

## TRANSPORTATION-RELATED CONCEPTS AND TERMINOLOGY

## A shipping transaction

- ✦ **Freight:** The transported material
- ✦ **Shipper / Consignor / (Freight) Originator :** The shipping party.
- ✦ **Consignee / Freight Receiver :** The receiving party
- ✦ **Carrier:** The firm that provides the transportation service
- ✦ **Freight bill-of-lading (freight bill):** A document serving as a contract between the shipper and the carrier, specifying the obligations of both parties. In particular, it specifies:
  - The Consignee
  - The **FOB (free-on-board) point**, i.e., the point where the freight changes ownership (origin or destination)
  - The **FOB terms-of-sale**
    - Who arranges for transport and carrier
    - Who pays for transport (collect, prepaid, prepaid and charged back)
    - FOB point
    - Loss & Damage terms and potential insurance

## Freight Types

- ✦ **Bulk cargo:** Cargo that is stowed loose on transportation vehicles, a tank or hold without any packaging; handled by pump, scoop, conveyor or shovel. Ex: grain, coal, petroleum and chemicals.
- ✦ **Break-bulk cargo:** Cargo in between bulk and containerized, that must be handled piece-by-piece by terminal workers; often stored in bags or boxes and stacked on **pallets**.
- ✦ **Pallet:** a small platform, usually 40x48in, on which (cartons of) goods are towered for handling in warehouses and transport vehicles.
- ✦ **Containerized cargo:** Cargo filling an entire container that is handled as a single unit.
- ✦ **Container:** A single, rigid, sealed, reusable metal box in which freight is shipped by vessel, truck or rail. Usually 8x8 ft in width & height, 20 to 55 ft long. Some container types include: standard, high cube, hard top, open top, ventilated, insulated, refrigerated, etc.
- ✦ **Dunnage:** Wood and packaging materials used to keep cargo in place inside a container or transportation vehicle.

## Freight Units

- ✦ Freight is typically measured by **weight**:
  - Short ton (American) 2000 lbs
  - Long ton (English) 2240 lbs
  - Metric ton 2204.6 lbs (1000 kgs)
- ✦ or sometimes by **cube**, i.e., volume.
- ✦ Transportation equipment (vehicles, vessels, etc.) has pre-specified weight and volume capacities; e.g.,
  - **Deadweight**: The number of long tons that a vessel can transport of cargo, supplies and fuel.
  - **TEU (Twenty-foot equivalent unit)**: Method for specifying a vessel load or capacity in units of containers that are 20ft long. (e.g., a 3000 TEU vessel can accommodate - at most - 1500 40ft containers).
  - **FEU (Forty-foot equivalent unit)**
  - **Slot**: A place for a container onboard a container ship (typically, one TEU).

## Carrier Types

- ✦ **Private carrier**: Owned and operated by a shipper. Usually refers to private trucking fleets. More advantageous solution for high density / short distance or special-need shipments.(e.g., Safeway)
- ✦ **Common carrier**: A for-hire carrier providing services to general public.
  - Parcel / express carriers (UPS, FedEx)
  - LTL (Less Than Truckload) Trucking (Yellow, Consolidated Freightways)
  - LCL
  - TL trucking (Hunt, Schneider)
  - CL
  - Rail carrier (Norfolk Southern)
  - Air carriers (Delta, Flying Tigers)
  - Ocean carrier (SeaLand, American President Lines)
    - Liner Shipping: vessels sailing between ports on regular schedule, which is published and available to public.
    - Tramp shipping: Vessels calling at different ports upon availability of cargo (used primarily for bulk shipping)
  - Pipeline

## Mediators and Integrators

- ✦ **Freight forwarder**: An agency that receives freight from the shipper and then arranges for transportation with one or more carriers for transport to the consignee. Typically, consolidates freight from many shippers to obtain better rates. Also, often provide pickup and delivery services, as well as other shipping services: packaging, temporary storage, customs clearing.
- ✦ **Transportation Broker**: An agency that obtains negotiated large-volume transportation rates from carriers and resells this capacity to shippers. No additional services are provided, though.
- ✦ **NVOCC (Nonvessel-operating common carrier)**: Owns no vessels, but provides ocean shipping freight-forwarding services.
- ✦ **Shipper's Association**: Not-for-profit association of shippers using collective bargaining and freight consolidation to obtain lower, high-volume transportation rates. Avoids premium charge paid to forwarders. Only non-competitive shippers may associate, due to monopoly restrictions.
- ✦ **Integrators**: Companies providing door-to-door domestic and international air-freight service. Owns and operate aircraft as well as ground delivery fleet of trucks (e.g., UPS, FedEx, Emery Worldwide).
- ✦ **3PL**: A third-party, or contract, logistics company, used to outsource logistics services. It can also handle: Purchasing, Inventory management/warehousing, transportation and order management (e.g., Schneider Logistics, Ryder Logistics, UPS Logistics)

## Transportation Systems

- ✦ **Direct Shipping**: Shipment travels directly from consignor to consignee. Used primarily for TL shipping.
- ✦ **Dead-head**: A portion of a transportation trip in which no freight is conveyed; an empty move.
- ✦ **Hub-and-spoke**: Large hub terminals are employed for freight consolidation. Medium-volume services are used for spoke-to-hub collection and hub-to-spoke distribution. Air freight, parcel shipping, LTL and, more recently, ocean shipping is organized in this manner.
- ✦ **Pickup and delivery (cartage)**: Local hauling of freight
- ✦ **Longhaul (or Linehaul)**: Terminal-to-terminal freight movements
- ✦ **Milk runs**: a vehicle route in which a truck delivers (picks up) freight from (for) a single terminal to (from) a number of consignees.
- ✦ **Interline / Intermodal shipment**: shipment employing more than one carrier / transportation mode.

## Charging Patterns for Common Carriers

### Related to **shipment size**

- **LTL and LCL shipments**: minimum total rate for quantities below a minimum threshold, then several weight categories with different rates.
- **TL and CL shipments**: rate depends only on equipment size ordered.
- **Time-volume rates**: encourages shippers to send minimum quantities regularly, in an effort by carriers to ensure regular flow of business

### Related to **distance**

- **Uniform rates**: independent of distance (e.g., USPS priority mail)
- **Proportional rates**: Fixed rate + variable rate per distance (truckload rates)
- **Tapered rates**: Increase with distance but at decreasing rate (air transportation)
- **Blanket rates**: constant rates for certain intervals of distance (e.g., UPS rates, bulk cargo).

## Charging Patterns for Common Carriers (cont.)

### Related to product shipped

- Weight/volume, value / weight, value/volume
- Liability to loss, damage or theft
- Risk of hazardous material
- Expense of handling
- Security of container or packaging

### Special services

- Diversion and reconsignment
- Special equipment, e.g., refrigeration
- Demurrage / detention
- Stopoff charges
- Switching
- etc.

### Deferred rates: If the shipper is willing to accept delay in shipment

- Rates can also be affected by the existing demand: Revenue management

### Factors affecting the choice of Mode and Carrier

- ✦ Door-to-door cost
- ✦ Loss and damage: likelihood
- ✦ Loss and damage: claims handling
- ✦ Transit time reliability
- ✦ Rate negotiation experiences
- ✦ Shipment tracking / tracing
- ✦ Door-to-door transit time
- ✦ Pickup / delivery service quality
- ✦ Single-line service availability (no interlines)
- ✦ Equipment availability

### Transportation-related Problems in the Supply Chain design and operation

- ✦ **User / Shipper's perspective**: Balance inventory, facility and transportation costs while maintaining a service level in the operations of the supply chain (typically, formalized in the context of "inventory control" theory).
- ✦ **Carrier's perspective**: Maximize profit by making best use of the available transportation capacity. Involved costs:
  - **Capital costs**
    - Vehicle-related: fleet cost and major maintenance
    - Terminal-related: land/rent, equipment, personnel
  - **Operational costs**
    - Trip-related: fuel, drivers, wear & tear
    - Freight handling
    - Overhead: planning and scheduling, customer service, etc.

## Some definitions for Logistics and Supply Chain Management

### ★ **Council of Logistics Management (CLM):**

The process of planning, implementing and controlling the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements.

### ★ **Chopra and Meindl:**

The primary purpose for the existence of any supply chain is to satisfy customer needs, in the process generating profits for itself. Supply chain activities begin with a customer order and end when a satisfied customer has paid for his or her purchase.

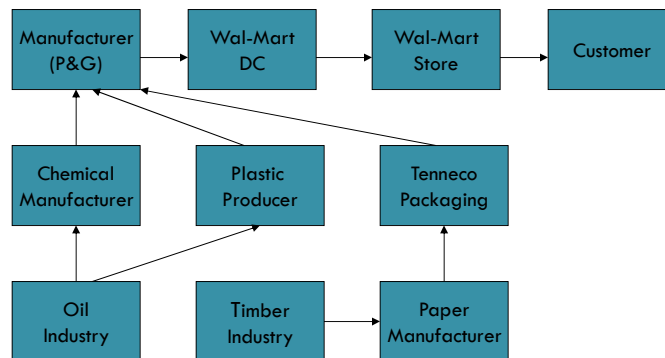
## Transportation Planning: a break-down approach

- ★ **Strategy or design issues:** How to structure the supply chain ( **scope:** years)
  - Logical configuration of the supply chain processes and their various operational cycles
  - Physical configuration of the supply chain
    - Location and Capacity of Production and Storage facilities
    - Transportation links and modes
  - Information technology (IT) infrastructure
- ★ **Planning issues:** Determining the operational policies that will drive the short-term decision making ( **scope:** months)
  - Which markets to be supplied by which locations
  - Planned Build-up of inventories / Inventory replenishment policies / Stockout handling
  - Levels of subcontracting
  - Timing and size of marketing promotions
- ★ **Operational issues:** Implement the operating policies in the best possible manner ( **scope:** shifts, days or weeks)
  - Allocate individual orders to inventory or production
  - Set a date that an order is to be filled
  - Generate the pick lists for a warehouse
  - Allocate an order to a particular shipping mode and shipment
  - Set delivery schedules for trucks
  - Place replenishment orders

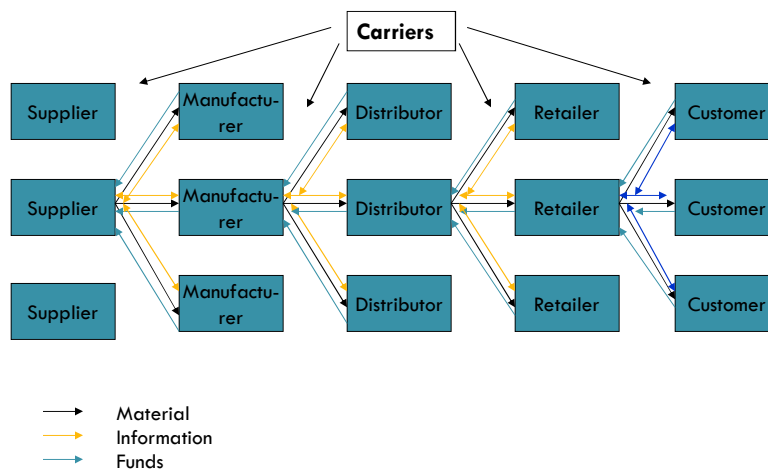
## So, what is a supply chain?

✚ **Chopra & Meindl**: A **supply chain** consists of all stages involved, directly or indirectly, in fulfilling a customer request.

✚ **Example**: A detergent supply chain:



## A more abstract characterization of a supply chain / network



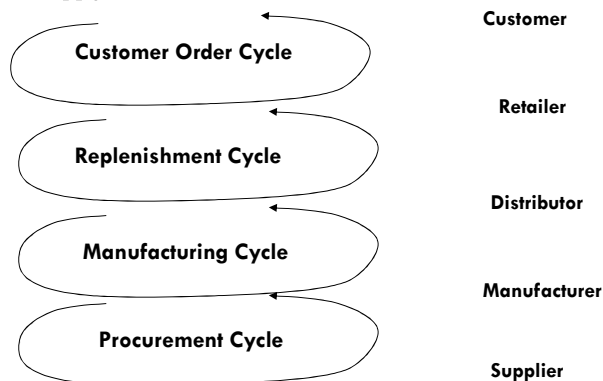
**Remark:** Although the modern world is much messier....



## A cycle-based process view for supply chain operations

**Cycles:** A sequence of steps characterizing the transactions that take place among two successive stages of the supply chain

### Stages



## Customer order cycle

All the processes directly involved in receiving and filling a customer order.

### **Major phases:**

- Customer Arrival (at a retail store, telemarketing center, company web site)  
**Phase Objective:** maximize customer arrivals to customer orders
- Customer Order Entry  
**Phase Objective:** ensure that the order entry is quick and accurate and is communicated to all other supply chain processes that are affected by it.
- Customer Order Fulfillment  
**Phase Objective:** get the correct and complete orders to the customer, by the promised due date and at the lowest possible cost
- Customer Order Receiving  
**Phase Objective:** Complete the transaction in an orderly fashion

## Replenishment Cycle

- ✚ All the processes involved in replenishing retailer inventory.
- ✚ **The primary objective** : Replenish inventories at the retailer at minimum cost, while providing a certain product availability to the customer.
- ✚ **Major Phases** :
  - Retail Order Trigger (by an appropriate replenishment policy)
  - Retail Order Entry
  - Retail Order Fulfillment
  - Retail Order Receiving

## Manufacturing Cycle

- ✚ All processes involved in generating the product that will fill the customer, retailer and distributor orders. It is driven by
  - the actual orders placed with the manufacturer,
  - forecasts for expected future demand, and
  - the current product availability in the manufacturer's finished-product warehouse.
- ✚ **Primary objective** : Meet the actual and/or forecasted demand in a **timely** and **cost-effective** manner, within the scope of the available production capacity
- ✚ **Major Phases** :
  - Order arrival from distributor, retailer or customer
  - Production Scheduling
  - Manufacturing and shipping
  - Receiving at the distributor, retailer, or customer

## Procurement Cycle

- ✦ All the processes necessary to ensure that materials are available for manufacturing to occur according to schedule.
- ✦ **Major Phases**: similar to the cycle characterizing the interaction between distributor and manufacturer.
- ✦ However, demand is driven by the manufacturer's production schedule rather than more exogenous market factors / customer behavior.

## A push vs pull view of the SC operations

- ✦ Categorizes SC processes based on whether they are initiated in response to a customer order ( **pull** ) or in anticipation of a customer order ( **push** ).
- ✦ **Examples**:
  - Compaq: All processes except for those involved in customer order cycle are of "push" type.
  - Dell: Dell assembles its computers to order and therefore, all processes except for those involved in the procurement cycle are "pull".
- ✦ **Remark**: Generally, if possible, a "pull" organization of the supply chain provides tighter control of inventory costs and the ability to support higher levels of product customization .