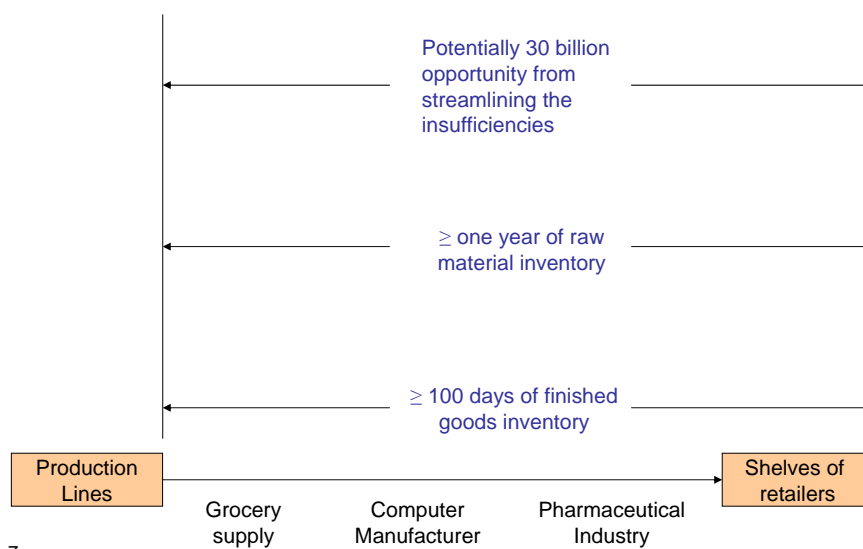| HP major Reseller	→	HP Reseller	→	HP Printer Div.	→	HP Integrated circuit Div.

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The common symptoms of bullwhip effect

➢ Excessive inventory.

➢ Poor product forecasts.

➢ Insufficient or excessive capacities.

➢ Poor customer service due to unavailable products or long backlogs.

➢ Uncertain production planning.

➢ High cost of correction.
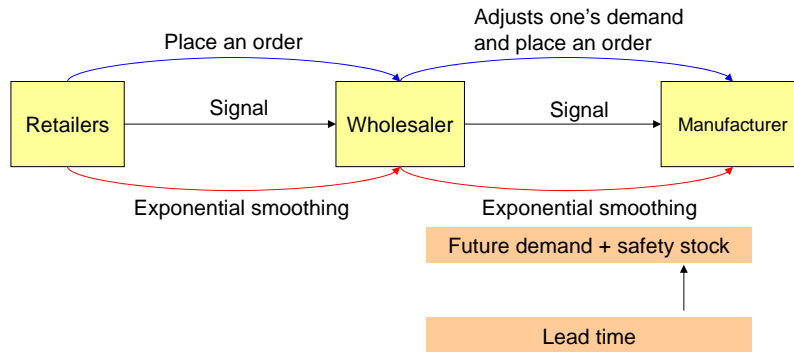
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What is bullwhip effect

Potentially 30 billion opportunity from streamlining the insufficiencies

≥ one year of raw material inventory

≥ 100 days of finished goods inventory

Production Lines	Grocery supply	Computer Manufacturer	Pharmaceutical Industry	Shelves of retailers

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The major reasons of the bullwhip effect

➢ Demand forecast updating.
➢ Order batching.
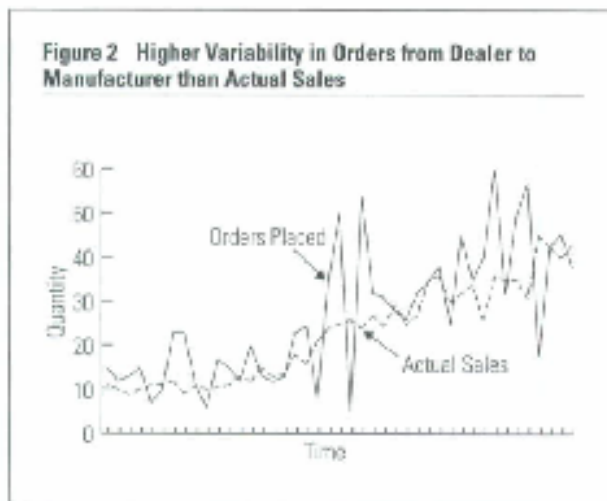➢ Price fluctuation.
➢ Rationing and shortage gaming.

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Demand forecast updating

> Forecasting is often based on the order history from the company's immediate customers.

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Demand forecast updating

Figure 2   Higher Variability in Orders from Dealer to Manufacturer than Actual Sales
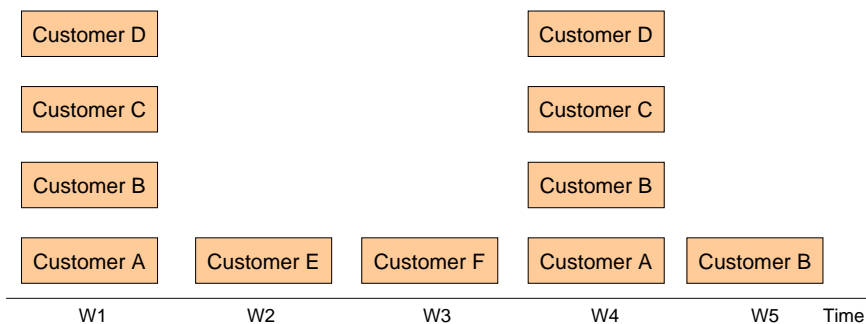
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Order batching

> Periodic ordering.
> - ✓ Order weekly, biweekly or monthly.
> - ✓ Time and cost of processing an order. (P&G: $35-$75)
> - ✓ Transportation cost. (Full truck load)
> - ✓ Generate order from MRP system. (run monthly)
> - ✓ A spike in demand at one time during the order cycle, followed by no demands for the rest of the time.
>
> Push ordering.
> - ✓ Pushed from customers periodically
> - ✓ Salespeople are regular measured: borrow ahead and sign orders prematurely to fill the quotas.
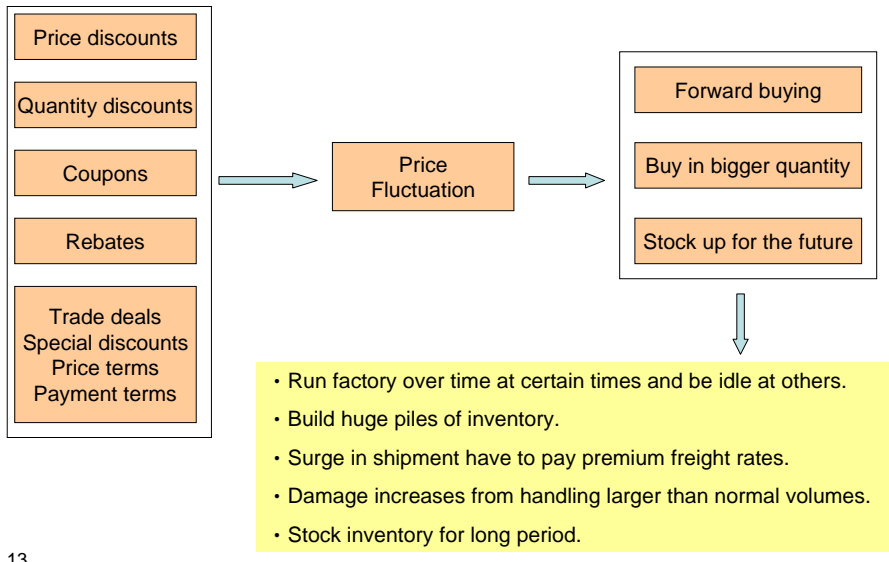
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Order batching

> Customer's order cycle may spread out or overlap.
> Most of the company do MRP or DRP to generate purchase order → order cycle overlap.
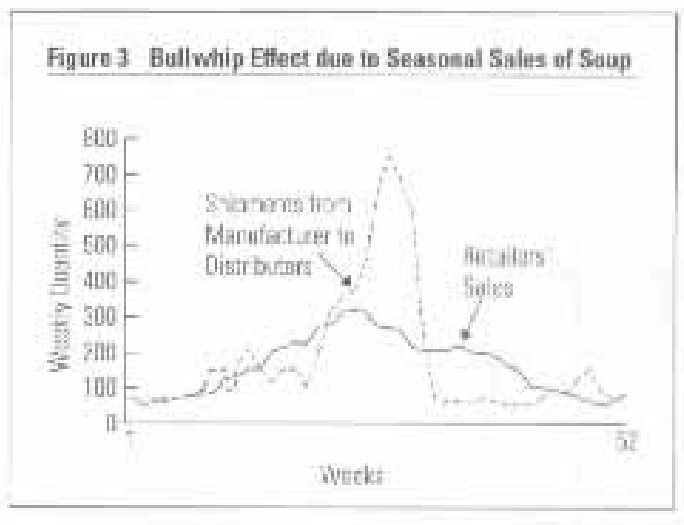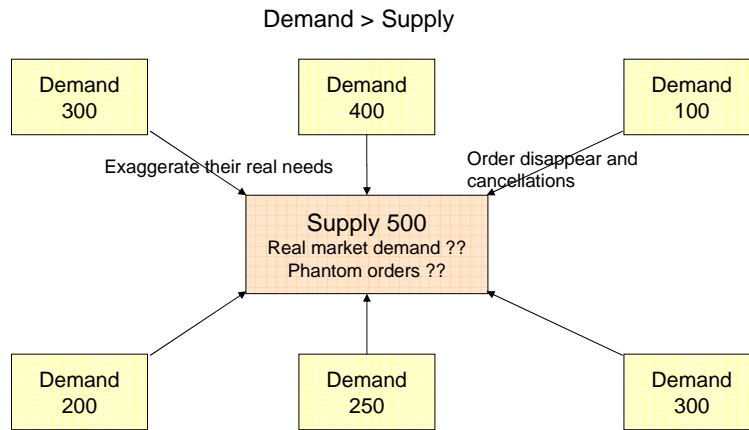
Customer D			Customer D	
Customer C			Customer C	
Customer B			Customer B	
Customer A	Customer E	Customer F	Customer A	Customer B
W1	W2	W3	W4	W5 → Time

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Price fluctuation

Price discounts

Quantity discounts

Coupons

Rebates

Trade deals
Special discounts
Price terms
Payment terms

Price
Fluctuation

Forward buying

Buy in bigger quantity

Stock up for the future

・Run factory over time at certain times and be idle at others.

・Build huge piles of inventory.

・Surge in shipment have to pay premium freight rates.

・Damage increases from handling larger than normal volumes.

・Stock inventory for long period.

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Price fluctuation

Figure 3 Bullwhip Effect due to Seasonal Sales of Soup

Shipments from
Manufacturer to
Distributors

Retailers'
Sales

Weekly Quantity

Weeks

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Rationing and shortage gaming

Demand > Supply

Demand 300	Demand 400	Demand 100

Exaggerate their real needs

Order disappear and cancellations

Supply 500
Real market demand ??
Phantom orders ??

Demand 200	Demand 250	Demand 300

DRAM / HP LaserJet printers / Motorola handsets and cellular phone

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How to counteract the bullwhip effect

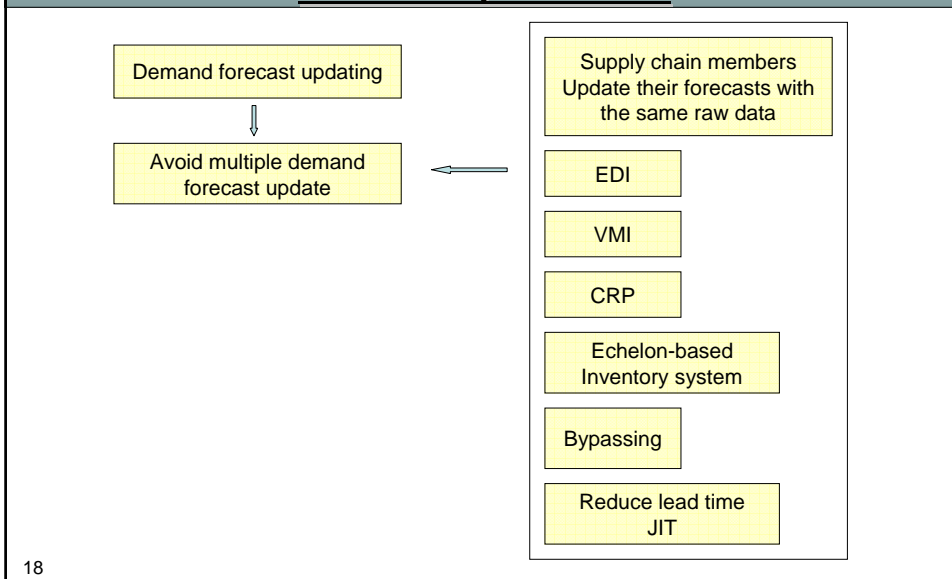➢Information sharing.
➢Channel alignment.
➢Operational efficiency.

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作業與運籌管理

A Framework for Supply Chain Coordination Initiatives

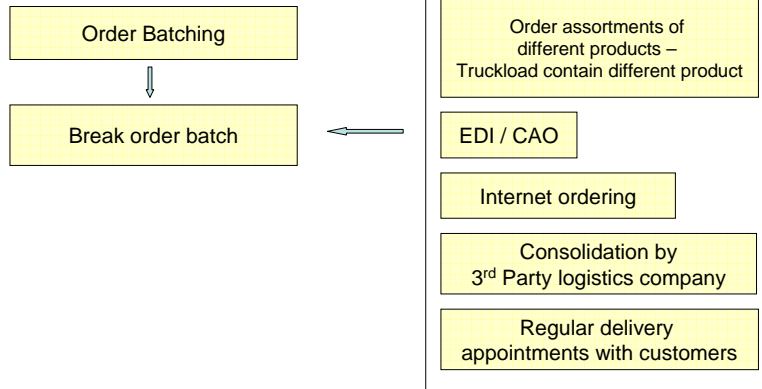| Causes of Bullwhip	Information Sharing	Channel Alignment	Operational Efficiency
Demand Forecast Update	• Understanding system dynamics • Use point of sale (POS) data • Electronic data interchange (EDI) • Internet • Computer-assisted ordering (CAO)	• Vendor-managed inventory (VMI) • Discount for information sharing • Consumer direct	• Lead time reduction • Echelon-based inventory control
Order Batching	• (EDI) • Internet ordering	• Discount for truck-load assortment • Delivery appointment • Consolidation • Logistics out-sourcing	• Reduction in fixed cost of ordering by EDI or electronic commerce • CAO
Price Fluctuations		• Continuous replenishment program (CRP) • Everyday low cost (EDLC)	• Everyday low price (EDLP) • Activity-based costing (ABC)
Shortage Gaming	• Sharing sales, capacity, and inventory data	• Allocation based on past sales	

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作業與運籌管理

How to counteract the bullwhip effect

Demand forecast updating

⇓

Avoid multiple demand forecast update ⇐

Supply chain members Update their forecasts with the same raw data

EDI

VMI

CRP

Echelon-based Inventory system

Bypassing

Reduce lead time JIT

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How to counteract the bullwhip effect

Order Batching

⇓

Break order batch

←

Order assortments of
different products –
Truckload contain different product

EDI / CAO

Internet ordering

Consolidation by
3rd Party logistics company

Regular delivery
appointments with customers

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How to counteract the bullwhip effect

Price fluctuation

⇓

Stabilize Prices

←

Uniform wholesale pricing policy

Every day low price (EDLP)

Every day low cost (EDLC)

CRP

ABC system

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作業與運籌管理 **How to counteract the bullwhip effect**

Rationing and shortage gaming

⇓

Eliminating gaming in Shortage situations

⇐

Allocate products in proportion to past sales records

penalty

The sharing of capacity Inventory information

Work with customer to place Order well in advance of the sales season

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作業與運籌管理

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