

# Supply Chain Management

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## **Part 10**

### **Bullwhip Effect in a Supply Chain**

# Supply chain coordination

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Supply chain coordination – all stages in the supply chain take actions together (usually results in greater total supply chain profits).

SC coordination requires that each stage take into account the effects of its actions on the other stages.

Lack of coordination results when:

1. Objectives of different stages conflict or
2. Information moving between stages is distorted

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.



## Bullwhip effect

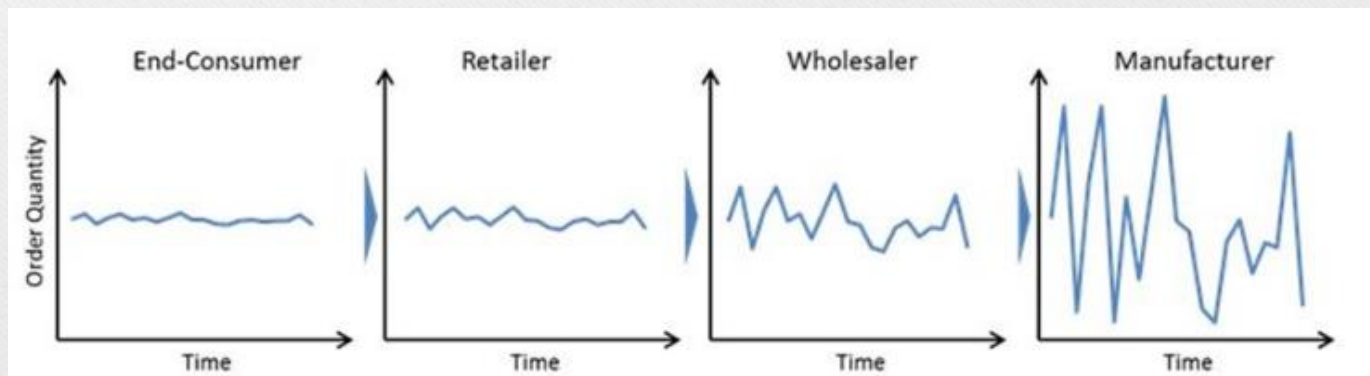
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One outcome of the lack of supply chain coordination is the *bullwhip effect*, in which fluctuations in orders increase as they move up the supply chain from retailers to wholesalers to manufacturers to suppliers.

The bullwhip effect distorts demand information within the supply chain, with each stage having a different estimate of what demand looks like.

# Bullwhip effect

Small changes in demand can produce a whip-like effect upstream.





## Impacts of the bullwhip effect

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- ***Manufacturing Cost:*** A firm can respond to the increased variability by either building excess capacity or holding excess inventory both of which increase the manufacturing cost per unit produced.
- ***Inventory Cost:*** To handle the increased variability in demand, a firm must carry a higher level of inventory.
- ***Replenishment Lead Time:*** The increased variability as a result of the bullwhip effect increases replenishment lead times in the supply chain.
- ***Transportation Cost:*** As a result of the bullwhip effect, transportation requirements fluctuate significantly over time which raises transportation cost.

## Impacts of the bullwhip effect

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- ***Labor Cost for Shipping and Receiving:*** Bullwhip effect increases labor costs associated with shipping and receiving in the supply chain.
- ***Level of Product Availability:*** Bullwhip effect hurts the level of product availability and results in more stockouts in the supply chain.
- **Relationships Across the Supply Chain:** Bullwhip effect has a negative effect on performance at every stage and thus hurts the relationships among different stages of the supply chain.



# Causes and potential remedies of the bullwhip effect

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## ***1- Forecasting based on orders and not customer demand:***

When stages within a supply chain make forecasts that are based on orders they receive, any variability in customer demand is magnified as orders move up the supply chain to manufacturers and suppliers.

***2- Lack of information sharing:*** The lack of information sharing between stages of the supply chain magnifies the information distortion.

***3- Ordering in large lots:*** When a firm places orders in lot sizes that are much larger than those in which demand arises, variability of orders is magnified up the supply chain.

## Causes of the bullwhip effect

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**4- Large replenishment lead times:** Information distortion is magnified if replenishment lead times between stages are long.

**5- Rationing and shortage gaming:** Order larger quantities than necessary, in order to eventually get what you need.

**6- Lot-size-based quantity discounts:** Lot-size-based quantity discounts increase the lot size of orders placed within the supply chain magnifies the bullwhip effect within the supply chain.



## Causes of the bullwhip effect

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**7- Price fluctuations:** Trade promotions and other short-term discounts offered by a manufacturer result in forward buying.

**8- Local optimization within functions or stages of a supply chain:** Incentives that focus only on the local impact of an action result in decisions that do not maximize total supply chain surplus.

# Counteracting of the bullwhip effect

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**1- Sharing customer demand data:** Make downstream demand data available to the upstream sites. Both sites can update their forecast with the same raw data.

**2- Designing single-stage control of replenishment:** Designing a supply chain in which a single stage controls replenishment decisions for the entire supply chain can help diminish information distortion.

**3- Reducing replenishment lead time:** By reducing the replenishment lead time, managers can decrease the uncertainty of demand during the lead time.

**4- Reducing lot sizes:** A reduction of lot sizes decreases the amount of fluctuation that can accumulate between any pair of stages of a supply chain, thus decreasing distortion.



## Counteracting of the bullwhip effect

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**5- Rationing based on past sales and sharing information to limit gaming:** Instead of allocating products based on orders, allocate in proportion to past sales (turn\_and\_earn approach).

**6- Stabilize prices:** Managers can dampen the bullwhip effect by eliminating promotions and using everyday low pricing (EDLP).

**7- Building strategic partnerships and trust:** Managers find it easier to use the levers discussed earlier to achieve coordination if trust and strategic partnerships are built within the supply chain.