



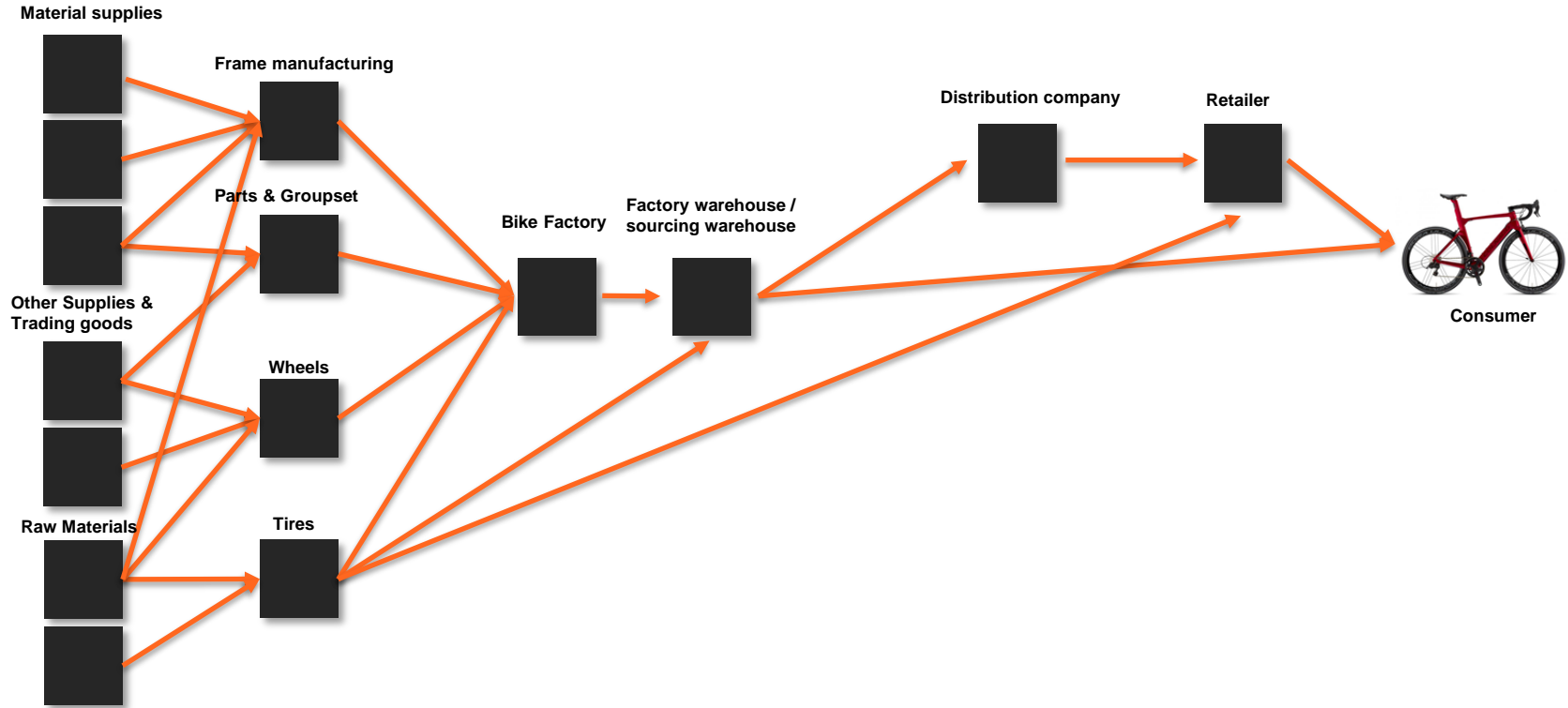
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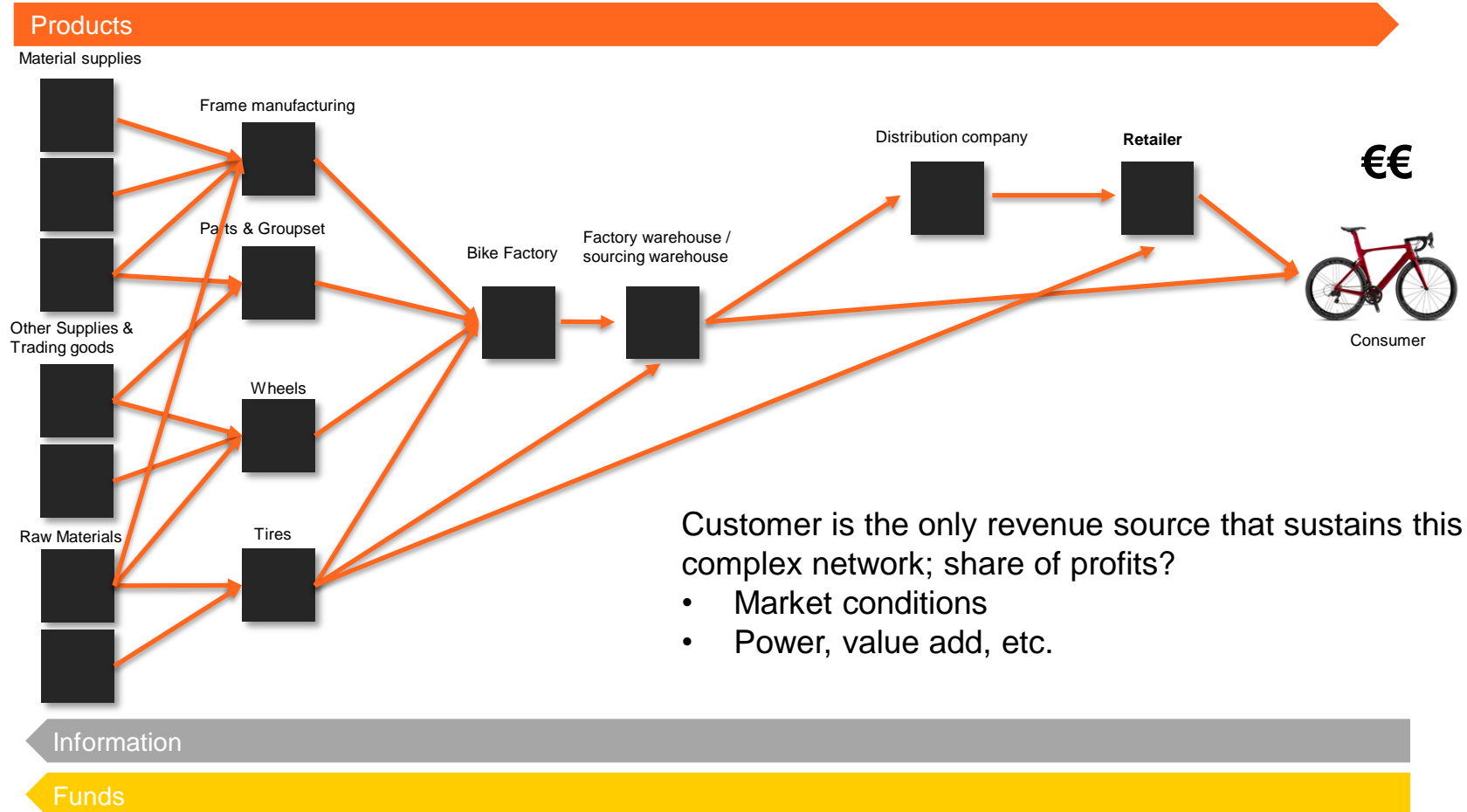
Introduction to Industrial Engineering and Management: Supply chain management

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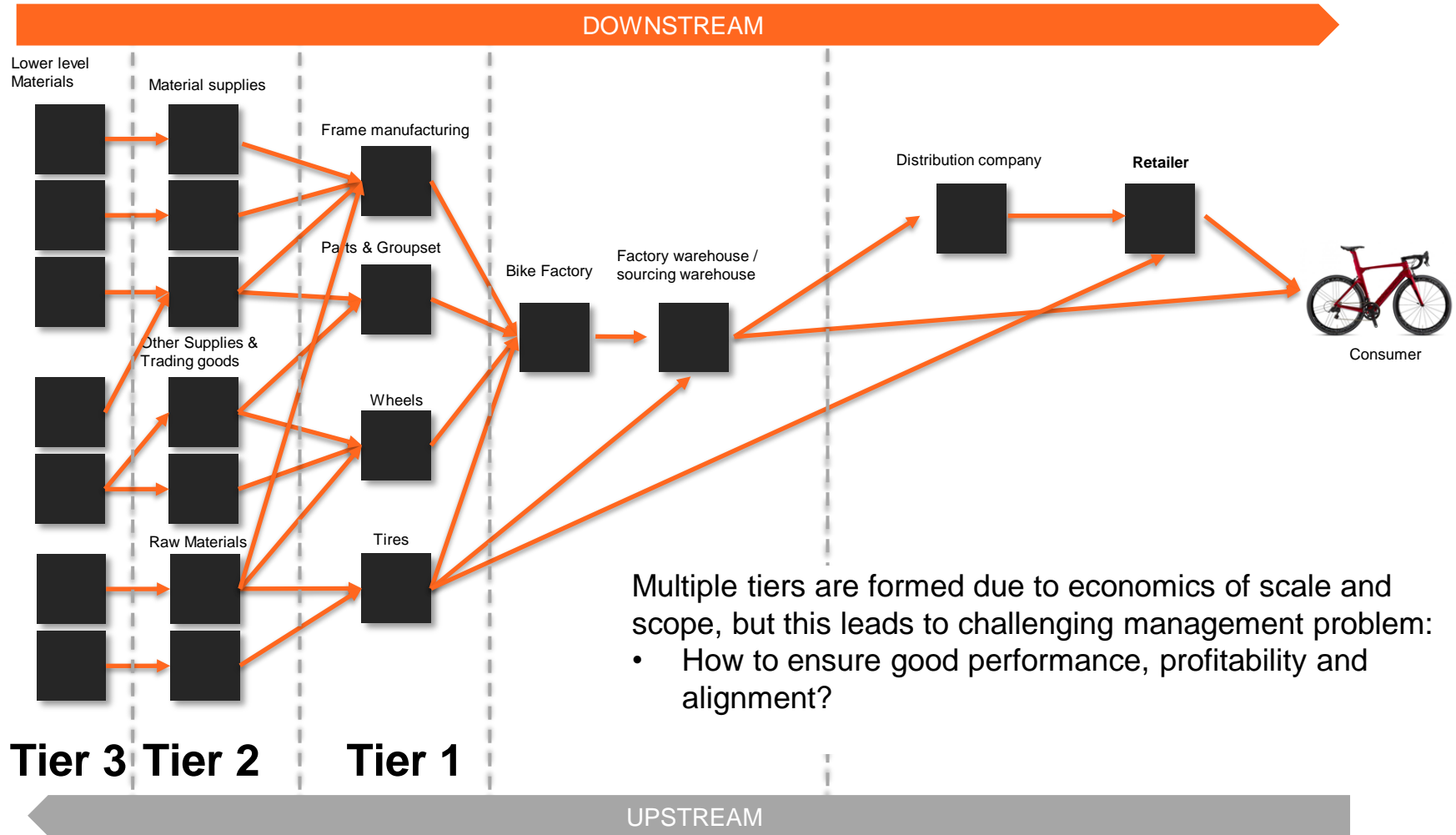
Supply chain consists of all the actors that are involved in the fulfillment of a customer request



Product, information and money flows need to be coordinated to make the supply chain work



Multiple tiers and complex structure makes supply chain management a challenging task



Best supply chain design is product and business model dependent

**Standard, low margin,
high volume**



**Specialized, high margin,
very low volume**

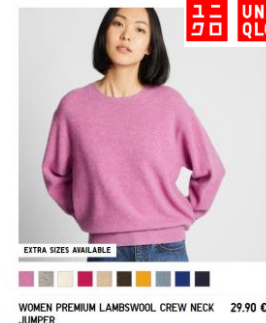


From profitable realization of strategy to creation of competitive advantages

Customer Value Proposition	Example	Supply Chain Strategy
High fashion at a reasonable price	Zara, Boohoo	Speed to market
Everyday low pricing	Uniqlo (Lidl)	Cost efficiency
Customer experience	Dell Direct	Responsiveness through configure-to-order
Product innovation	Apple	Efficiency through outsourced manufacturing and logistics
Product selection and availability	Amazon	Efficient and reliable order fulfillment with continuous tech development

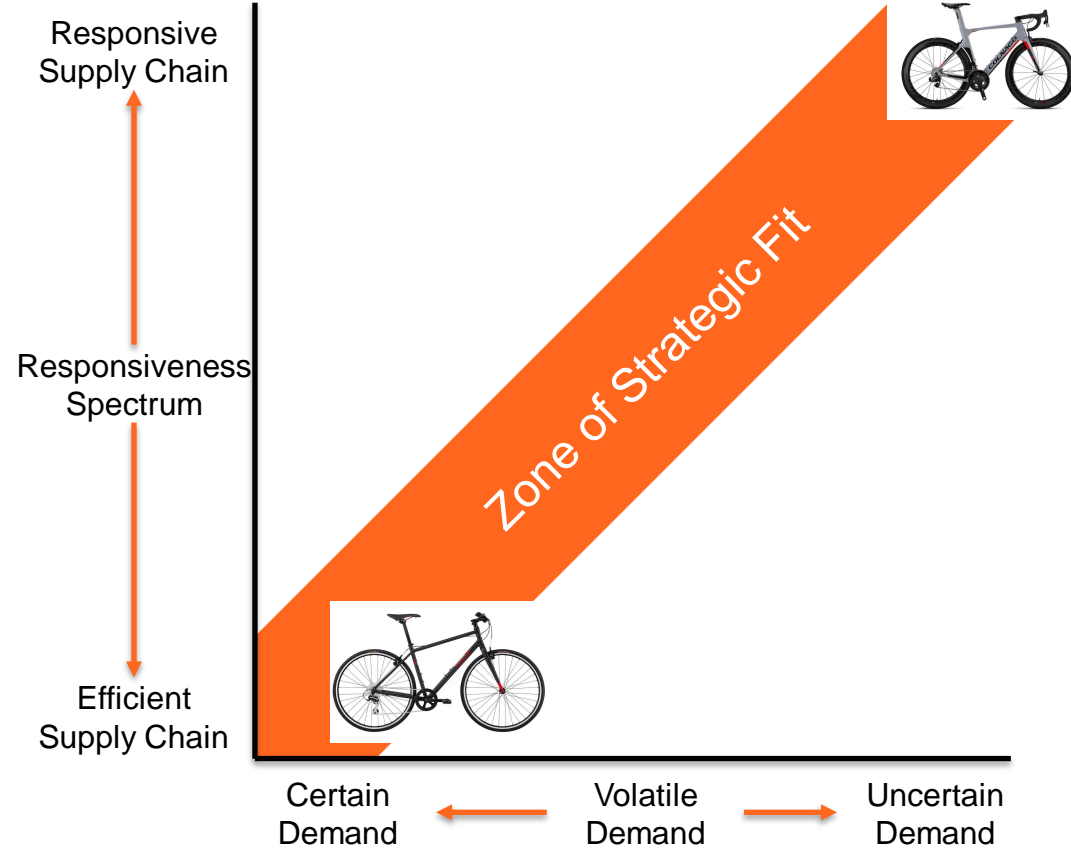
Owning it
Boohoo's business model is as cheeky as a bikini paired with chaps

Snapping up Karen Millen shows the ambition of the Manchester fast-fashion group

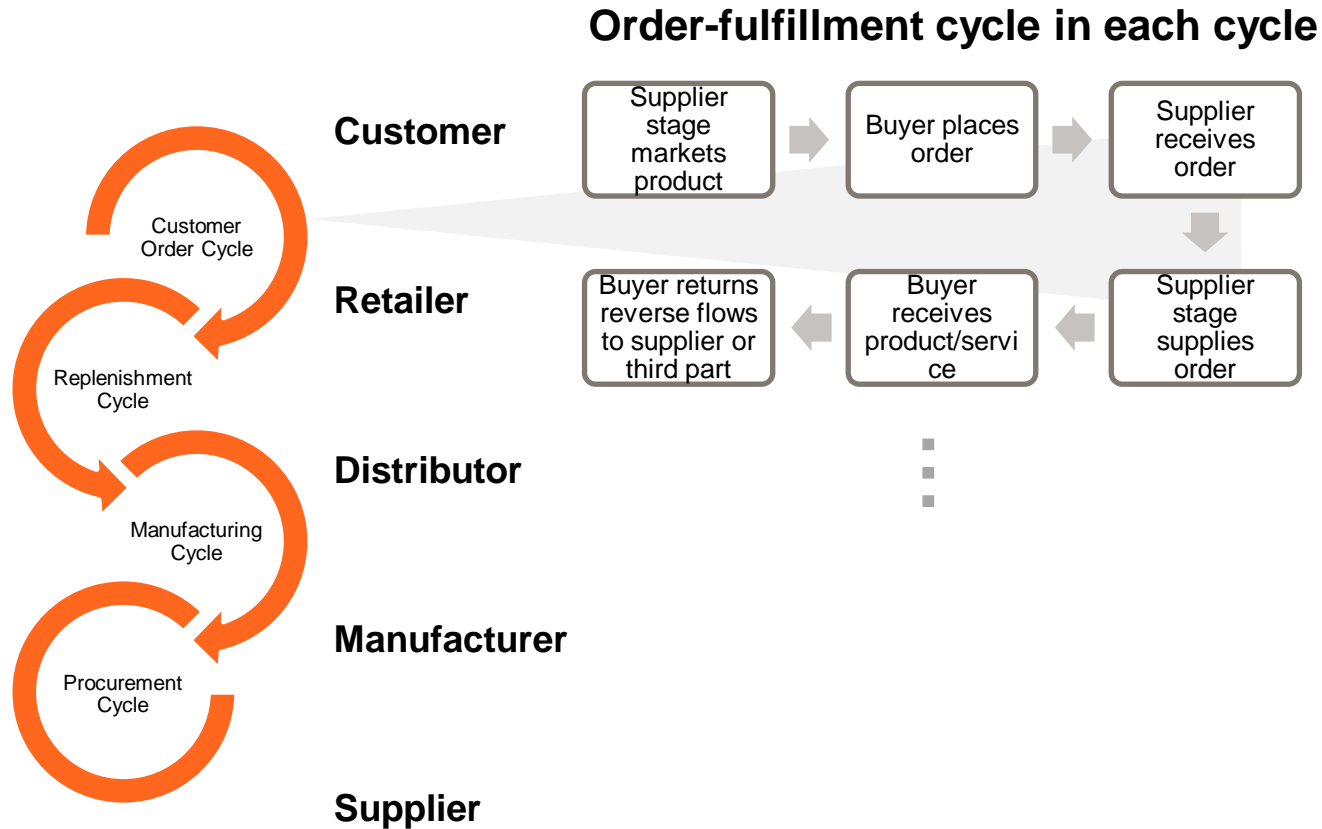


Strategic fit and scope

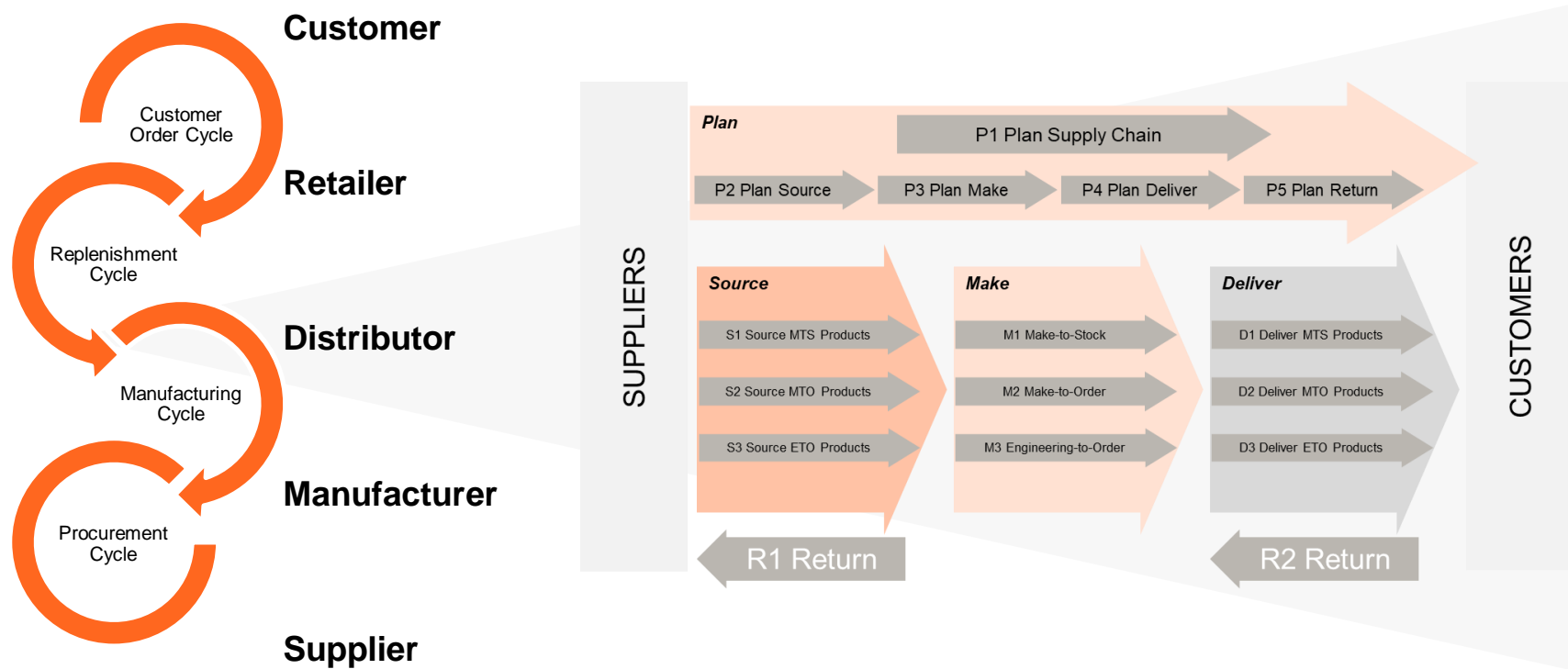
- Supply chain is a company network that is designed for supplying a product
- **From customer value to supply chain strategy:**
 1. **Customer and supply uncertainty**
 2. **Supply chain capabilities**
 3. **Achieving strategic fit**
- Cost efficiency versus flexibility and speed
- Mismatch minimization and profit maximization is the goal



Cycle view of supply chain



Process view of supply chain – Supply Chain Operations Reference model (SCOR)



Traditional functional organization of tasks challenges coordination even within the firm

Materials handling

- How to move product
- Packaging, containerization
- Storage layout

Warehousing

- Storage, Mixing, Break bulk
- Pick, Pack and Ship
- What to stock Where in WH

Inventory Control

- How much to stock where
- Trigger points
- Replenishment plan

Purchasing/Procurement

- What to buy from who
- Corporate or Group

Order processing

- Receiving, Entry, status
- Order management

Planning group

- Facility location
- Network design
- Demand planning

Customer Service

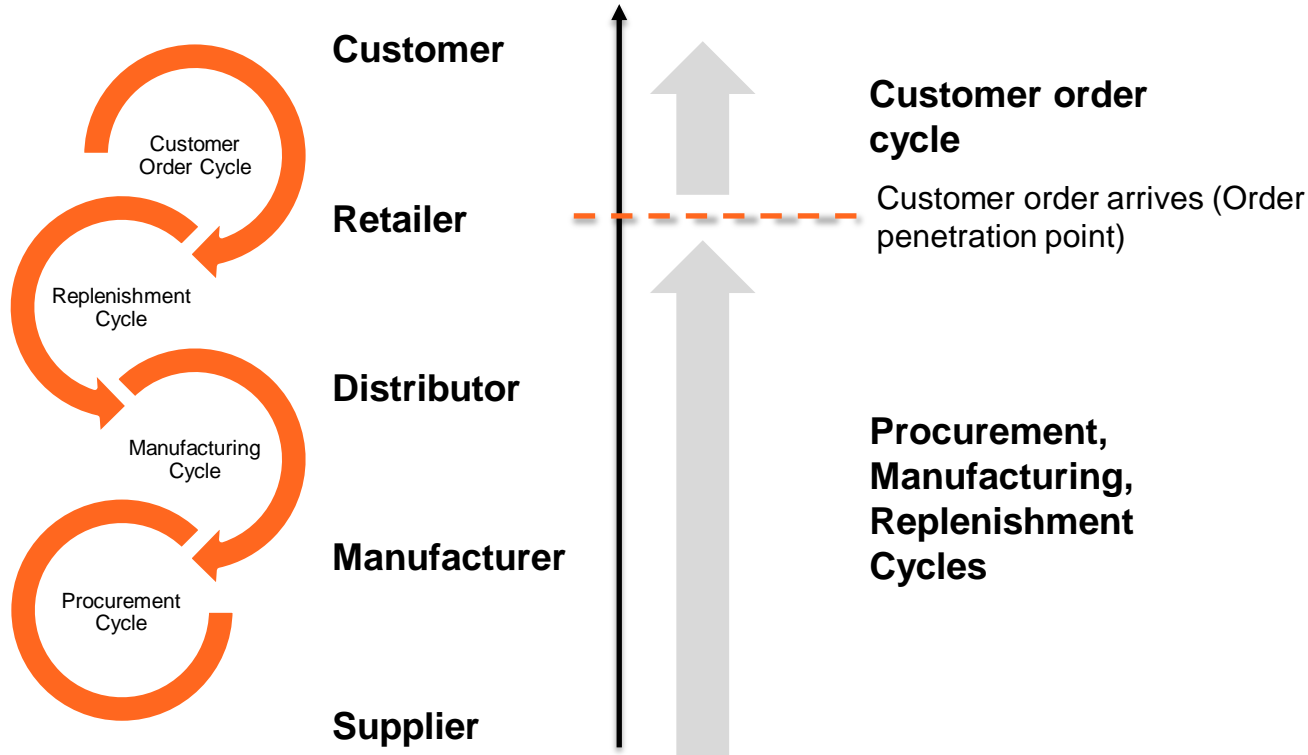
- Geographic
- Product line specific

Transportation

- Inbound vs. Outbound
- Domestic vs. International
- Modal control (Rail, road, Parcel, Air...)

Push/Pull view of the supply chain

Where to
place OPP for
our two
bikes?



Planning is critical part of supply chain management; Decision lead time

Why we need planning?

Everything is uncertain

- Demand, Capacity, Material availability, Costs, Prices

Long time delays in complex chains

- Between supply chain steps
- Within process steps between tasks
- Decision lead time = From decision to delivery

Structures are rigid

- Adaption to changes takes time
- Structure, processes and liabilities

Tasks are interdependent

- Delivery of the final product is dependent of all of the production, sourcing, deliveries and inventories upstream

Planning in 3 time-horizons

Strategy & Design – Long term

- Obtaining strategic resources and capacity to meet long-term demand
- Choice of strategic locations depending on the markets
- Development and utilization of production process technology
- Planning long delivery components

Sales & Operations planning – Medium term

- Balancing supply and demand
- Sales, production and purchasing plans

Control and Schedule operation – Short term

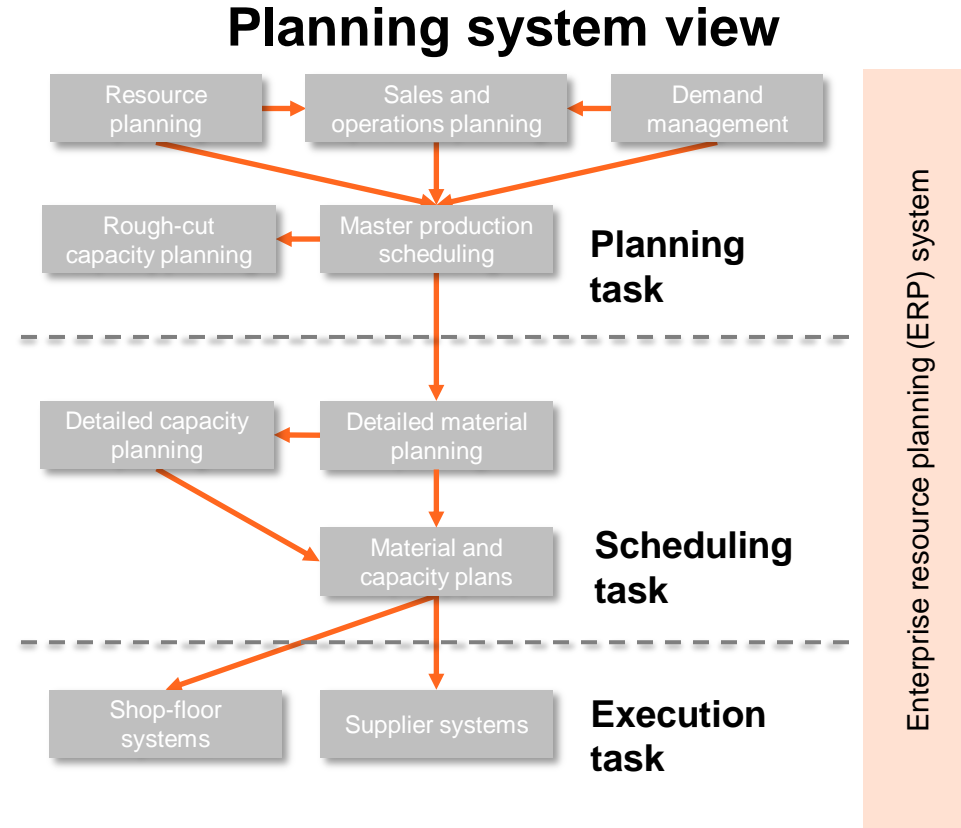
- Shop-floor resource allocation
- Short-term scheduling
- Managing exceptions

Planning process for supply chain

From **forecasting** demand to **adjusting capacity**, to **scheduling** actions

Targets:

- Maximize sales – availability of prod/service to customer
- Minimize costs and tied-up capital
- Hold up the customer service agreements



Inflexibilities and delays in SC: Forecasting is a critical task

Good forecasting

- “One set of numbers”
- Robust with predictable error
- No bias (systematic errors)

Characteristics of forecasts

- Always wrong
- Longer horizon, larger error
- Aggregate forecasts are more accurate

Types of methods

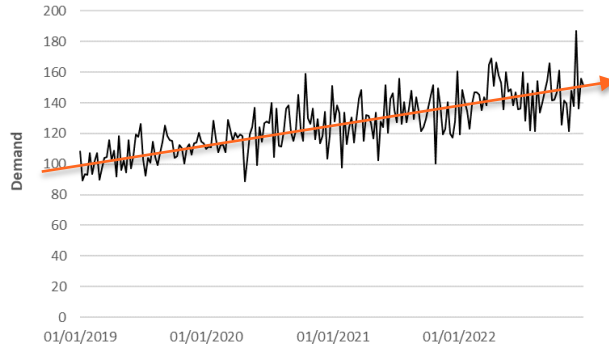
- Qualitative
- Time series
- Causal
- Simulation

Important data

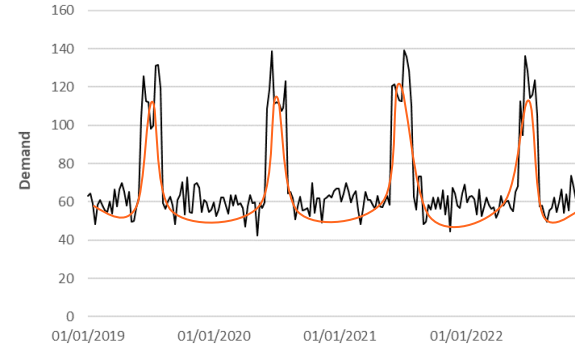
- Past demand
- Lead times
- Planned marketing
- Planned pricing
- Competitive actions
- Important external factors

Components in a forecast

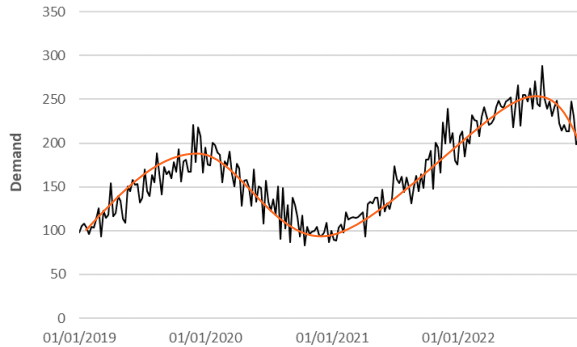
Trend



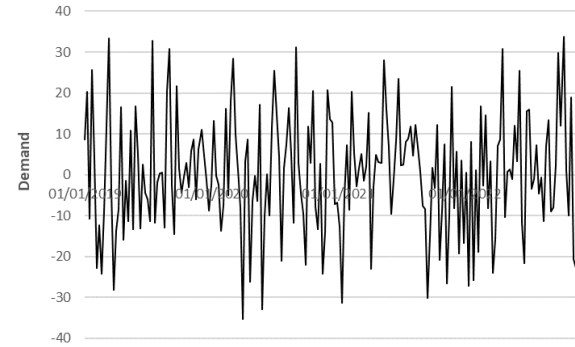
Seasonality



Cyclical

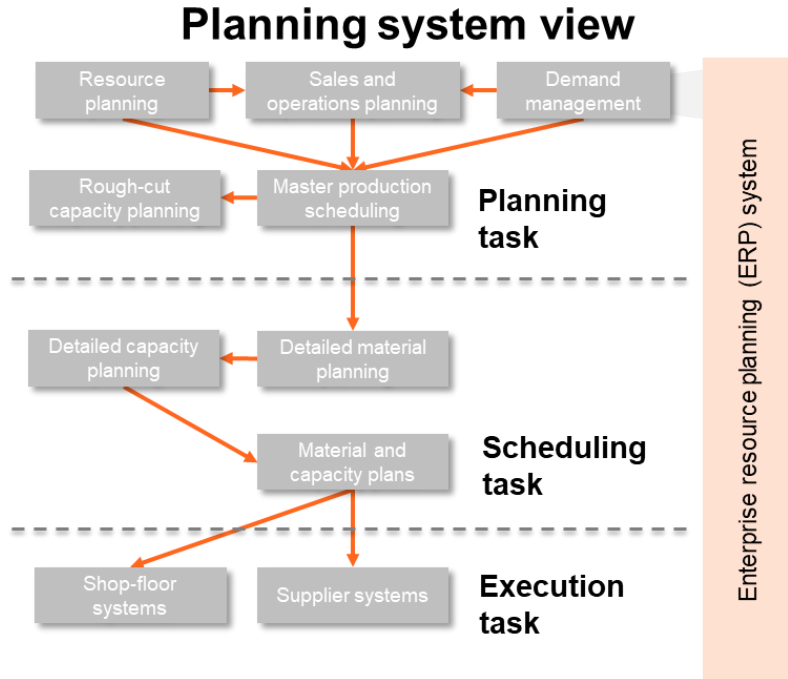


Random variation



From a forecast to an aggregate plan

Cross functional planning effort



Demand-supply balancing = Sales & Operations planning (S&OP)

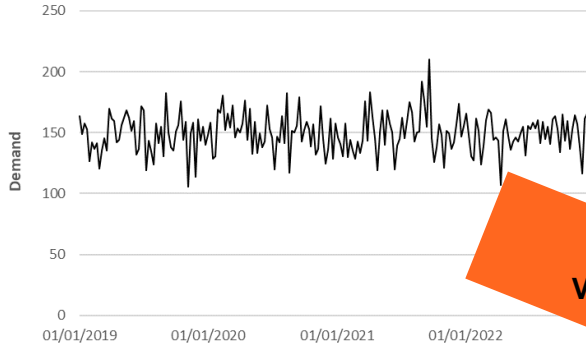
Supply constraint: You can **only** sell what is available for supply
Demand constraint: You should **only** produce what you are able to sell

Supply chain integration by SOP:

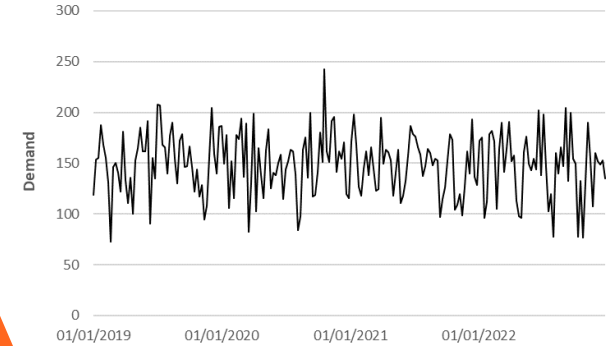
- Evaluate potential demand and commit “one set of numbers)
- Identify supply constraints and bottlenecks
- Create a common plan that the entire supply chain is capable and committed to execute

Supply chain coordination: Bull-whip effect

Customer sales at Retailer

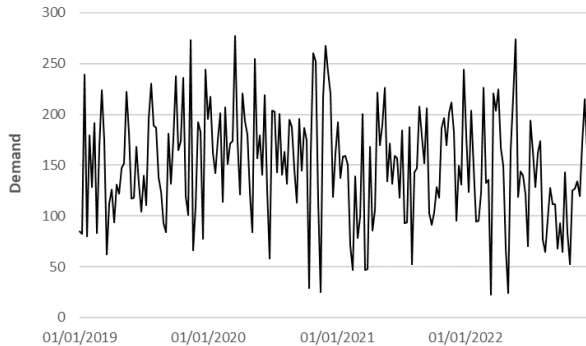


Retailer's Orders to Wholesaler

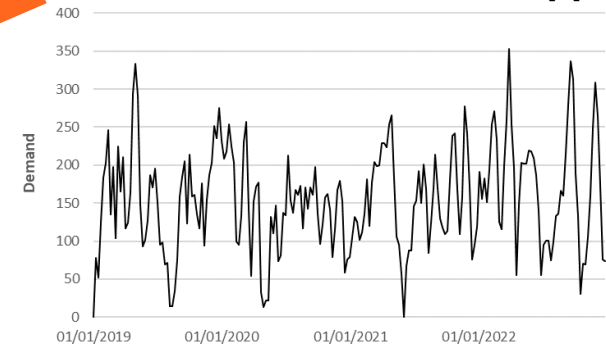


Volatility propagates upstream, why?

Wholesaler's Orders to Manufacturer



Manufacturer's Orders with Supplier



Reasons and mitigation strategies for bullwhip

- **Incentives misaligned**
 - Local optimization
 - Sales force incentives
- **Information distortion and delays**
 - Forecast driven operations
 - No information sharing
- **Operational inflexibilities**
 - Large production lots
 - Long lead times
- **Rationing and shortage gaming**
- **Pricing misaligned**
 - Quantity discounts
- **Aligning goals and incentives**
- **Pricing schemes for coordination**
- **Information accuracy and visibility**
- **Collaborative planning and forecasting (S&OP)**
- **Reduce lot sizes and lead times**