

# Logistics

**Logistics:** deals with the planning and control of material flows and related information in organizations, both in the public and private sectors. Broadly speaking, its mission is to get the right materials to the right place at the right time, while optimising a given performance measure (e.g. minimising total operating costs) and satisfying a given set of constraints (e.g. a budget constraint).

Civil organisations: in firms producing and distributing physical goods. Key issue: decide how and when raw materials, semi-finished and finished goods should be acquired, moved and stored.  
Also: garbage collection, mail delivery, etc.

Military: supply of troops with food, armaments, ammunitions and spare parts, as well as the transport of the troops themselves.

**Logistics systems:** made up of a set of *facilities* linked by *transportation services*.

*Facilities:* Sites where materials are processed, e.g. manufactured, stored, sorted, sold or consumed.

Include: manufacturing and assembly centres, warehoused, distribution centres (DCs), transshipment points, transportation terminals, retail outlets, mail sorting centres, garbage incinerators, dump sites, etc.

*Transportation services:* move materials between facilities using vehicles and equipment such as trucks, tractors, trailers, crews, pallets, containers, cars, and trains.

**Supply chains:** a complex logistics system in which raw materials are converted into finished products and then distributed to the final users (consumers or companies).

Includes: suppliers, manufacturing centres, warehouses, DCs and retail outlets.

## **Push versus pull supply chains:**

*Pull (or make-to-order (MTO))* system: finished products are manufactured only when customers require them. Hence, in principle, no inventories are needed at the manufacturer.

*Push (or make-to-stock (MTS))* system: production and distribution decisions are based on forecasts. Production anticipates effective demand, and inventories are held in warehouses and at the retailers.

## Logistic systems: three main activities

**1. Order processing** strictly related to information flows.

### **2. Inventory management**

*Inventories:* stockpiles of goods waiting to be manufactured, transported or sold.

Aim of inventory management: determine stock levels in order to minimise total operating cost while satisfying customer service requirements.

Consider: relative importance of customers, economic significance of the different products, transportation policies, production process flexibility, competitors' policies.

### **3. Freight transportation**

Inventory and transportation strategies are intertwined.

Three main strategies for distributing a product:

- *Direct shipment.* Goods are shipped directly from manufacturer to end-user (retailers in case of retail goods).
  - + No expenses for operating a DC, reduce lead times
  - A large fleet of small trucks may be required, if typical shipment size is small and customers are dispersed over a wide geographic area.
- *Warehousing.* Goods are received by warehouses and stored in tanks, pallet racks or on shelves. When an order arrives, items are retrieved, packed and shipped to the customer.
- *Crossdocking / Just-in-time distribution.* A cross dock is a transshipment facility in which incoming shipments are sorted, consolidated with other products and transferred directly to outgoing trailers without intermediate storage or order picking.  
Shipments spend just a few hours at the facility.

## **Three alternatives for transportation of materials:**

- *Private transportation.* The company operates a private fleet of owned or rented vehicles.
- *Contract transportation.* A carrier is in charge of transporting materials through direct shipments regulated by a contract.
- *Common transportation.* The company can use a carrier that uses common resources (vehicles, crews, terminals) to fulfil several client transportation needs.

## **Players:**

- *Shippers*. Include both producers and brokers.
- *Carriers*. Like: railways, motor carriers and shipping lines.
- *Governments*. Construct and operate several transportation infrastructures, e.g. rail facilities, roads, ports, and airports; regulate several aspects of the industry.

Some shippers operate own transportation fleet —> act as dedicated carrier.

# Freight transportation

*Long-haul:* goods are moved over relatively long distances, between terminals or other facilities. Transport by truck, rail, ship, or any combination of these modes.

*Short-haul:* goods are transported, usually by truck, between pick-up and delivery points situated in the same area.

# Distribution channels

Few manufacturing firms sell their own products to end-users directly.

In most cases: *intermediaries* participate in product distribution:

- *sales agents or brokers*, who act for the manufacturer
- *wholesalers*, who purchase products from manufacturers and sell them to retailers, who in turn sell them to end-users.

*Retailer*: a person or company that sells goods directly to the public for their own use.

*Distribution channel*: path followed by a product from the manufacturer to the end-user.

# Freight consolidation

*Consolidation*: make use of economies of scale in transportation, by consolidating small shipments into larger ones.

Three ways:

- *Facility consolidation*. Small shipments that have to be transported over long distances —> transport large shipments over long distances and small shipments over short distances.
- *Multi-stop consolidation*. Less-than-truckload pick-up and deliveries associated with different locations served by the same vehicle on a multi-stop route.
- *Temporal consolidation*. Adjust shipment schedules forward or backward, to make a single large shipment rather than several small ones.

# Modes of transportation

Five basic modes:

- Ship
- Rail
- Truck
- Air
- Pipeline

Can be combined in several ways to obtain door-to-door services.

Selection of carrier by shipper:

- Price (or cost)
- Transit time

*Cost:* sum of all costs associated with operating terminals and vehicles.

*Price:* the rate charged by the carrier to the shipper.

*Transit time:* time a shipment takes to move between its origin and destination, influenced by weather and traffic conditions.

Modes from most expensive to cheapest: air, truck, rail, pipeline, ship.

(Truck ~7x more expensive than train ~4x more expensive than by ship.)



# Air traffic

# Terminal Building



Where passengers purchase tickets, check baggage, board and disembark planes

# Jetway



The hallway that  
joins the plane to  
the terminal

## Control Tower



The tower from which air traffic controllers direct planes in the air and on the ground

# Hangar

A place where  
airplanes are stored  
and repaired



## Round-Trip



A trip that begins in one city, goes to another, and ends in the originating city

# Open-Jaw Trip



A journey that interrupted by surface travel OR has a return destination other than the originating city



# Hub and Spoke Route

A major airport is the  
center point - hub

Connecting flights  
are the spokes



## Direct Flight



A flight carries  
travellers from one  
destination to another  
– no stopovers

## Online Connection



Travel between two destinations in which travellers change aircraft (not airlines) to complete the journey

## Interline Connection



Travel between two destinations in which travellers change airlines to complete the journey



# Load Factor

Percentage of seats  
filled on the airplane

