

# Introduction to the Beer Game

The purpose of the Beer Game is to experience systemic effects and to introduce the need for supply chain and network management. Specifically it shows:

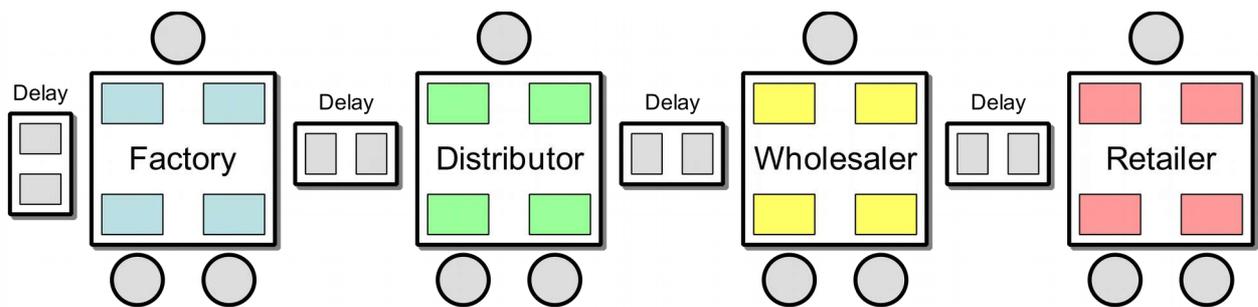
- How single parts in a system influence each other.
- How individual thinking differs from systemic thinking (network thinking).
- Potentials for systems optimization and the use of information systems.

## The Beer Game setup

The Beer Game supply chain consists of four stages:

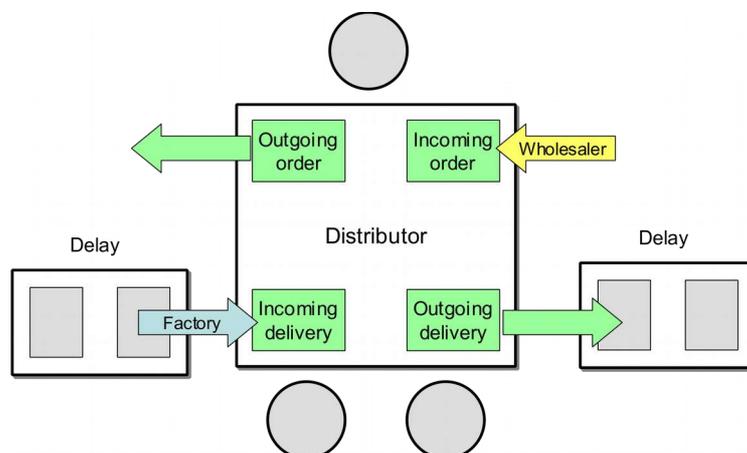
- The **retailer** (pink) has to fulfil the end consumer's orders.
- The **wholesaler** (orange) has to fulfil the retailer's orders.
- The **distributor** (green) has to fulfil the wholesaler's orders.
- The **factory** (blue) has to produce the beer to fulfil the distributor's orders.

The Beer Game is played in groups of 3, each of these groups sits around one table and plays one supply chain stage (see figure).



Every table has the same layout that shows four different areas (see figure):

- The place for incoming orders (inbox) – coming from the downstream stage
- The place for outgoing orders (outbox) – going to the upstream stage
- The place for incoming deliveries (receiving) – coming from the upstream stage
- The place for outgoing deliveries (dispatch) – going to the downstream stage



Deliveries are “on the road” for 2 weeks (lead time); production also takes 2 weeks. This lead time delay is represented by 2 two extra fields between the tables that hold the deliveries and are moved forward in each week.

## General playing procedure

The game runs in weeks and it starts in week 1. In each week, each supply chain group has to proceed with the following steps:

1. Receive new deliveries and update the play sheet (“incoming” and “available”).
2. Receive orders in the inbox and update the play sheet (“new order” and “to ship”).
3. Calculate the total amount that will be shipped (“your delivery”), note down the amount, and place it in a box in the dispatch area on your table.
4. Agree on a new order amount, note down the number, and put it in an envelope in the outbox field.

## The goal

*Your goal is to minimize your cost!*

*(Remember that you compete against the same stage in the other supply chains – retailer against retailer, distributor against distributor etc.)*

There are two different kinds of cost:

1. **Inventory cost:** Items in stock cost € 0,50 per week in holding costs.
2. **Backorder cost:** If an incoming order cannot be (fully) fulfilled, items are outstanding and have to be put on “backorder” to be fulfilled in the following week(s). Each item on backorder costs € 1,00 per week.

## What is a backorder?

If an incoming order cannot be fully fulfilled due to a lack of available items in the inventory, items go on backorder. In this case your inventory is empty and a number of items have to appear as backorder in your play sheet.

## What happens in the next week?

In the following week, you will add the old backorder to the new incoming order to calculate the amount “to ship”. Again, if the available inventory is too little to fulfil the amount “to ship”, items have to be put on backorder and will cost \$ 1,00 per item.

## Some general rules

- No communication is allowed between supply chain groups, supply chain groups must not talk to each other at any time!
  - Especially the customer demand is only known to the retailer.
- If stock is available, an order has to be fulfilled.
- Every order has to be fulfilled, either in the current week (if enough stock is available) or in one of the next weeks (items go on backorder).
- Either the inventory or the backorder, one of them is always zero (0)!

## Each week's steps in detail

### 1. Incoming delivery (new delivery)

Add incoming delivery to controlling sheet and update "available". Add incoming delivery to old inventory to get the available number of items in stock.

$$\text{Available} = \text{Inventory (last week)} + \text{Incoming}$$

### 2. Incoming order (new order)

Open envelop and enter the order amount to your controlling sheet and then calculate the amount that has to be shipped. Take into account any backorders.

$$\text{To ship} = \text{backorder (last week)} + \text{New Order}$$

### 3. Prepare delivery

Figure out the amount that will be delivered to the next stage and write the number on a delivery slip, fold it, and place it into a shipping container.

If the amount to ship exceeds the available stock, then you have to deliver whatever is available, otherwise you will simply fulfil the order.

$$\begin{aligned} \text{If (To ship)} > \text{Available} & \text{ then Your Delivery} = \text{Available} \\ \text{If (To ship)} < \text{Available} & \text{ then Your Delivery} = \text{To ship} \end{aligned}$$

### 4. Calculate backorder

If the outstanding orders ("to ship") cannot be fulfilled, then put the remaining items on backorder.

$$\begin{aligned} \text{If (To ship)} > \text{Available} & \text{ then Backorder} = \text{To ship} - \text{Available} \\ \text{Else Backorder} & = 0 \end{aligned}$$

### 5. Calculate inventory

The new inventory is simply the available stock minus the delivery that is made. It is zero in case the outstanding orders ("to ship") cannot be fully satisfied (in case of backorders).

$$\begin{aligned} \text{If (To ship)} > \text{Available} & \text{ then Inventory} = 0 \\ \text{Else Inventory} & = \text{Available} - \text{To ship} \end{aligned}$$

### 6. Place new order

Discuss and place your new order (or production order). Note down your order using an order slip and fill it into your controlling sheet, then place your order in the outbox using an envelope.