



TEXAS A&M UNIVERSITY
GALVESTON CAMPUS.

INTRODUCTION TO THE MARITIME INDUSTRY

9. Cargo Handling and Warehousing



MARA 205

Professor: Dr. Jean-Paul Rodrigue



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INTRODUCTION TO THE MARITIME INDUSTRY



A – Logistics and Supply Chains

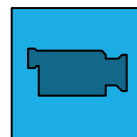
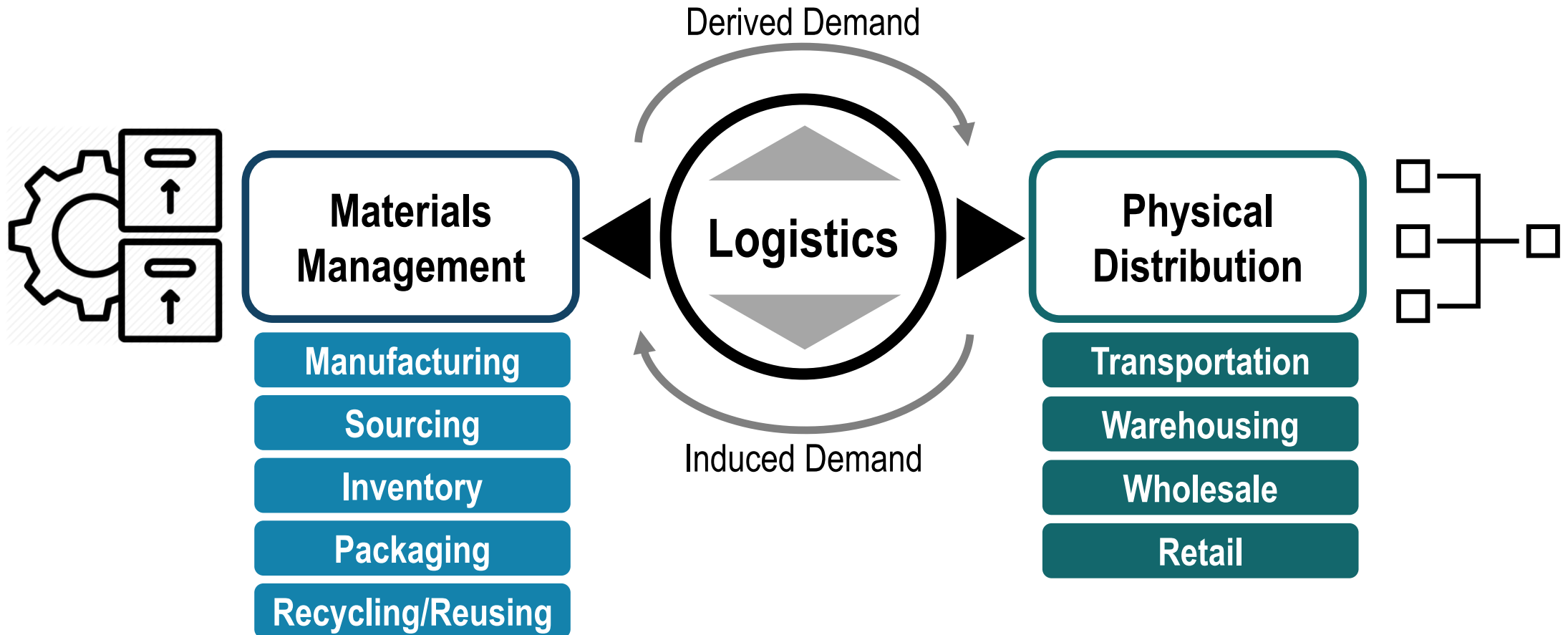
Logistics

- Is there a difference between logistics and supply chain management?
 - Yes and no...
 - A wide set of activities dedicated to the transformation and distribution of goods, from raw material sourcing to final market distribution as well as the related information flows.
 - Logistics is more about the transportation dimension, while supply chain management is more about organization and procurement.
- Physical distribution
 - Activities involved in the movement of goods from points of production to final points of sale and consumption.
- Materials management
 - Activities involved in the manufacturing of commodities in all their stages of production along a supply chain.

The Concept of Logistics

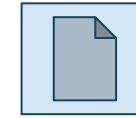


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What is Supply Chain Management?

Logistics Goals and Operations



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Fulfillment (Goals)

Order

- Right product
- Right quantity

Delivery

- Right location
- Right time

Quality

- Right condition

Cost

- Right price



Demand (Operations)

Transportation

- Handling
- Packaging

Inventory

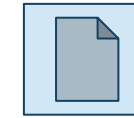
- Production scheduling
- Warehousing

Orders

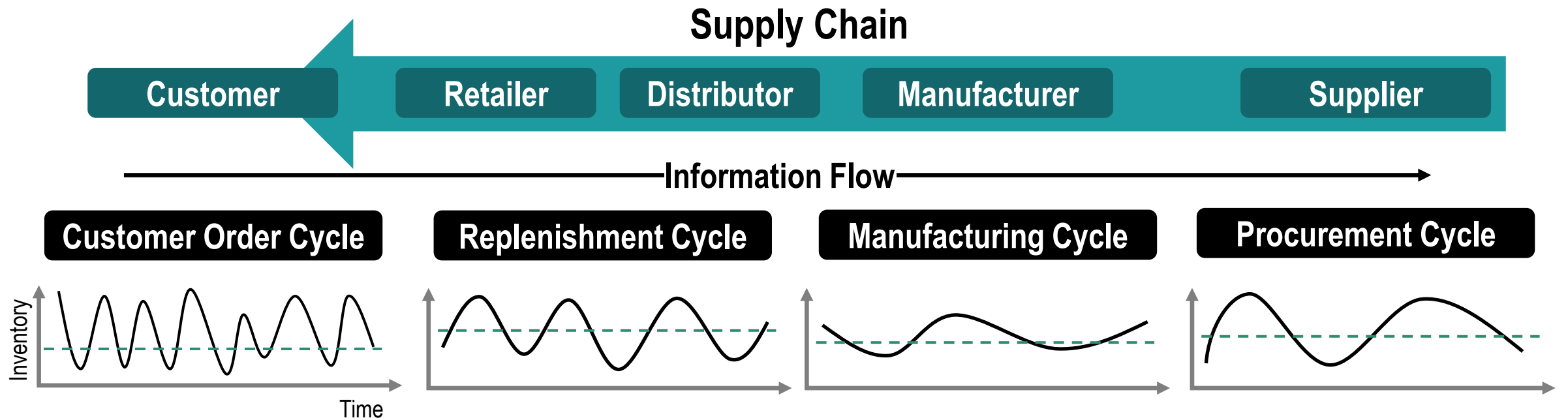
- Sales
- Purchase



The Supply Chain and its Cycles



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Two Important Logistics Costs

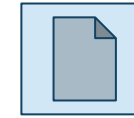
- Warehousing costs:
 - Fixed costs of owning or leasing warehousing space.
 - Vary according to the number and the size of facilities.
 - Irrespective of the amount of inventory being handled.



- Inventory carrying costs:
 - Variable costs of maintaining and processing inventory in a warehouse (utilities, insurance, taxes, labor costs).
 - Vary according to the volume handled.

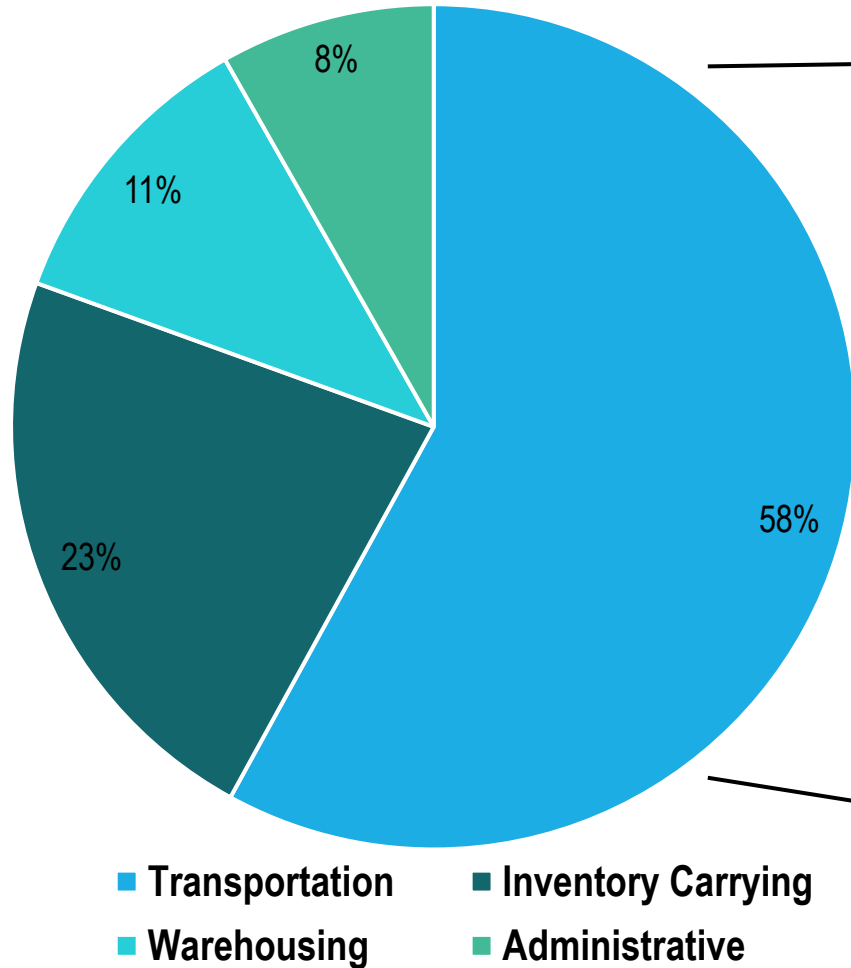


Global Logistics Costs by Function and Mode, 2018

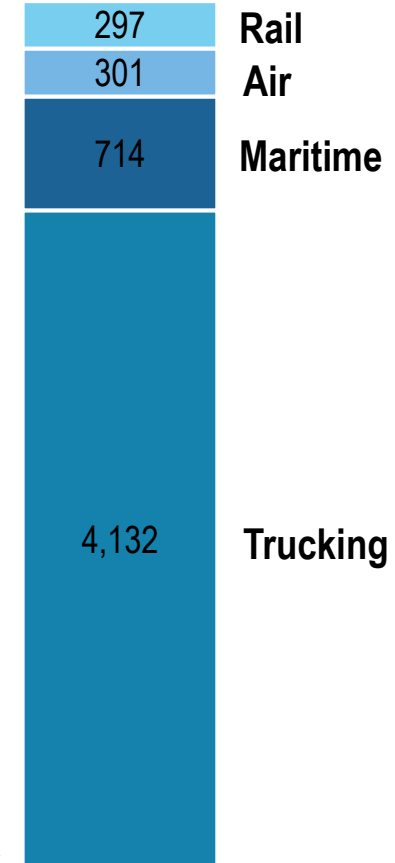


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Logistics Costs by Function

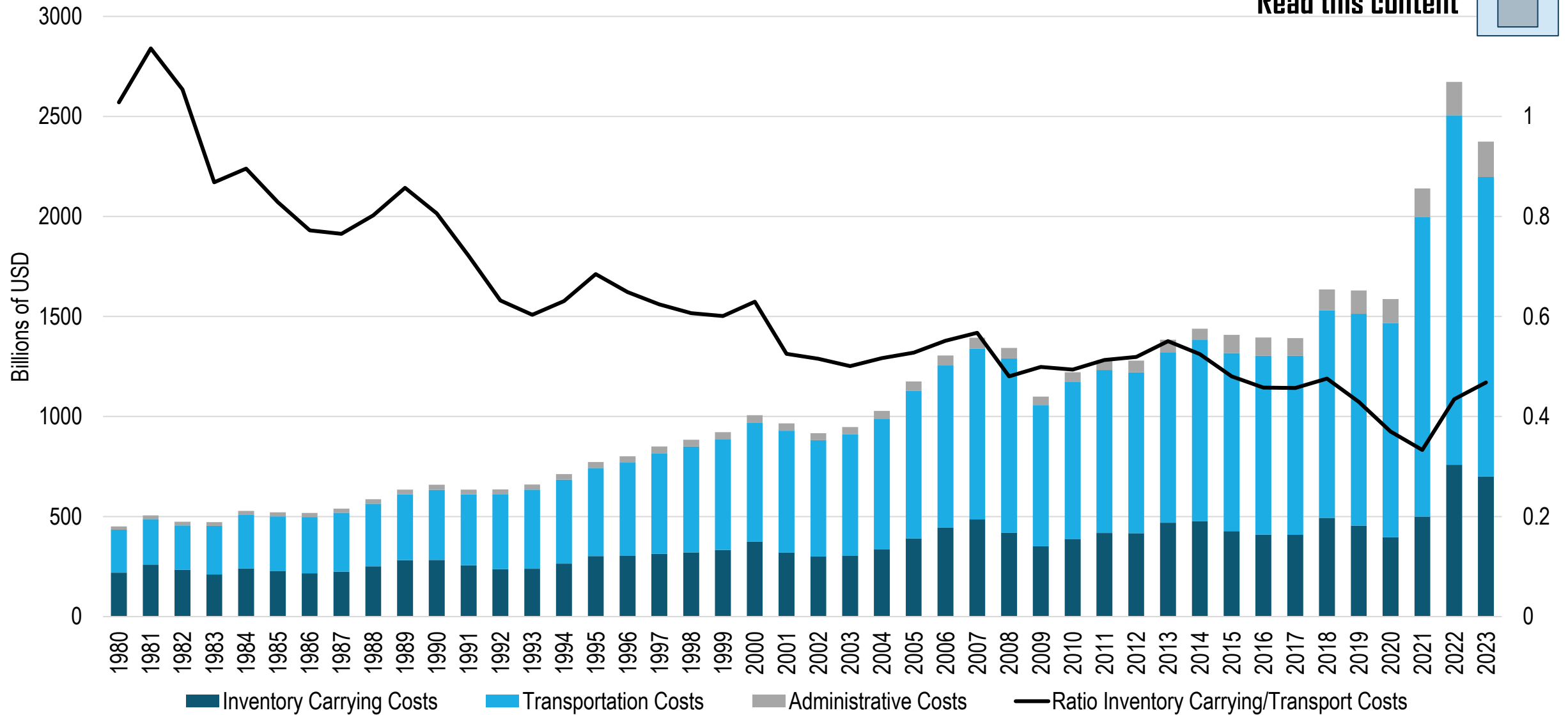
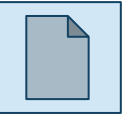


Logistics Costs by Mode (billions USD)

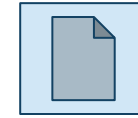


Logistics Costs, United States, 1980-2023

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Logistical Activities Related to Containerization



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Container Management



- Broking/Leasing.
- Inventory management.
- Transport routing.
- Container tracking.

Container Transportation



- Maritime shipping (Routing, Scheduling).
- Terminal operations (Transshipment, Storage/Stacking, Gate access).
- Inland transportation (Rail operations, Drayage, Repositioning).

Cargo Handling



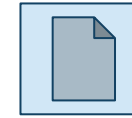
- Loading (Packing, Palletizing and Bundling).
- Transloading (Re-bundling).
- Unloading (Unbundling, de-palletizing and Unpacking).

Container Maintenance

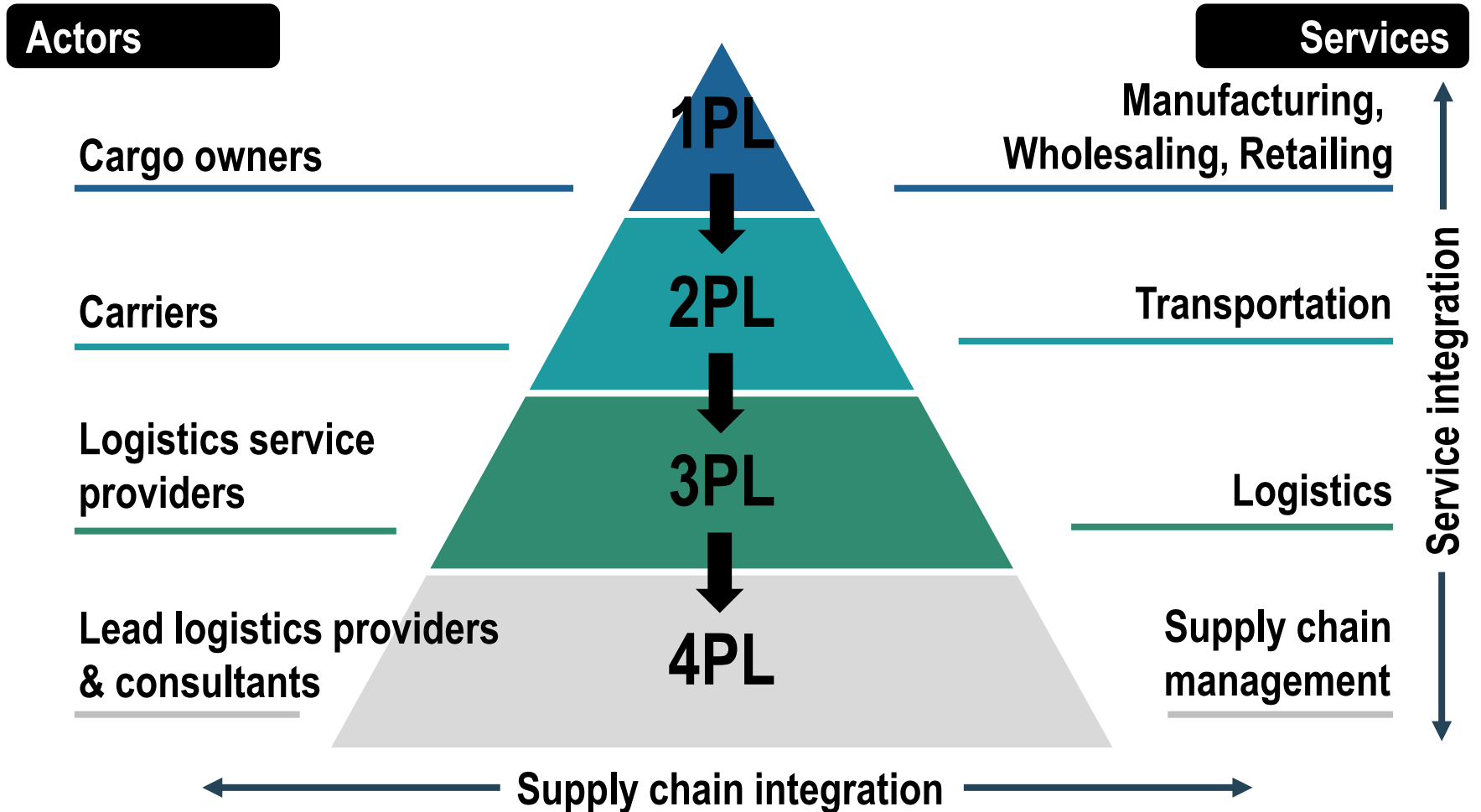


- Empty stacking.
- Inspection.
- Cleaning & Repair.

Main Actors and Layers to Logistics Services



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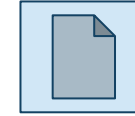
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B – Packaging and Cargo Stowage

Types of Packaging



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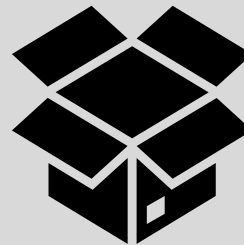
PRIMARY PACKAGING

- Packaging touching the product.
- Boxes and wraps.
- Designed for individual items.
- Designed for shelf storage/display of single item.



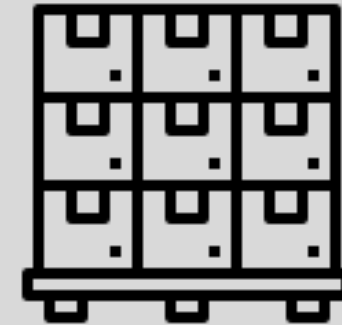
SECONDARY PACKAGING

- Packaging bundling items of a product.
- Boxes and wraps.
- Designed for shelf storage/display.



TERTIARY PACKAGING

- Packaging bundling products for transport.
- Boxes, pallets and containers.



© GTS

Secondary Packaging into Tertiary Packaging



Cargo Terms

- Stowage
 - Arranging and securing cargo.
 - In a cargo hold, container, or truckload.
 - Safety (no damage to cargo, conveyance, equipment and labor).
 - Efficiency (maximize available cargo space; stowage factor).
 - IMO guidelines for cargo stowage.



Cargo Terms

- Dunnage
 - Material used to support, protect, and separate cargo items during transportation or storage.
 - Reduce the risk of damage to ship, cargo area (or container) and cargo from impact as the cargo is loaded and transported.
 - Wood blocks, styrofoam peanuts, air bags, bubble wrap, crinkle paper, plastic bracing, fillers, and planks.



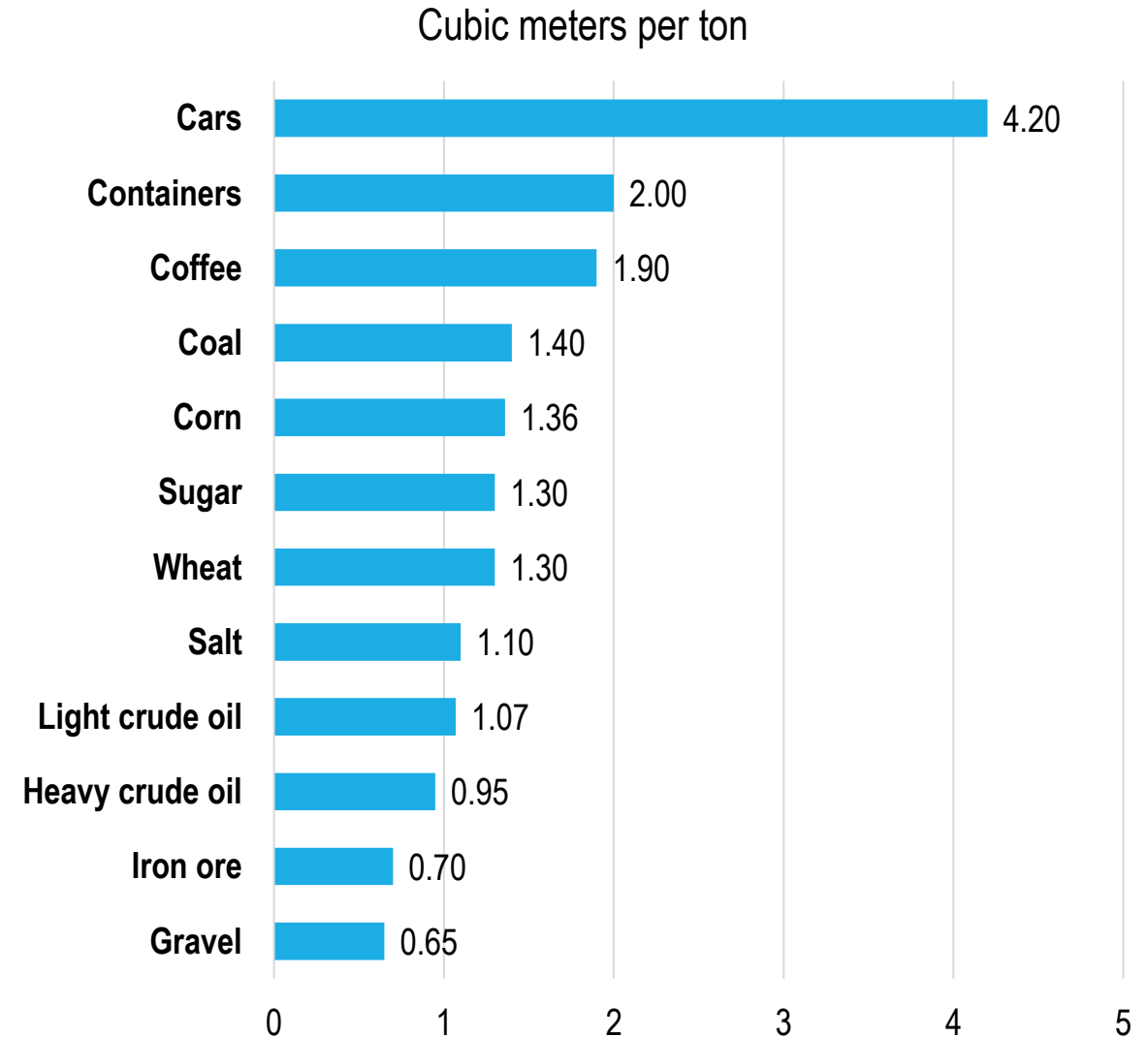
Cargo Terms

- Broken Stowage
 - Lost space to cargo because of the shape of the cargo, packaging, dunnage, shape of compartment, pillars.
 - Empty space between cargo units.
 - Palletization decrease broken stowage.
 - 10% - 15% of total cubic capacity is allowed for broken stowage.



Cargo Terms

- Stowage factor
 - The volume of cargo (cubic meters or feet) occupied per ton.
 - A function of the density and nature of the cargo.
 - Weighting out (bulk ships) versus cubing out (breakbulk ships).
 - Calculate areas and volume needed to fulfill the mission of the ship.





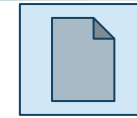
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C – Ports and Storage Facilities

Nature and Function of Warehousing



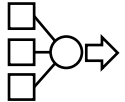
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NATURE



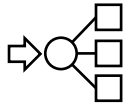
Buffer

Reconcile supply & demand



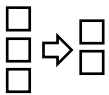
Consolidation

Massification of inventory



Deconsolidation

Atomization of inventory



Transloading

Change load unit or composition



Postponement

Adjust timeliness of inventory

FUNCTION



Storage

Holding goods in inventory



Receiving & shipping

Receiving goods from suppliers and shipping to customers



Inventory management

Managing stock levels



Order fulfillment

Preparing orders (packing)



Quality control

Inspection and compliance

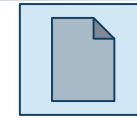


Added-value services

Customization, labeling

PEMP
PEMP
PEMP
PEMP

Warehouses and Distribution Centers



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WAREHOUSE



STORAGE

- Supply-driven (storage).
- Buffer-related function (inventory holding).
- Inventory stored for weeks or months.
- Cargo ownership usually by supplier / producer.
- Consolidation of cargo.
- Limited added value outside storage.
- Coping with unforeseen demand.

PEMP
PEMP
PEMP



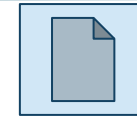
DISTRIBUTION CENTER



THROUGHPUT

- Demand-driven (throughput).
- Fulfilling orders (processing and fulfillment).
- Inventory stored for days or weeks.
- Cargo ownership usually by distributor / customer.
- Consolidating, deconsolidating, sorting a cargo load or changing the load unit.
- Assembly, packaging and light manufacturing.
- Coping with stable and predictable demand.

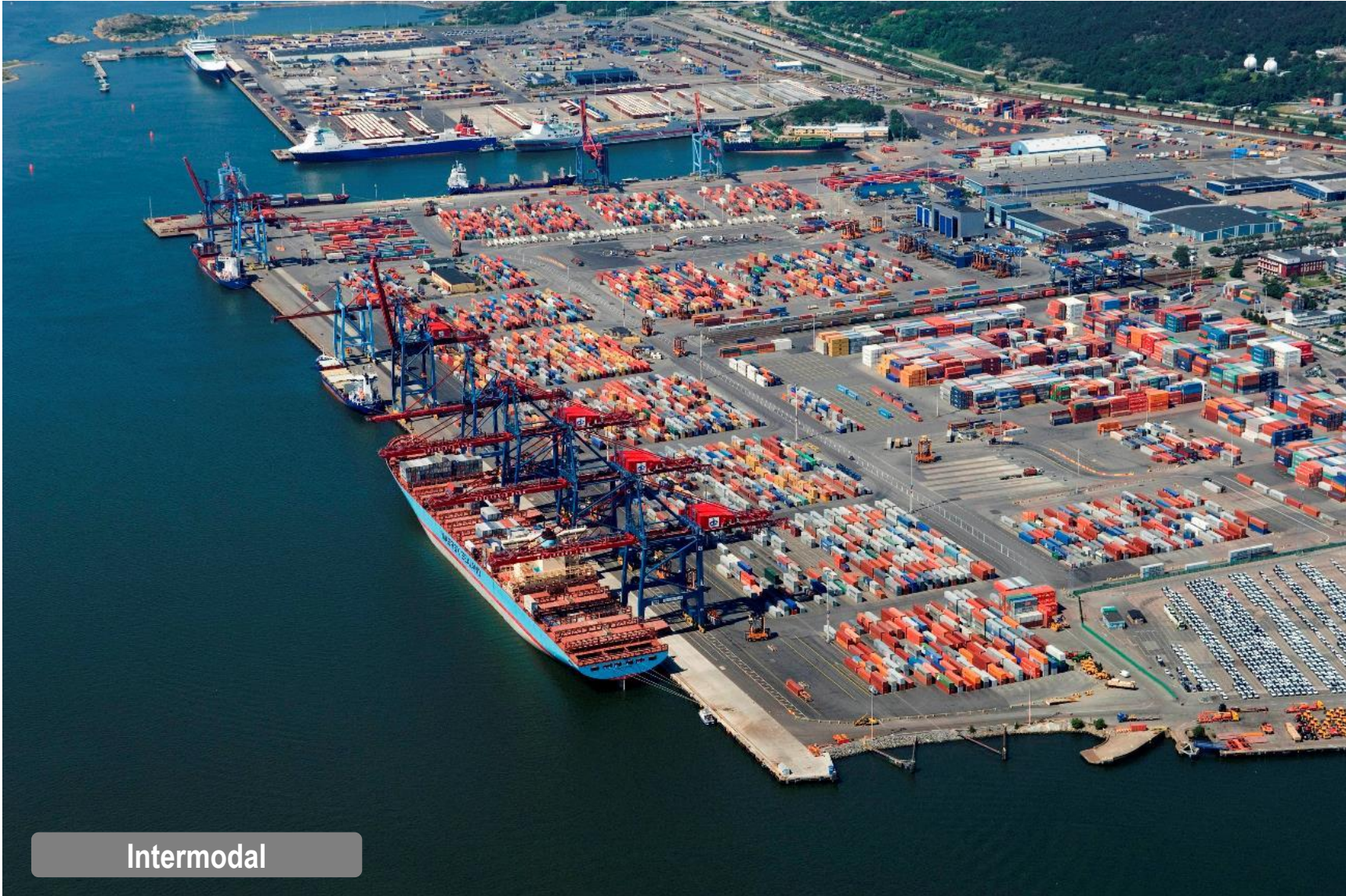
Types of Freight Facilities



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	Facility	Fabrication	Storage	Distribution
TERMINALS 	Bulk or transload	Port industrial complex	Storage of raw materials	Bulk inventory management
	Intermodal		Inventory at terminal	Container logistics
STORAGE 	Bulk warehouse		Single-purpose storage	Inventory management
	Warehouse		Multi-purpose storage	Inventory management
	Multitenant facility	Light manufacturing	Multi-purpose storage	Inventory management
DISTRIBUTION 	Distribution center	Assembly, packaging, labelling	Short-term storage	Inventory replenishment
	Cross-docking facility			Sorting inventory
	Urban logistics depot		Specialized inventory	Last-mile logistics
PARCELS 	E-fulfillment center		High rack inventory	Packing parcels
	Sortation center			Sorting parcels

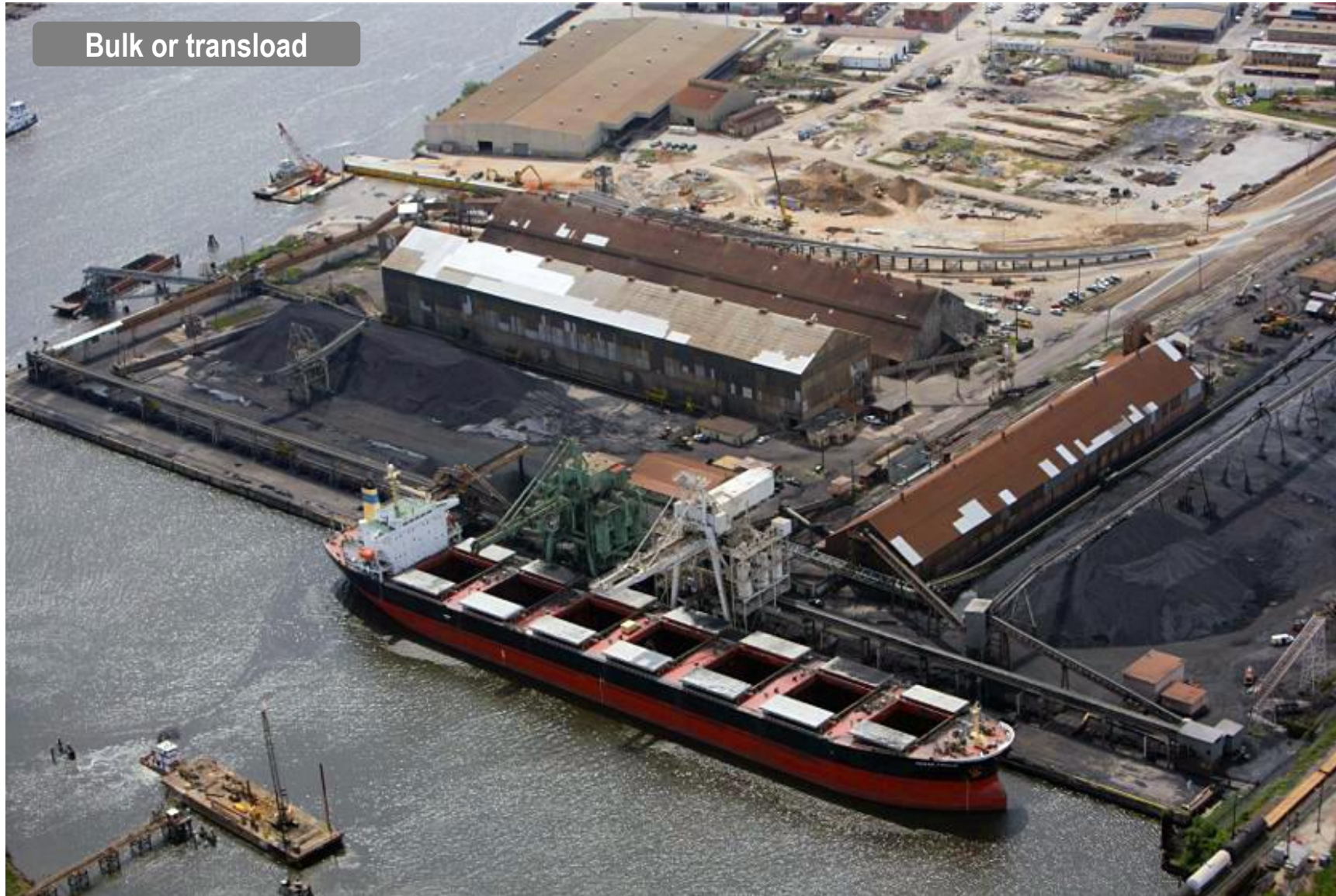
Container Terminal, Port of Gothenburg, Sweden



Intermodal

- Container yard as a buffer.
- Stacking density.
- Dwell time.

Coal Bulk Facility, Mobile, Alabama



- Outdoor stockpiles and sheds.
- Grabs and conveyor belts.
- Dust issues (sprinklers).

Bulk Warehouse (Corn)



Bulk warehouse

- Equipment and supplies stored in large quantities.
- Original container or without packaging.



Liquid Bulk Warehouse (Petroleum Products), Houston



Liquid Bulk warehouse

- Fixed and floating roof tanks.
- Can be heated to increase viscosity.
- Pipelines and pumping stations.

Port Centric Distribution Center



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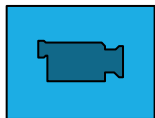
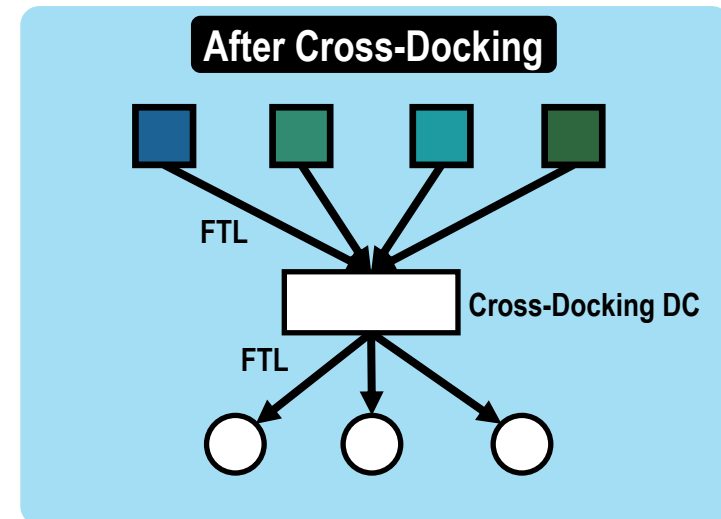
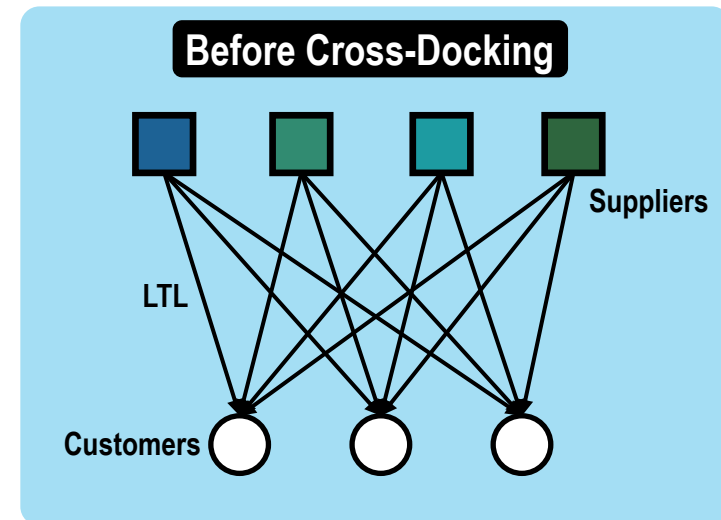
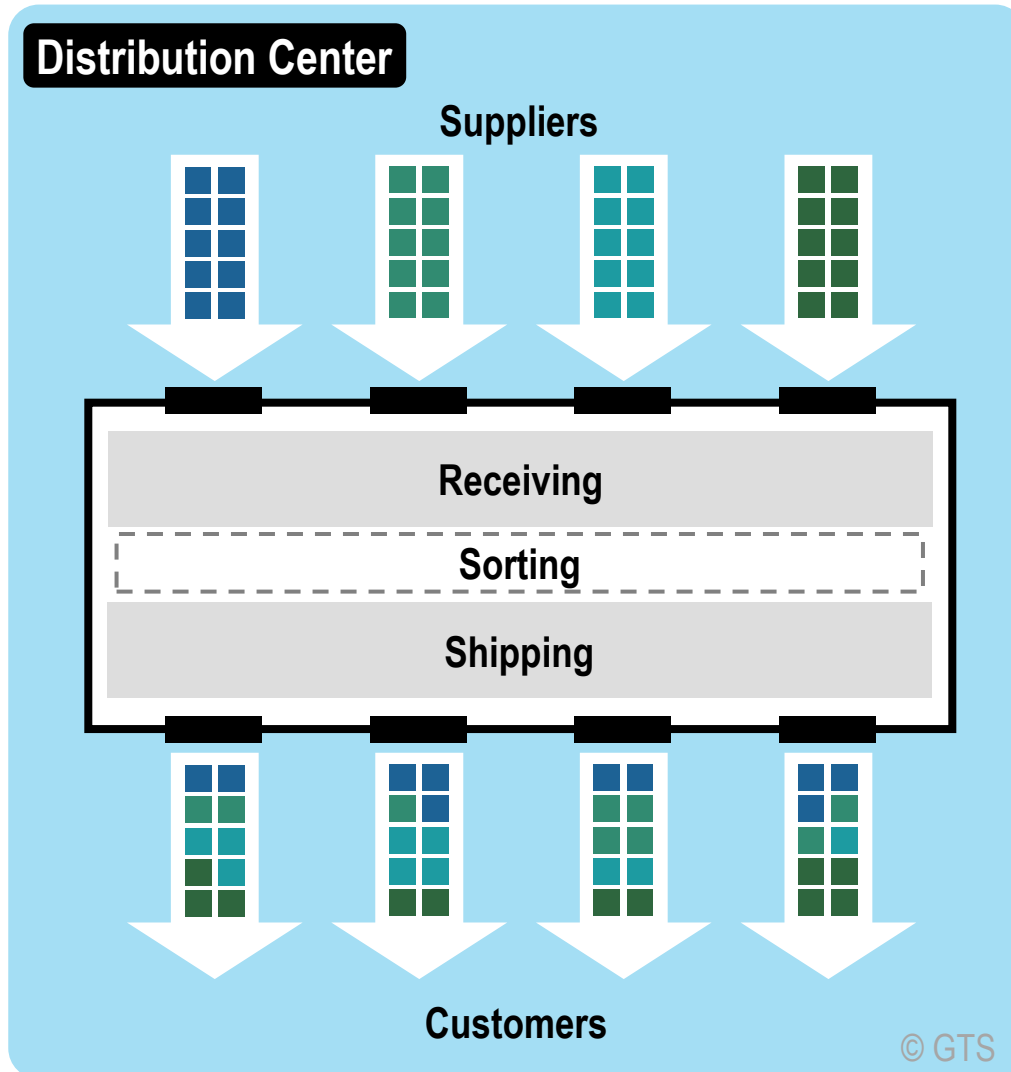
Distribution center

- In proximity to a container terminal.
- Import retail goods.
- Destuff containers.
- Fulfill orders for regional distribution centers.

Cross-Docking Distribution Center



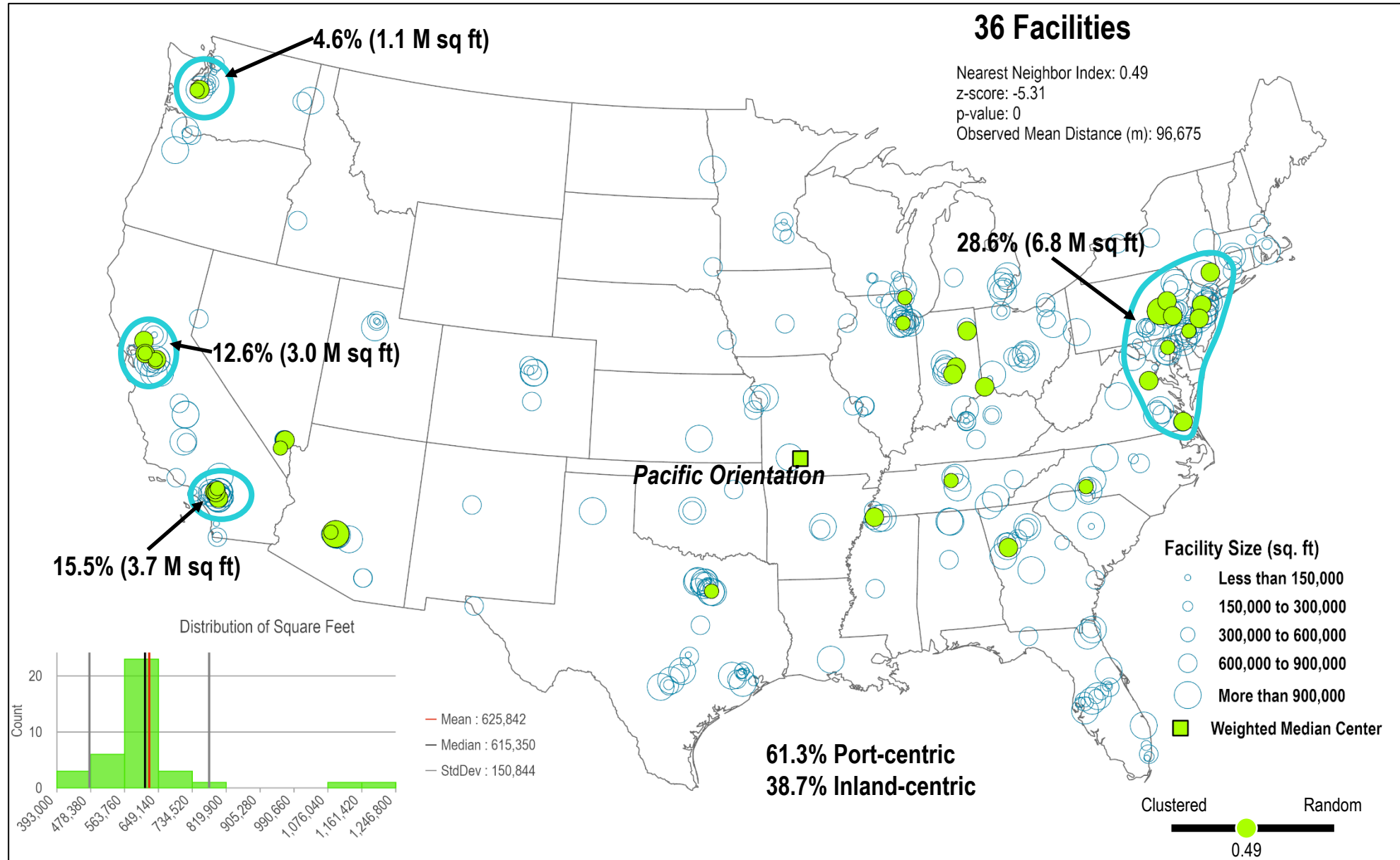
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Amazon Inbound Cross Dock Facilities Network



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Import Cold Storage Facility, Port of Philadelphia



Cold storage facility

- Destuffing reefers in cold storage warehouses.
- Customs inspections and fumigation.
- Retailers and wholesalers orders fulfilled.



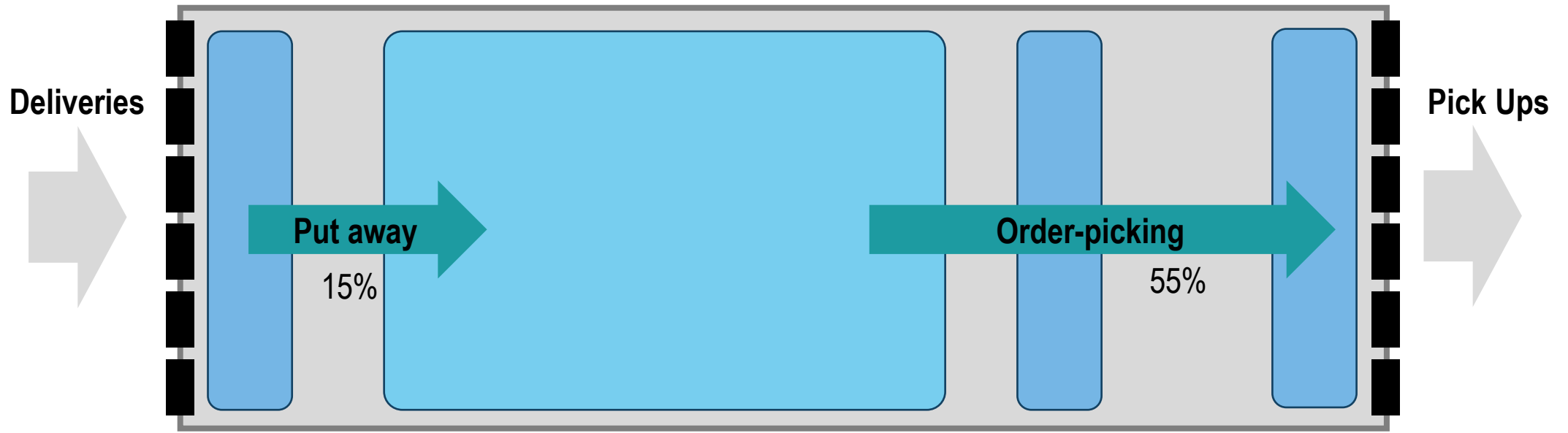
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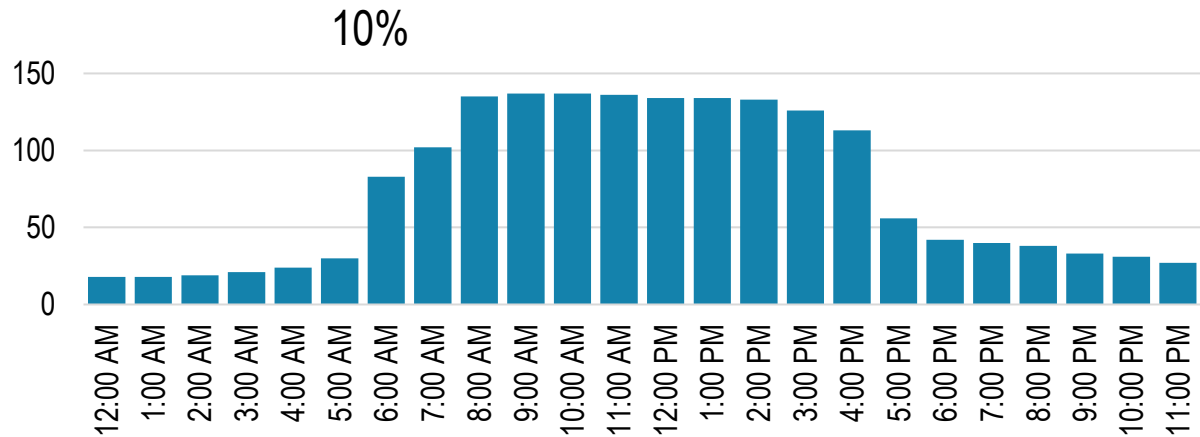
D – Warehousing Operations

Main Warehousing Operations



Receiving **Storage** **Picking** **Shipping**

Sortation
Packing



Operating Hours of Distribution Centers



Warehousing / Distribution Center: Receiving



Warehousing / Distribution Center: Storage



Warehousing / Distribution Center: Order Picking



Warehousing / Distribution Center: Shipping

