

# LEC001 Introduction to Supply Chain

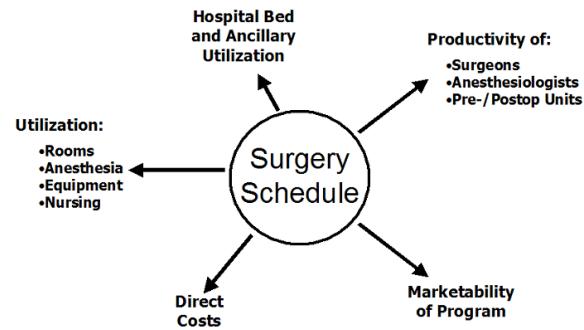
VG441 SS2020

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University of Michigan

# About the Instructor

Instructor: Cong Shi 时聰, Associate Professor at UM

Research Areas: Supply Chain, Revenue Management, Service Operations

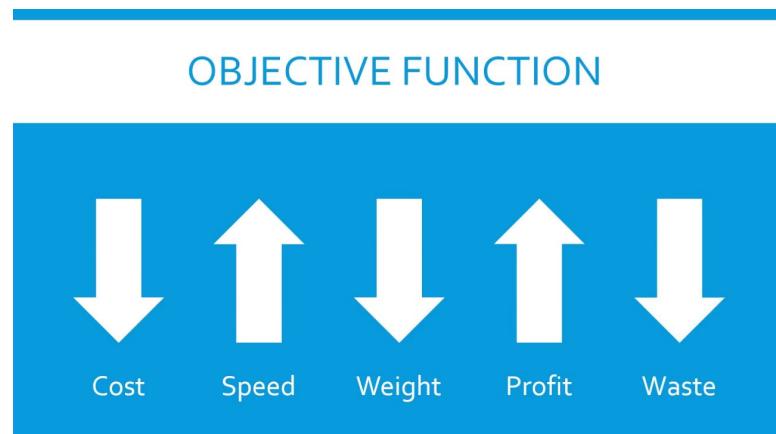


Methods: Optimization, Probability, Data Science, Learning Theory



# Course Objectives

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



# What is Supply Chain?

整个过程

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



2019 Annual Business Logistics Cost ~ 2.5 trillion  
(~ 15% of total US GDP)

# What is Supply Chain?

定义

- 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?

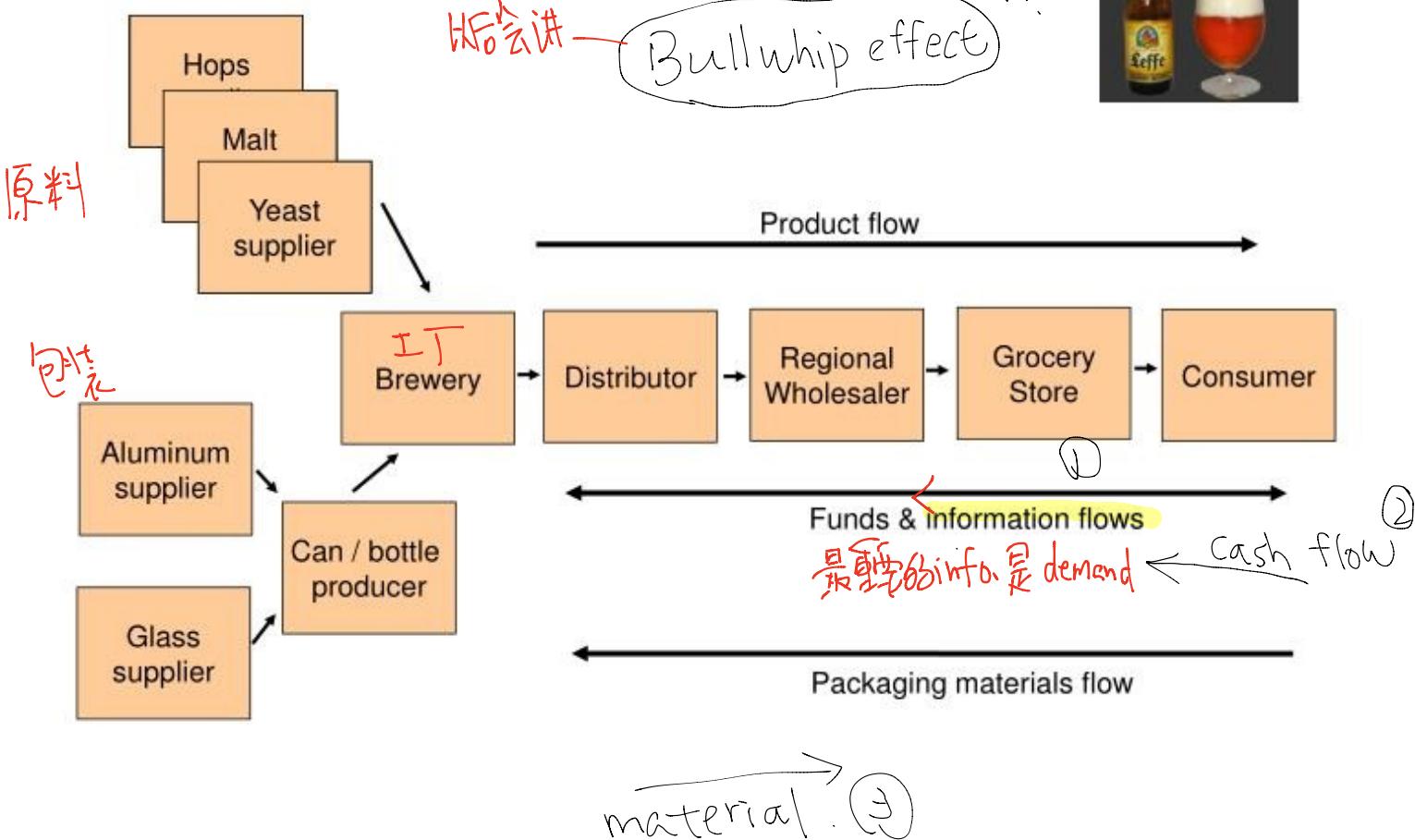
SCM is the set of practices required to perform the functions of a SC and to make them

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

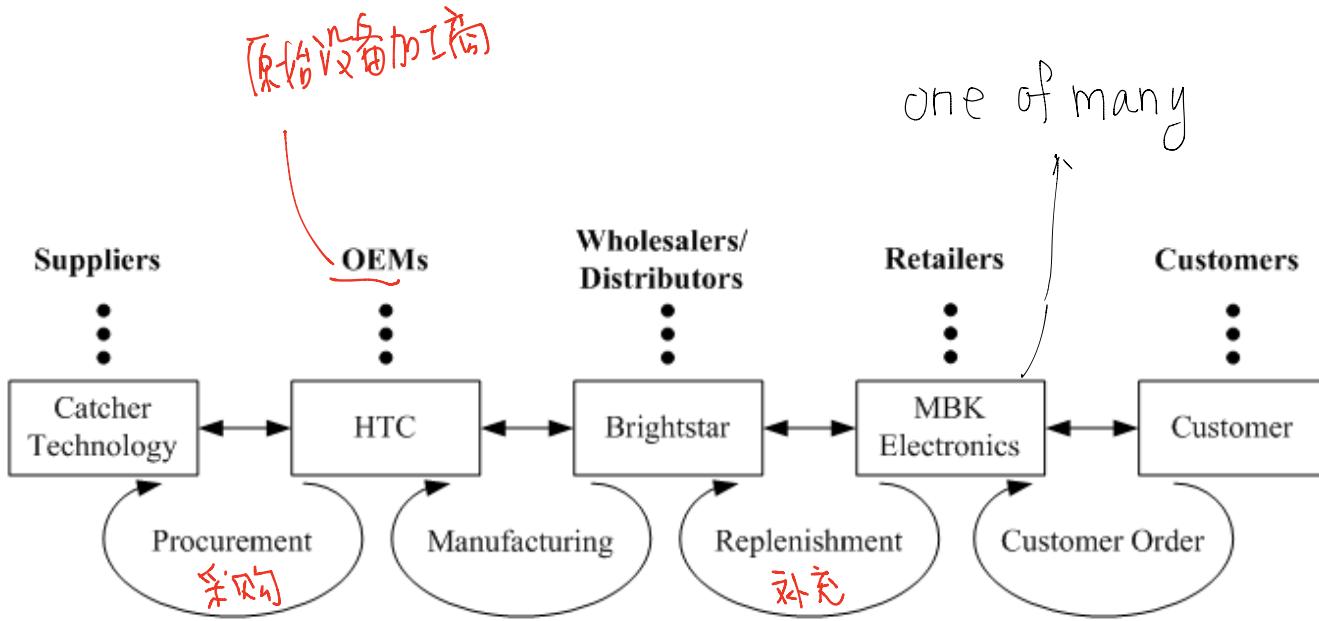


# An Example of SC

## Beer supply chain example



# Another Example of SC



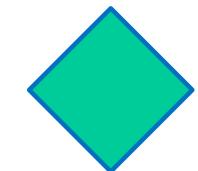
focus all attention on its core product

Outsource 原厂 (外包)

# Schematic Diagram

大 network 而不是 chain.

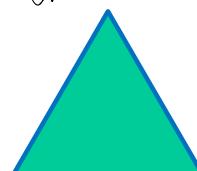
tier 2 給 tier 1 提供  
electronic part



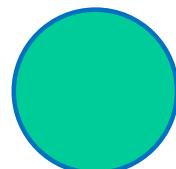
(Tier 1, 2)  
Supplier



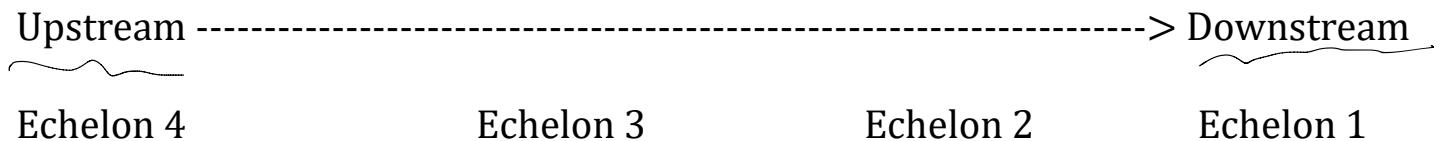
Plants  
Manufacturing  
Assembly



Warehouses  
Distribution Center



Retailers  
Customers



choose Suppliers

= sourcing decisions ,

bidding

& auction

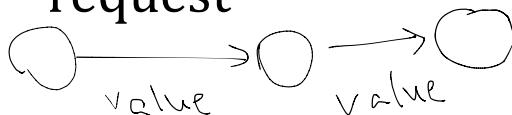
# SC Objectives

- The objective of every supply chain is to maximize the overall value generated

reduce cust. cost, max profit / max value

(价值)?

- 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***

利润

# Typical Set of Practices

Over stock  
Under stock

库存

仓库

- Demand forecasting
  - Production planning
  - Inventory management
  - Warehouse location (facility location) → integer programming  
*用*  
*\* Solve*
  - Supplier selection (sourcing)
  - Transportation, shipping, last-mile delivery
  - Revenue management (dynamic pricing)
- prof 的方向， algorithm
- Each part requires optimization!

labor/machine.

scheduling algorithms

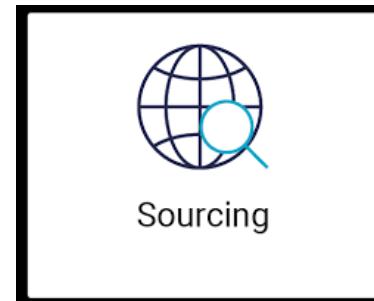
shortest-path  
max flow  
Vehicle routing

具体见 video  
40' 10"

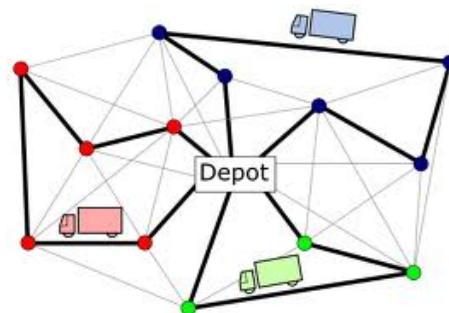


# Decisions

- **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



Sourcing



# 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

SKU 库存单位

# VMI (Vendor Managed Inventory)

小販

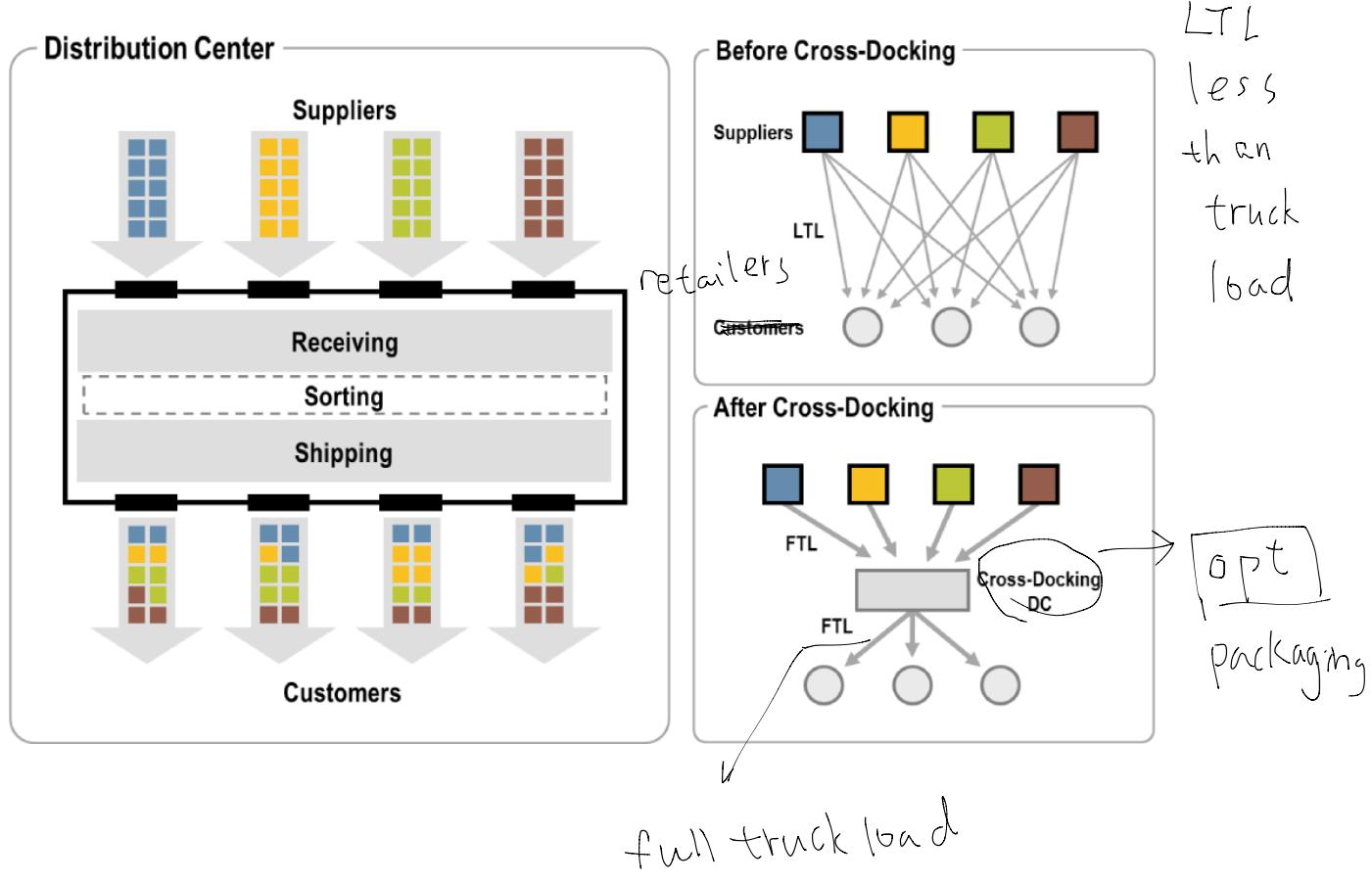
- Vendor employee is on-site of Martwart's facility
- Physically replenish <sup>补充</sup> inventory <sup>存货</sup> on a visit
- Vendor has (partial) access to Walmart's inventory system (MRP/ERP)

Benefits:

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

分散管理

# Cross-Docking Strategy



# Sam's Club

会员：锁定客户

也会使价格↓



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

material requirements  
planning

MRP

太慢了



Problems: stock keeping unit

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

Stock keeping unit