

LEC001 Introduction to Supply Chain

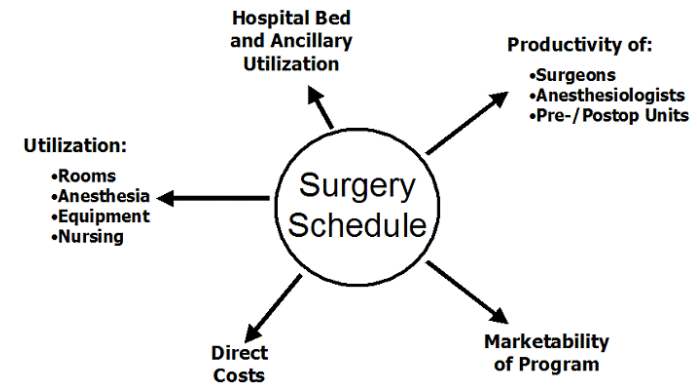
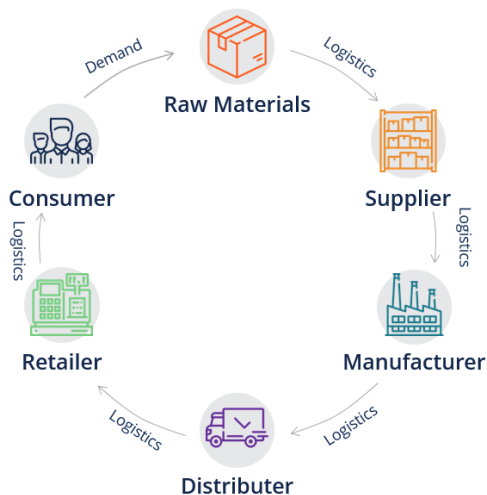
VG441 SS2021

Cong Shi
Industrial & Operations Engineering
University of Michigan

About the Instructor

Instructor: Cong Shi 时聪, Associate Professor at UM

Research Areas: Supply Chain, Revenue Management, Service Operations

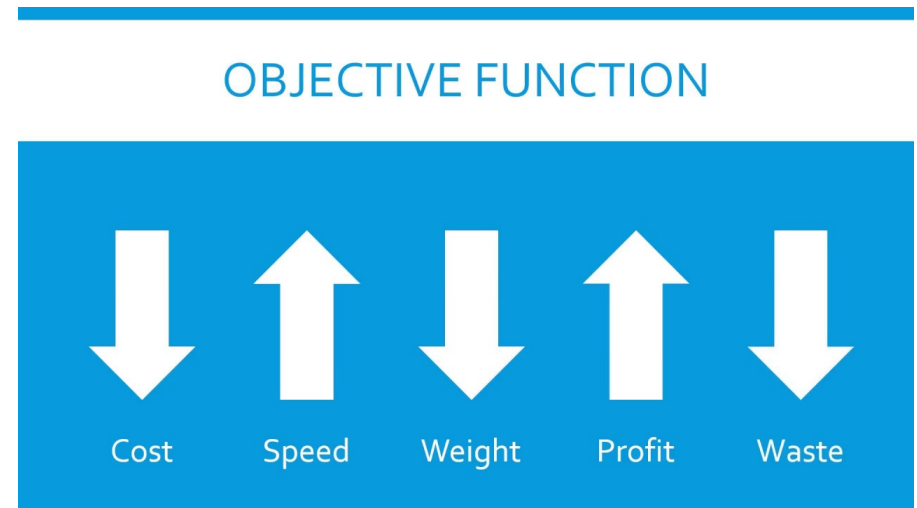
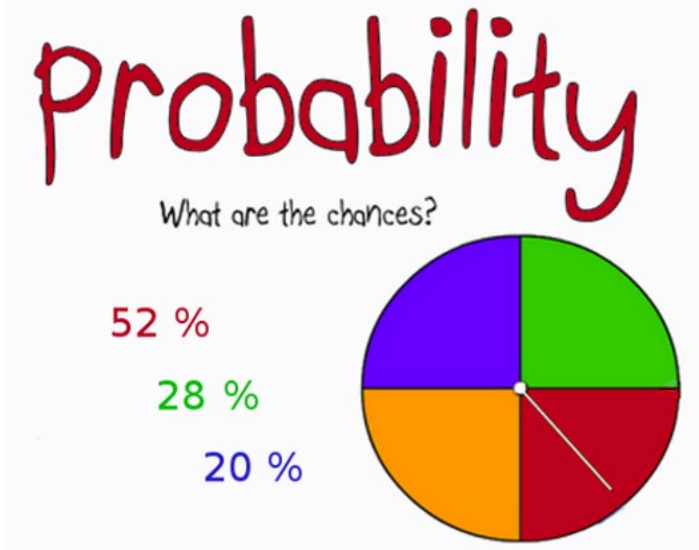


Methods: Optimization, Probability, Data Science, Learning Theory



Course Objectives

- Goal 1: Learn terminologies and principle for SCM
- Goal 2: Learn algorithmic approaches for SCM



What is Supply Chain?

All the activities and infrastructure whose purpose is to move products from where they are produced to where they are consumed



2020 Annual Business Logistics Cost ~ 2.6 trillion
(~ 16% of total US GDP)

What is Supply Chain?

- A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request
- Its existence is to satisfy customer needs, in the process generating profits for itself
- It not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves

What is Supply Chain Management?

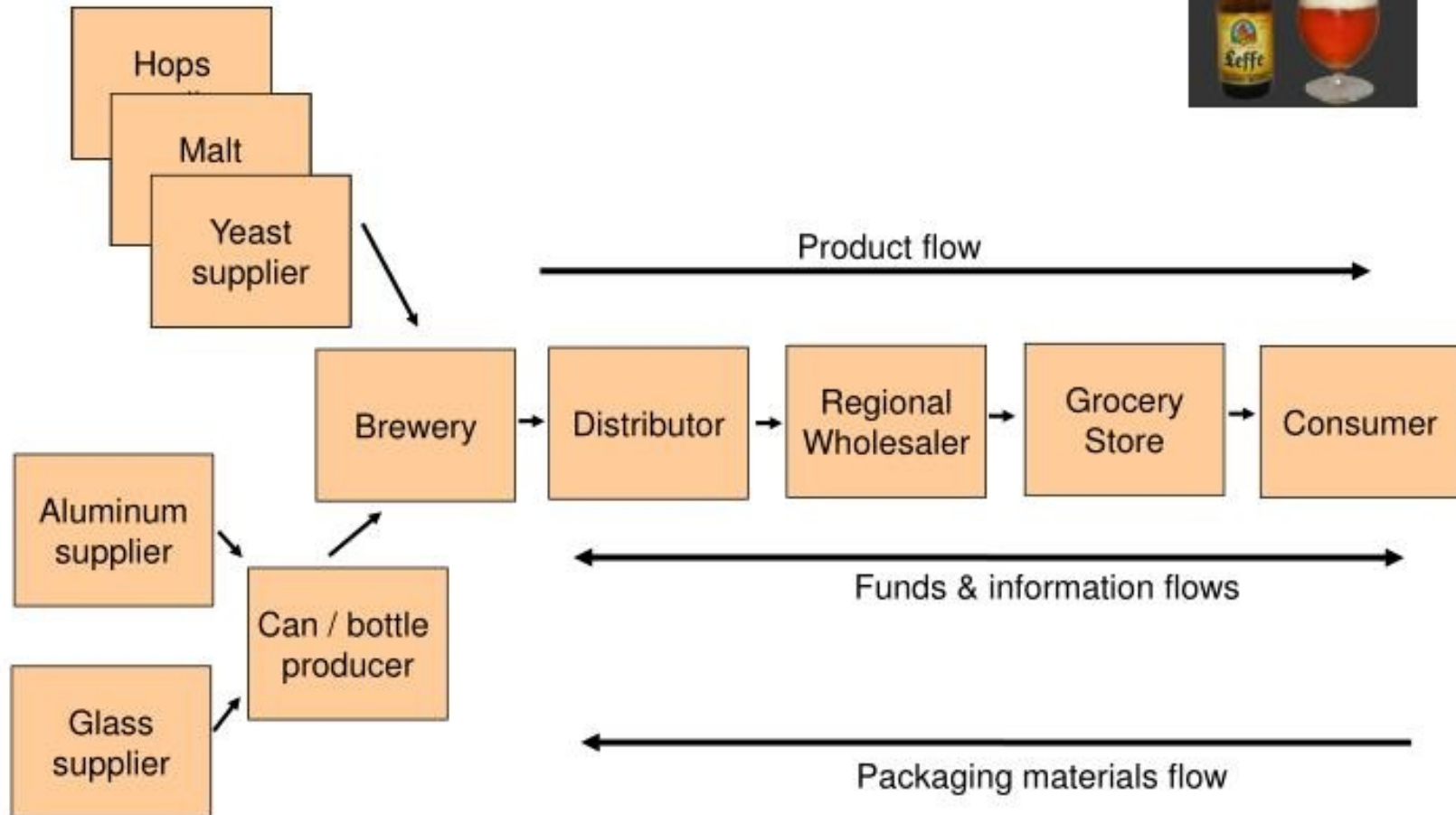
SCM is the set of practices required to perform the functions of a SC and to make them

- ♦ more efficient
- ♦ more profitable
- ♦ more equitable
- ♦ less costly
- ♦ less wasteful
- ♦ less stressful

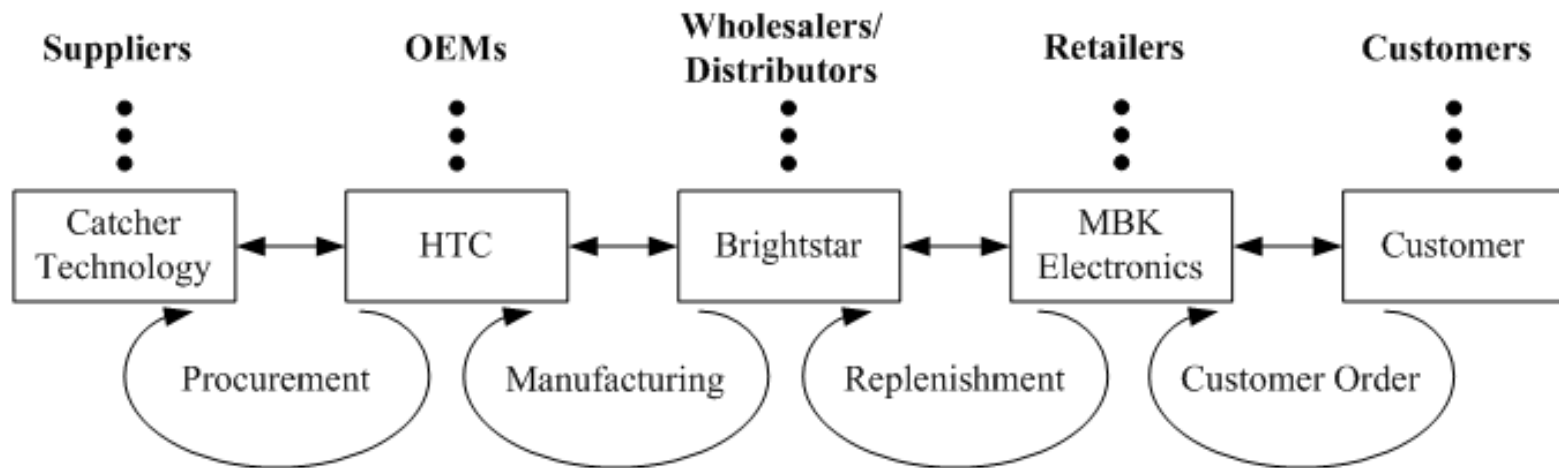


An Example of SC

Beer supply chain example



Another Example of SC



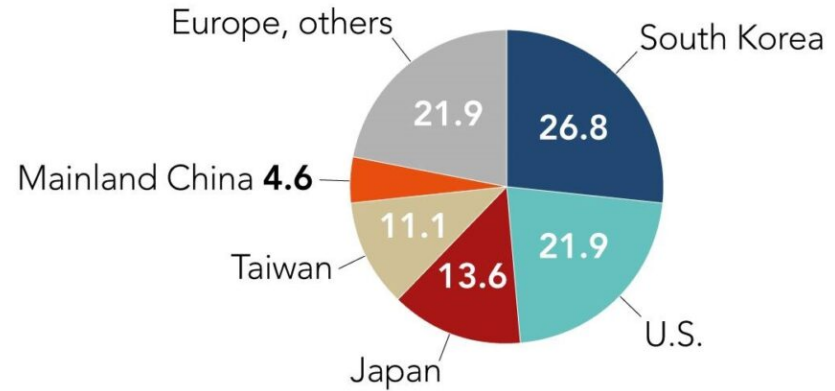
Apple iPhone 12

<https://www.apple.com/supplier-responsibility/pdf/Apple-Supplier-List.pdf>

(200+ suppliers, 1600 parts)



iPhone 12 Pro component providers, by country and region *(By value, in percent)*



Total does not equal 100 due to rounding

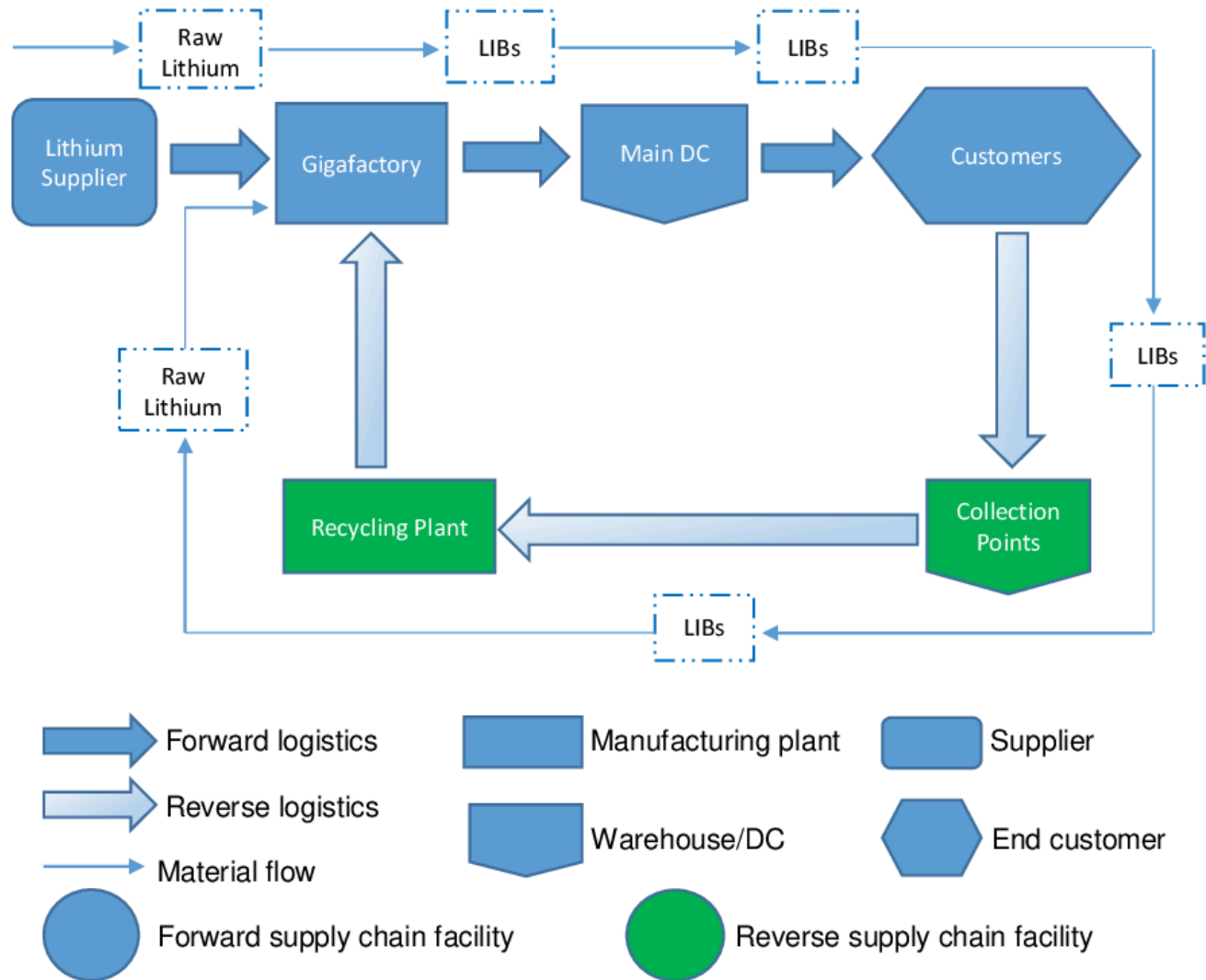
Source: Ratios based on estimates by Fomalhaut Techno Solutions

- iPhone 12 Pro OLED panel from Samsung– \$70 per unit
- Qualcomm Snapdragon X55 5G modem - \$90 per unit
- A14 Bionic – \$40 per unit
- SK Hynix DRAM – \$12.8 per unit
- Samsung flash memory – \$19.2 per unit
- Sony CMOS sensors \$7.4 – \$7.9.

Cost of making an iPhone 12 = \$406

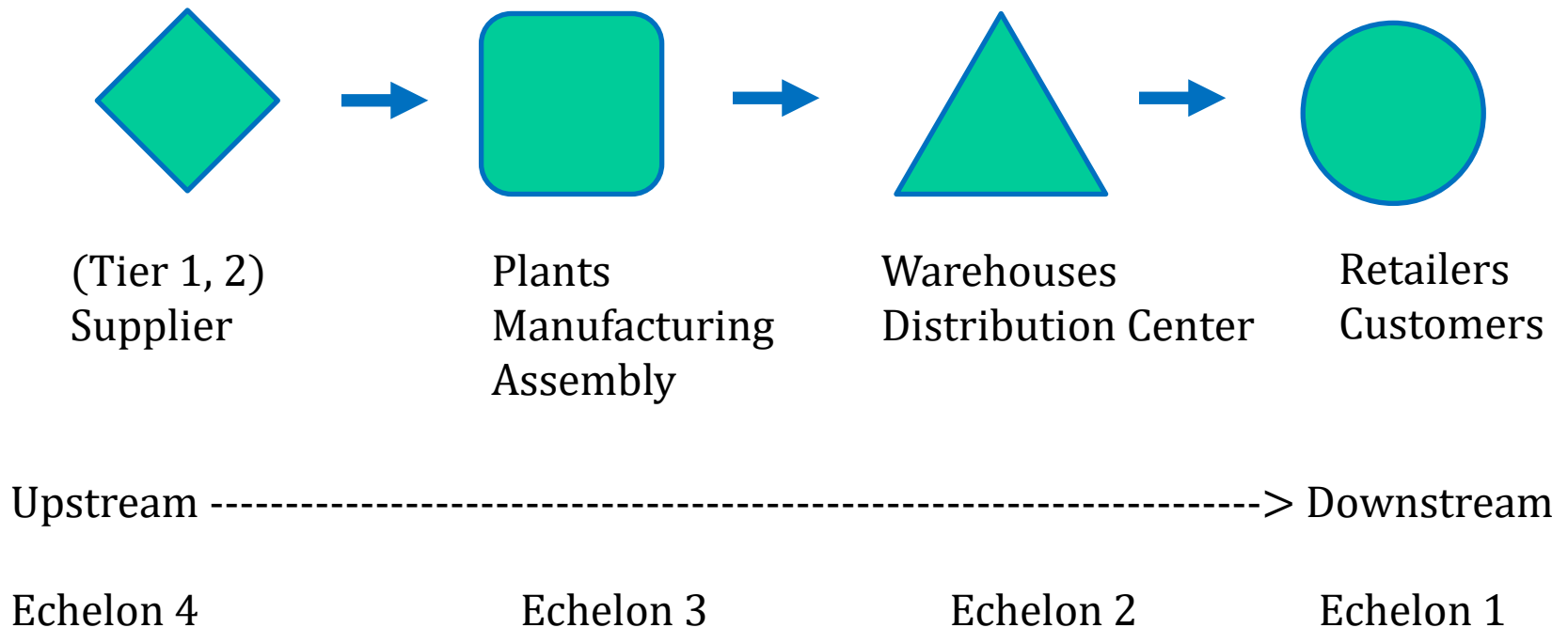
Selling Price = \$999 (42.5% gross margin)

Tesla



Key battery suppliers: LG, Panasonic, CATL(宁德时代)

Schematic Diagram



SC Objectives

- The objective of every supply chain is to maximize the overall value generated
- The value is the difference between what the final product is worth to the customer and the effort the supply chain expends in filling the customer's request
- The total profit, to be shared across all supply chain stages, is called *supply chain profitability*

Typical Set of Practices

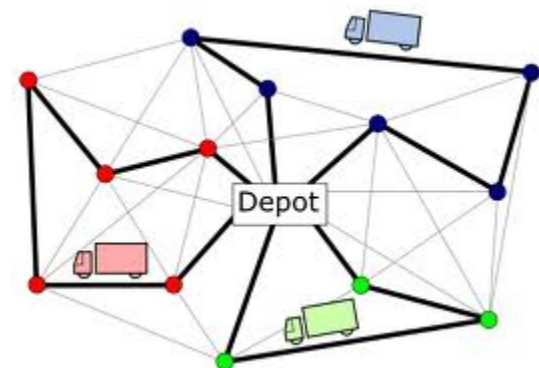
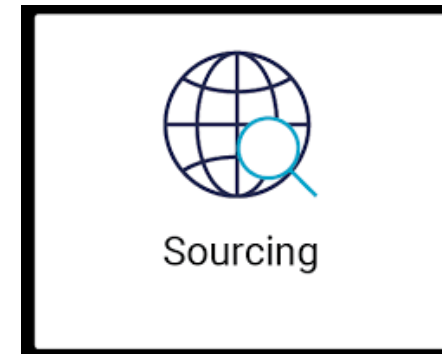
- Demand forecasting
- Production planning
- Inventory management
- Warehouse location (facility location)
- Supplier selection (sourcing)
- Transportation, shipping, last-mile delivery
- Revenue management (dynamic pricing)

Each part requires optimization!



Decisions

- **Strategic** (long-term planning):
 - Location & sizes of warehouses
 - Location & capabilities of factories
 - Contracts with suppliers
- **Tactical** (medium-term planning):
 - Assignments of customers to warehouses
 - Inventory policies at warehouses
- **Operational** (short-term planning):
 - Filling customer orders
 - Routing of delivery vehicles



More Decisions

- On-Demand E-Hailing/Ride-Sharing Platform (Uber, Lyft, DiDi)
 - Demand Prediction
 - Dynamic Matching
 - Dynamic Pricing
- Airline (Network) Revenue Management
 - Inventory and Capacity Constraints
 - Dynamic Booking and Pricing
- Amazon Fresh
 - Perishable Inventory Systems
 - Order Fulfillment (Service Level)
- Online Algorithms and Online Reinforcement Learning

Walmart Case

- Founded by Sam Walton in 1962 in Arkansas
- Focused on “Every Day Low Price”
- Focused on superb customer service



Several supply chain innovations

- ♦ VMI
- ♦ Cross-docking strategy
- ♦ Sam's club

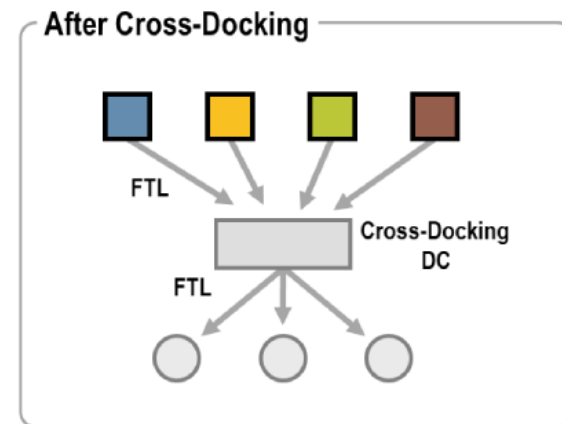
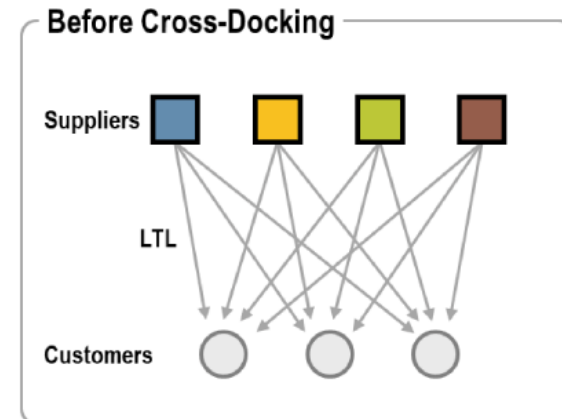
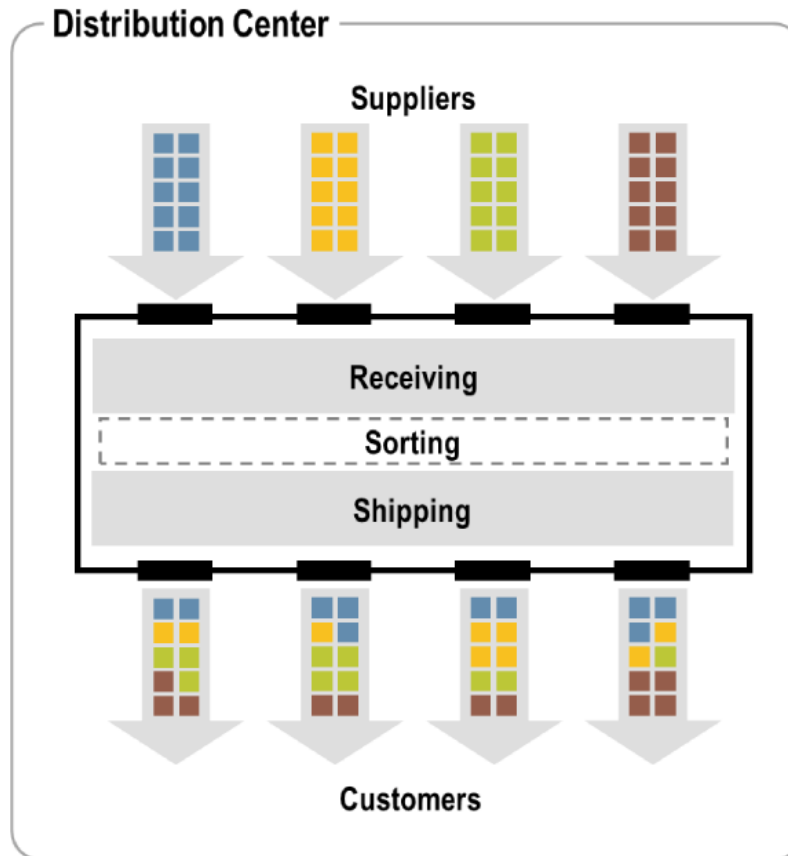
VMI (Vendor Managed Inventory)

- Vendor employee is on-site of Walmart's facility
- Physically replenish inventory on a visit
- Vendor has (partial) access to Walmart's inventory system (MRP/ERP)

Benefits:

- ♦ Protect vendor from under-stock and lost-sales
- ♦ Better inventory carrying costs
- ♦ Easy “decentralized” management for Walmart

Cross-Docking Strategy



Sam's Club



Membership Fee (Sam's club): \$45 basic, \$100 premium

Membership Fee (Costco): \$60 basic, \$120 executive (2% cashback)

Membership Fee accounts for 95% of net profit!!!

Target (Failure) Case

- Expansion into Canada in 2013
- Had to close 133 stores and laid off 17600 employees
- Lost \$2.5 billion



Problems:

- Wrong demand prediction (based on US sales)
- Poor SKU selection and inventory management
- Overstock and understock at the same time