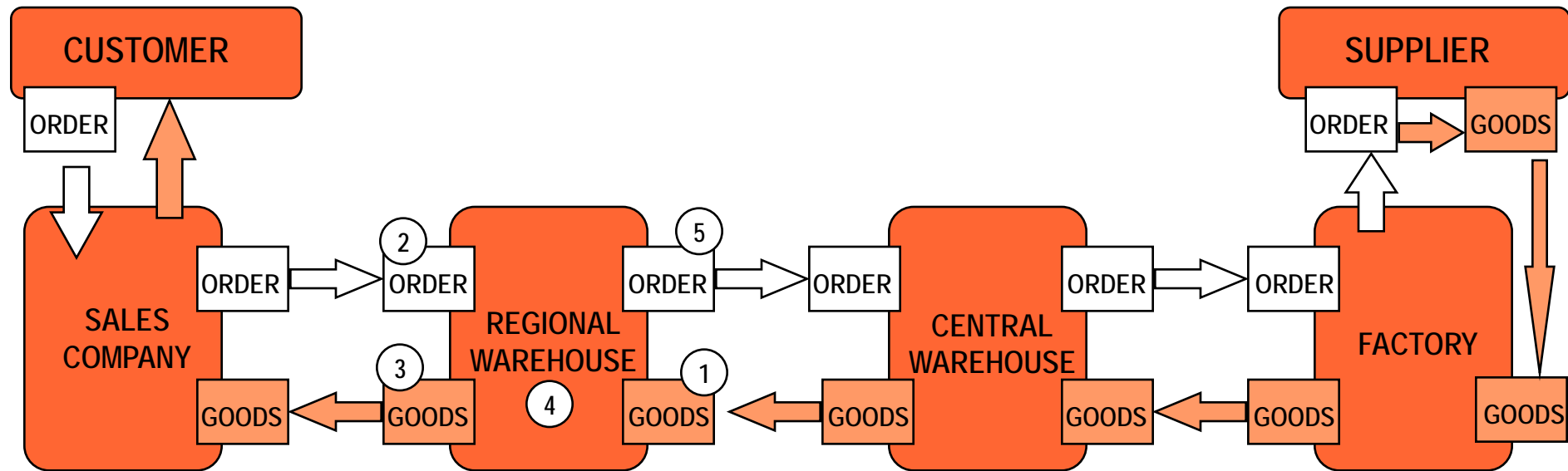


To show before playing

Beer Game

The aim of the game is to manage a distribution channel from factory to consumer in order to achieve low costs and high service level.

Game board



Relevant costs and service measures

Costs

- Production
- Transport
- Inventory carrying
- Warehousing
- Materials handling
- Ordering
- Information

Service measures

- Stock availability
- Lead time
- Delivery reliability
- Delivery accuracy
- Flexibility
- Information

Simplifications in the Beer Game

- Only one actor at each stage
- Only one product
- No capacity constraints
- Constant lead time (provided that products are available in stock)
- The supplier always delivers on time
- No random happenings

- We focus a limited number of key figures...

Measured in the Beer Game

Costs

- Production
- Transport
- **Inventory carrying**
- Warehousing
- Materials handling
- Ordering
- Information

Service measures

- **Stock availability**
- Lead time
- Delivery reliability
- Delivery reliability
- Flexibility
- Information

Starting point

Equilibrium – all are in the same situation

- All stocks contain 12 units
- All orders are on 4 units
- All deliveries are on 4 units

We start with playing 4 days to learn the routines

In total we play 70 days

Order of work for a day

- 1 Receive goods (+ move goods in pipeline)
Mark *Del. from supplier* in the form and calculate *Available stock*
- 2 Receive order (+ move order in pipeline)
Mark *Customer order* in the form and calculate *Expected delivery*
- 3 Deliver correct amount (= write and put delivery card)
Compare *Available stock* and *Expected delivery*. The smallest of these two figures should be delivered. Mark *Delivery* in both squares and calculate *Outgoing stock* and *Outgoing shortage*
- 4 Order suitable amount (= write and put order card)
Mark *My order* in the form

Form

Day 0	<i>Outgoing stock</i>		12	<i>Outgoing shortage</i>		0	
Day 1	<i>Del. from supplier</i>	+	4	<i>Customer order</i>	+	4	<div style="border: 2px solid red; border-radius: 50%; padding: 10px; display: inline-block;"> My order <input style="width: 100px; height: 20px; border: 1px solid black;" type="text" value="4"/> </div>
	<i>Available stock</i>	=	16	<i>Expected delivery</i>	=	4	
	<i>Delivery</i>	-	4	<i>Delivery</i>	-	4	
	<i>Outgoing stock</i>	=	12	<i>Outgoing shortage</i>	=	0	
Day 2	<i>Del. from supplier</i>	+		<i>Customer order</i>	+		My order
	<i>Available stock</i>	=		<i>Expected delivery</i>	=		<input style="width: 100px; height: 20px;" type="text"/>
	<i>Delivery</i>	-		<i>Delivery</i>	-		<input style="width: 100px; height: 20px;" type="text"/>
	<i>Outgoing stock</i>	=		<i>Outgoing shortage</i>	=		<input style="width: 100px; height: 20px;" type="text"/>
Day 3	<i>Del. from supplier</i>	+		<i>Customer order</i>	+		My order
	<i>Available stock</i>	=		<i>Expected delivery</i>	=		<input style="width: 100px; height: 20px;" type="text"/>
	<i>Delivery</i>	-		<i>Delivery</i>	-		<input style="width: 100px; height: 20px;" type="text"/>
	<i>Outgoing stock</i>	=		<i>Outgoing shortage</i>	=		<input style="width: 100px; height: 20px;" type="text"/>

Some rules

- You must deliver if you can.
- You must not deliver more than what's ordered.
- Shortages should be delivered as soon as possible.
- Orders can not be withdrawn.
- You're not allowed to talk to each other.
- Don't show order and delivery cards to anyone.
All cards should be placed upside down.

To show after playing

Expected behaviour

- Fluctuating curves with big variations
- Bigger variations further away from the market
- Later reaction further away from the market
- Big orders in panic when shortages increase
- Blaming each other
- Complaining over the customers

Why do the fluctuations occur?

- You optimise your own part of the system without considering the totality (sub optimisation)
- Incomplete information
- Long lead times cause slow reaction
- Each player builds their own buffers
- Bad control over one's situation (don't consider old orders)

Suggested solutions

- Improve your own inventory management
- Reduce lead times
- Change the distribution structure
(remove one or several warehouses)
- Provide the factory with market information
- Provide all parties with market information

Five scenarios to simulate

- The original Beer Game (the one we played)
- Information lead time = 0 (transport time constant)
- No intermediaries, (central and regional warehouses are removed)
- The factory gets access to market demand
- All parties get access to market demand

Results from simulations

Scenario	Cost index (%)	Fluctuation at factory compared to market (%)
Beer Game original	100	900
Info lead time = 0	58	500
No intermediaries	28	350
Factory gets market info	68	425
All parties get market info	39	200

Source: Norrman, 1995
(Data from van Ackere et al, 1993)