Transportation Insight®

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Transportation Insight

Principles and Practices of Transportation

A guide for Malaysia Polytechnic Students

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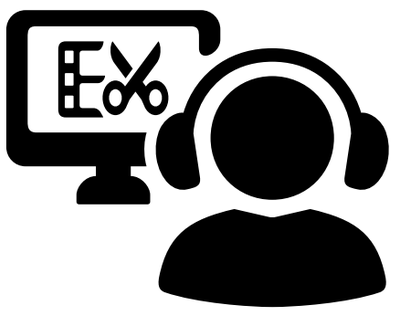

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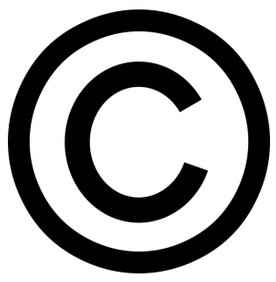

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Preface

بسم الله الرحمن الرحيم

In the name of Allah, the Most Gracious, the Most Merciful. This book has been prepared as a learning aid to help students and readers understand the concept of Principles and Practices of Transportation. The main aim is to provide clear explanations, practical insights, and examples that will support students, especially those taking the DPL30053 Principles ans Practices of Transportation.

The topics covered are designed to give a comprehensive understanding of transportation systems, their functions, and their importance in today's world. By exploring both the principles and practices, this book aims to bridge theory with real-life applications, making the subject more meaningful and easier to relate to actual industry scenarios.

It is our sincere hope that this book will serve as a reliable reference for students, lecturers, and anyone interested in transportation studies. We also welcome constructive feedback and suggestions, as they are essential for future improvements and the continuous development of this work.

Dr Muhammad Nazri Bin Abdul Halim
Politeknik METrO Johor Bahru
September 2025

Synopsis

The objective of this book is to provide a reliable source of information and knowledge, especially for students who are enrolled in the DPL30053 Principles and Practices of Transportation course and require references related to transportation concepts and practices.

This book is fully developed based on the Polytechnic MOHE syllabus for the WBL Diploma in Logistics and Supply Chain program. Transportation Insight emphasizes the fundamental principles, functions and operations of transportation systems, including their role in supporting logistics efficiency and economic development.

Through this subject, students will be exposed to different modes of transportation, key elements of transportation management, and current issues in the industry. The knowledge gained will not only enhance their academic learning but also help them apply these concepts in various logistics and supply chain contexts.

We warmly welcome constructive suggestions and comments from lecturers, students, and readers. Such feedback is invaluable in improving the quality of this book for future use.

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Topic 1 : Transportation Overview

LEARNING OUTCOMES

At the end of this chapter, student should be able to :

- Examine transportation logistics
  - Core components of transportation
  - Transportation roles in logistics system

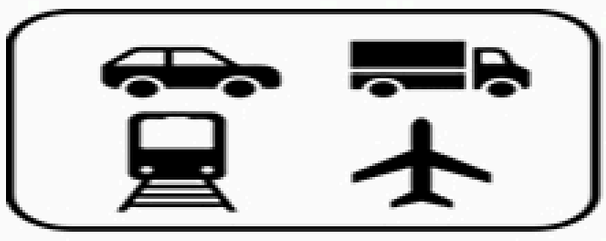
- Apply transportation concepts
  - Transportation functionality
  - Transportation principles
  - Transportation utilities
  - Transportation players

CORE COMPONENTS OF TRANSPORTATION

A) Transportation

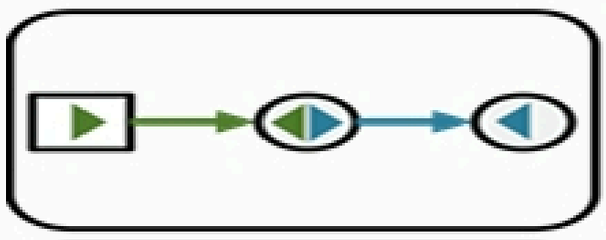
- The actual movement of products from one place to another.
- Part of logistics, considering packaging, best routes, and transport modes.
- Main functions:

1. Operations Management – managing processes to produce and deliver goods.
2. Vehicle & Fleet Management – coordinating delivery vehicles for efficiency.
3. Infrastructure Administration – maintaining infrastructure (roads, ports, airports, canals, rails, pipelines).



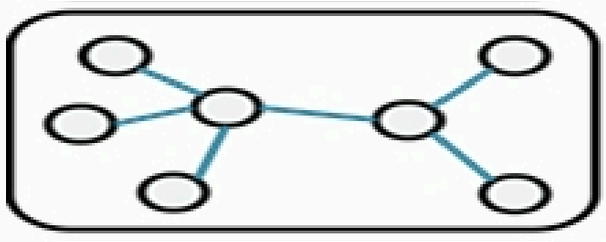
MODES

- Conveyances used for the mobility of passengers and freight.
- Mobile elements of transportation.



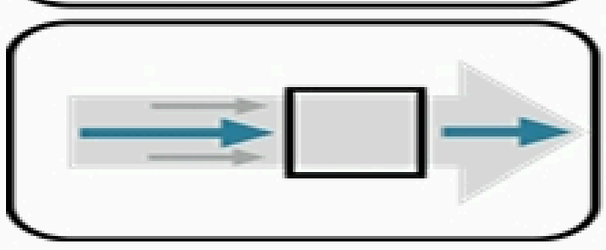
INFRASTRUCTURES

- Physical support of transport modes, such as routes and terminals.
- Fixed elements of transportation including superstructures.



NETWORKS

- System of linked locations (nodes).
- Functional and spatial organization of transportation.



FLOWS

- Movements of people, freight and information over their network.
- Flows have origins, intermediary locations and destinations.

Topic 1 : Transportation Overview

Modes

- Vehicles used to move people or goods.
- Some carry only passengers, some only freight, some both.

Infrastructures

- Physical support for transport modes.
- Routes = rail tracks, canals, highways.
- Terminals = ports, airports.
- Superstructures = movable/shorter lifespan assets (e.g., cranes, control equipment).
- Example:
  - Airport → Infrastructure : runways | Superstructure : terminals, control equipment.
  - Port → Infrastructure : piers, navigation channels | Superstructure : cranes, yard equipment.

Networks

- A system of linked locations showing how transport is organized.
- Shows which places are connected and how often they're serviced.
- Some locations are more connected (accessible) than others.

Flows

- Movements of people, goods, or information across the network.
- Always have origin → intermediary stop → destination.
- Example: Flying from one airport to another may require a hub (transit) stop.

B) Transportation System

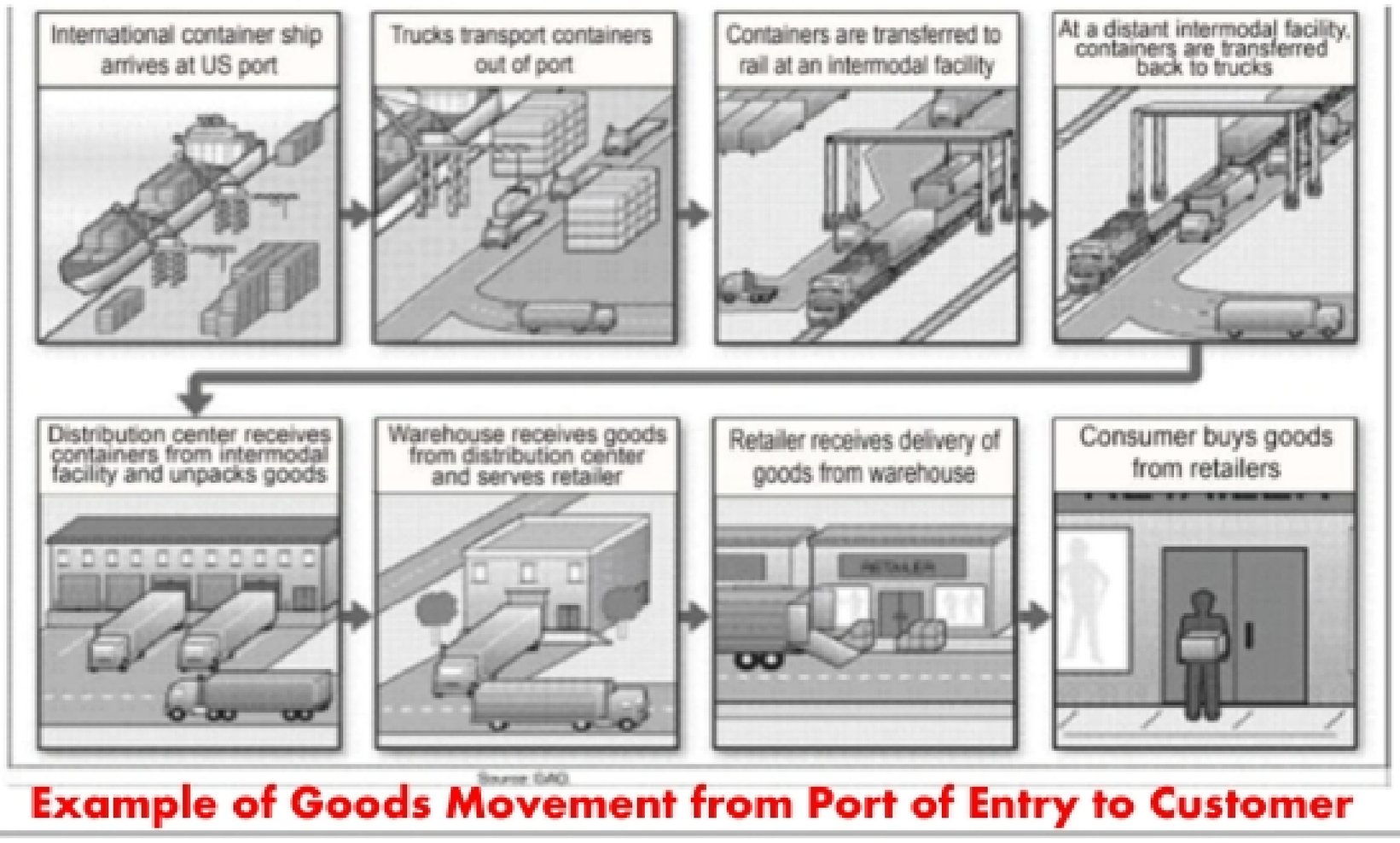
- The physical link connecting suppliers, factories, warehouses, customers, and channel members in the supply chain.
- Fixed points are places where goods temporarily stop (e.g., factories, warehouses, ports).
- Purpose: To coordinate movement of people, goods, and vehicles using routes efficiently.
- Goal: Lower transport costs and improve delivery times through good scheduling and route planning.

C) Freight Transportation

- The process of moving goods from one place to another (e.g., factory → port → company).
- Ensures goods are delivered from the source to the destination.
- Very important because timely delivery keeps factories and organizations running smoothly

Movement of Goods
Arises from distribution of raw materials, skills and labor.
Manufacturer will move raw materials from their place of origin to the processing plant and moving the finished goods to the consumption point.
Multi-jurisdictional cooperation required.
Complex chain of inter-regional and international trips.
Must be loaded, unloaded and transferred.
Information must be processed through logistics managers.
Logistics managers meet choices between transport modes rationally.
Require accommodations related to storage.

Topic 1 : Transportation Overview



Example of Goods Movement from Port of Entry to Customer

D) Passenger Transportation

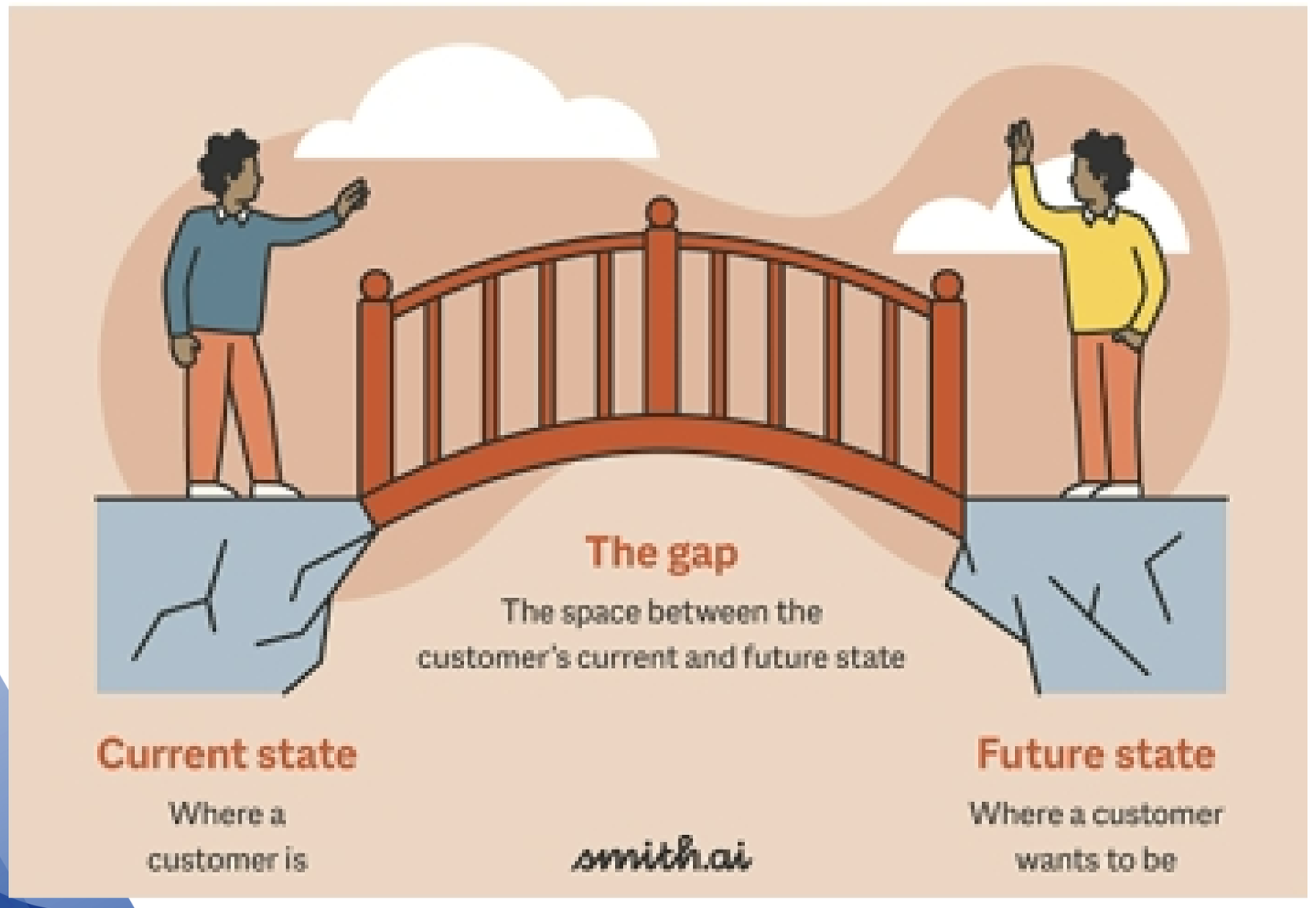
- The process of moving people from one place to another.
- Related to personal needs and interests (e.g., shopping, recreation, work, travel).
- Demand is high because people rely on transportation to meet daily requirements.

Movement of Passengers
Trip generation and attractions well understand and predicted.
People will travel from their homes to place where the value of their services and salaries will be greater than when they remained in own locality
Can be handle within a single jurisdiction
Movements often begin and end within the same jurisdiction.
Board, get off and transfer without assistance.
Process information and act on it without assistance.
Make choices between transport modes without assistance but often irrationally.
Require travel accommodations related to comfort and safety.

TRANSPORTATION ROLES IN LOGISTIC SYSTEM

A) Bridge Over

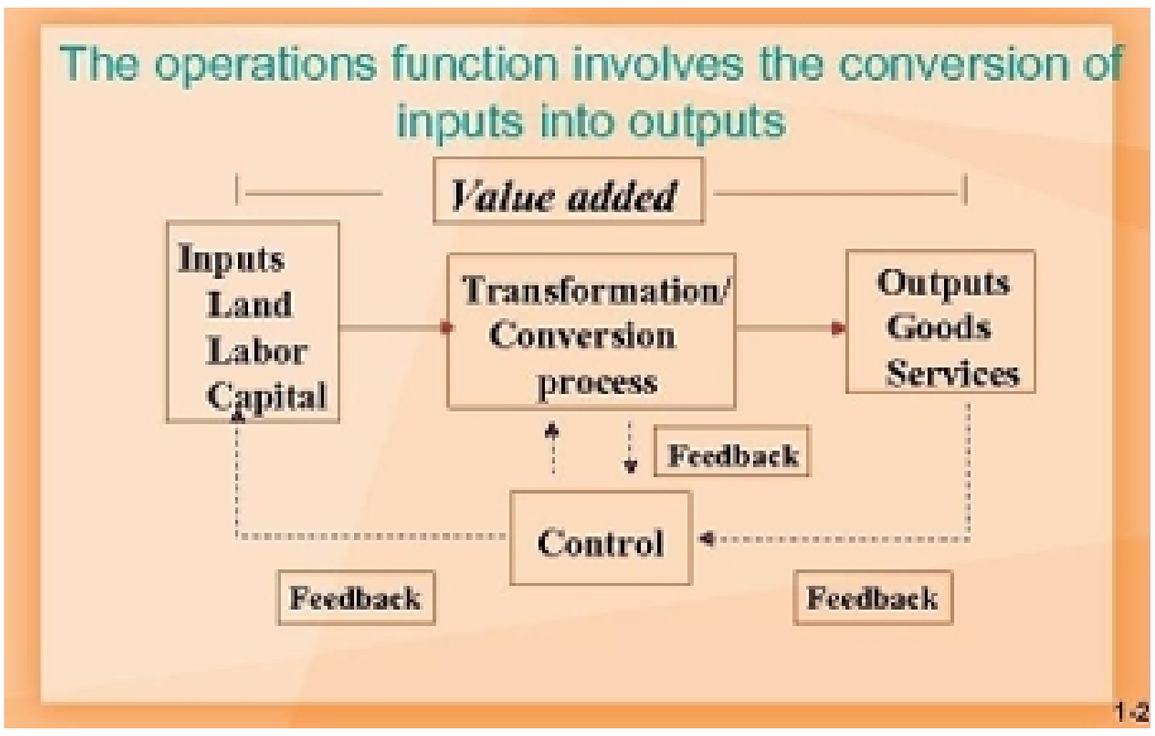
- In a supply chain, goods stop at fixed points (e.g., factory, warehouse).
- Transportation links connect these points so goods can move smoothly.
- This movement bridges the gap between buyer and seller.

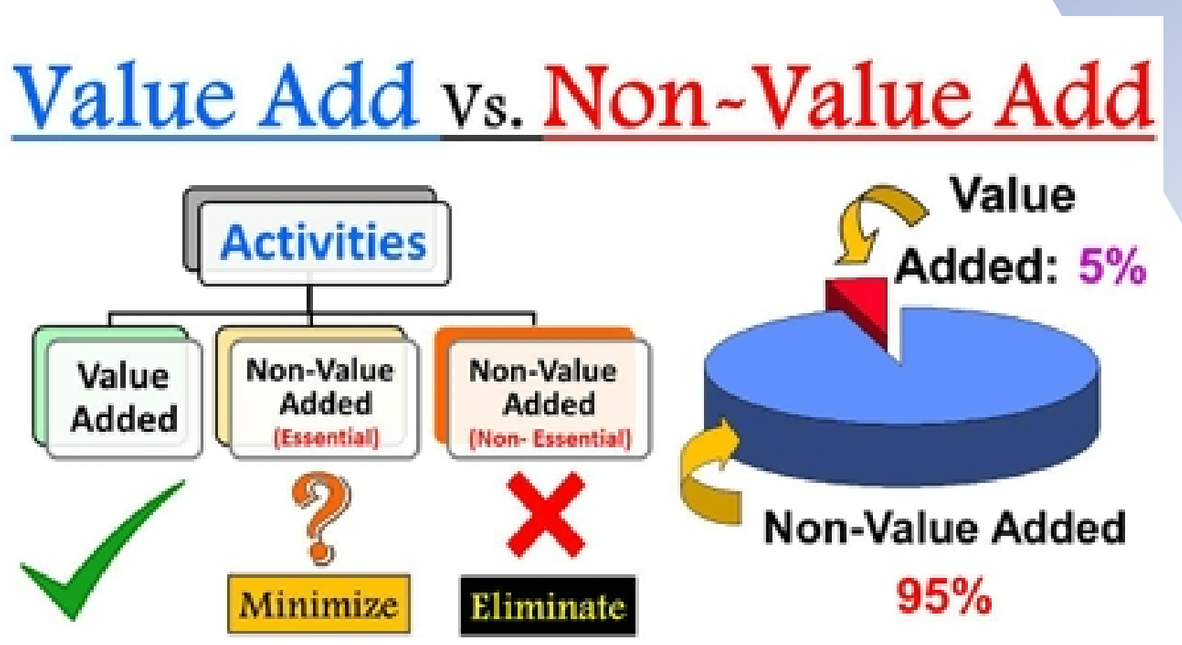


Topic 1 : Transportation Overview

B) Value Added

- Transportation connects a company's different locations.
- It adds value by creating place utility → making sure the right product is available at the right place when needed.





C) Global Impact

- In today's global economy, supply chains stretch across countries and continents.
- This wider distance increases transportation costs to connect buyers and sellers far apart (sometimes thousands of miles).

D) Importance in Company

- The quality of transportation influences how competitive a company's products are.
- Good transportation supports smooth facility operations and reliable service.
- Effective transportation has a big impact on customer satisfaction.

E) Importance in Economy

- About 50% of total logistics cost comes from transportation.
- Shows how important transportation is for the economy.
- Transportation spending (taxes, tolls, fuel, etc.) helps increase a country's revenue.

F) Cost Service Trade Off

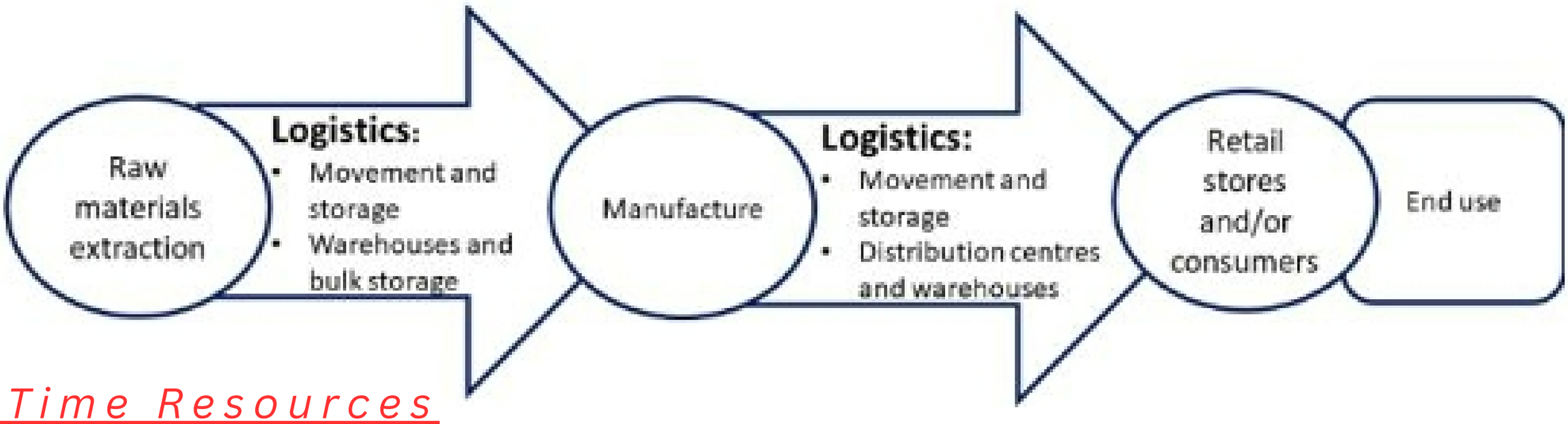
- A company must choose between better service at higher cost or reasonable service at lower cost.
- Example: Switching from sea to air transport → faster delivery but much more expensive.
- Common trade-off: lower inventory costs but higher transportation costs.

Topic 1 : Transportation Overview

TRANSPORTATION FUNCTIONAITY

A) Product Movement

- Transportation is needed to move materials, components, WIP, or finished goods to the next stage or closer to customers.
- Its main value: move inventory to the right destination in the supply chain.
- Good transportation performance is crucial for procurement, manufacturing, and customer service



1. Time Resources

- Aim: minimize in-transit inventory.
- Tech helps track location & arrival time of shipments.

2. Financial Resources

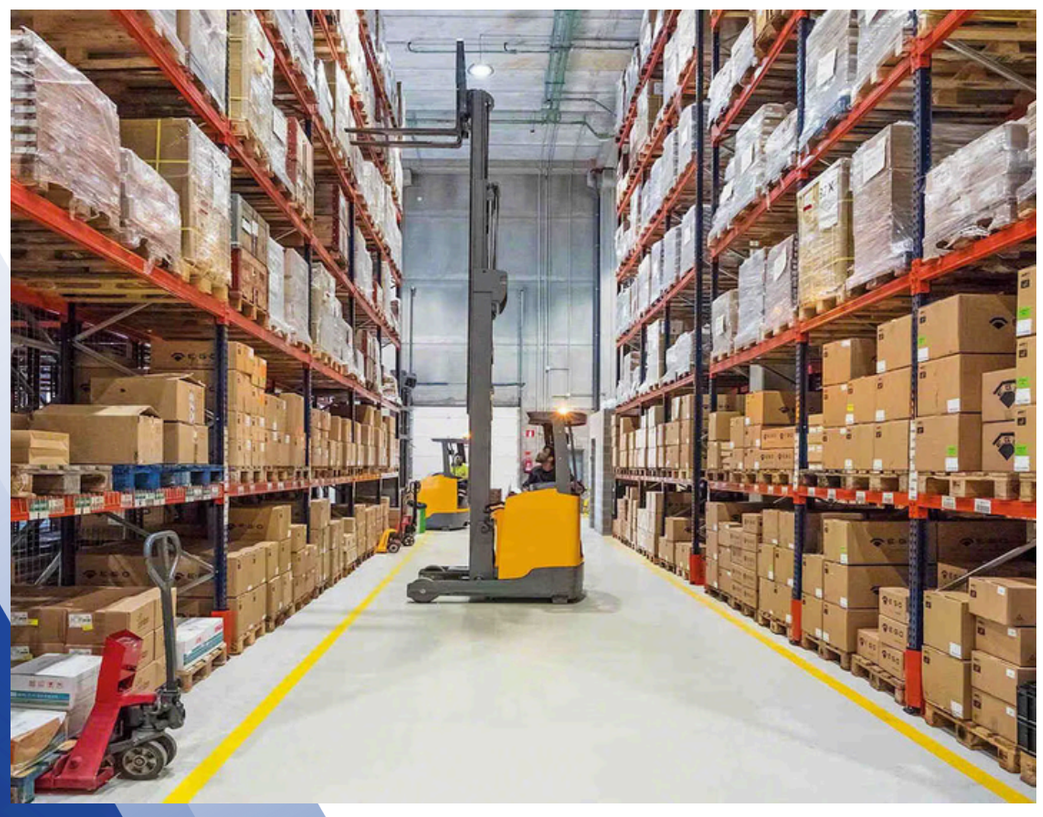
- Costs: driver wages, vehicle use, equipment, admin.
- Extra cost: loss & damage of products.

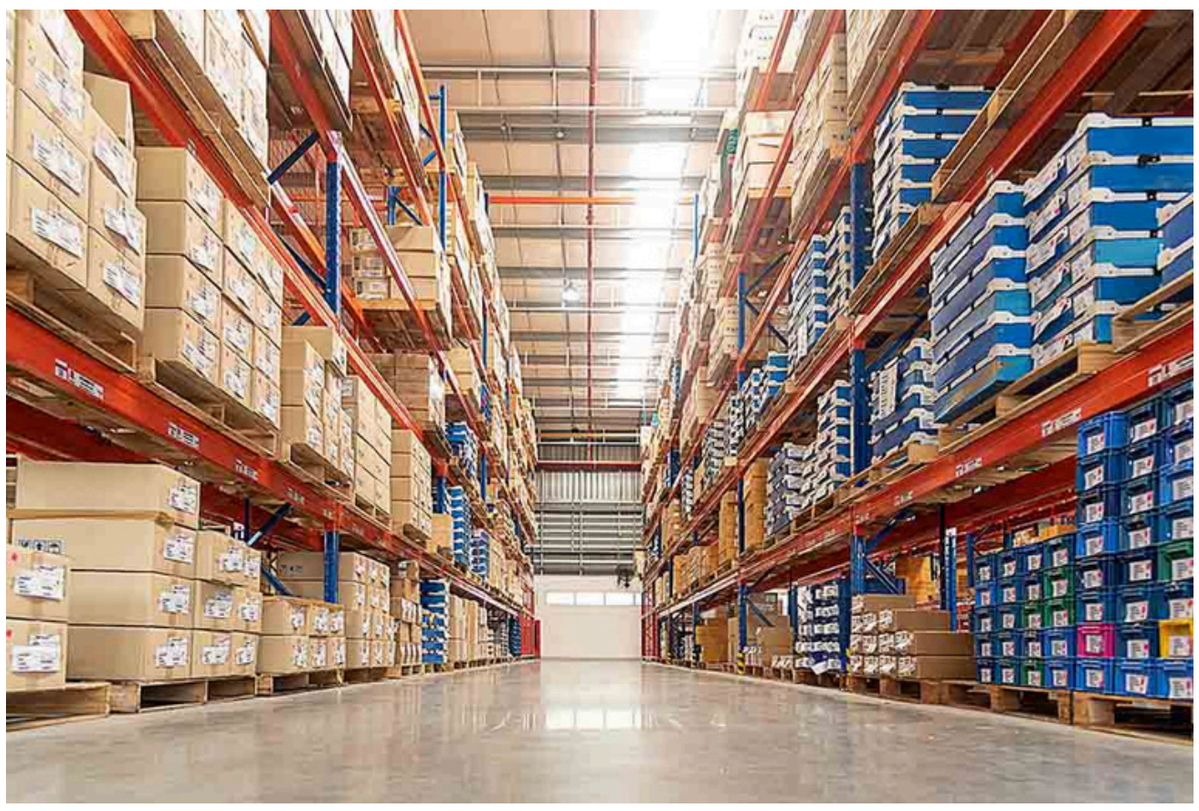
3. Environmental Resources

- Transportation = high fuel & oil use.
- Issues: congestion, air pollution, noise pollution (even with fuel-efficient vehicles).

B) Product Storage

- A less visible role of transportation is its function as storage for products.
- While goods are moving in a vehicle, they are considered stored in transit.
- Transport vehicles can also be used as temporary storage at the shipping point or destination.
- However, using vehicles as storage is costly compared to warehouses and is usually not efficient.





Topic 1 : Transportation Overview

TRANSPORTATION PRINCIPLES

- Used to evaluate different transportation strategies and practices.
- Main objective:

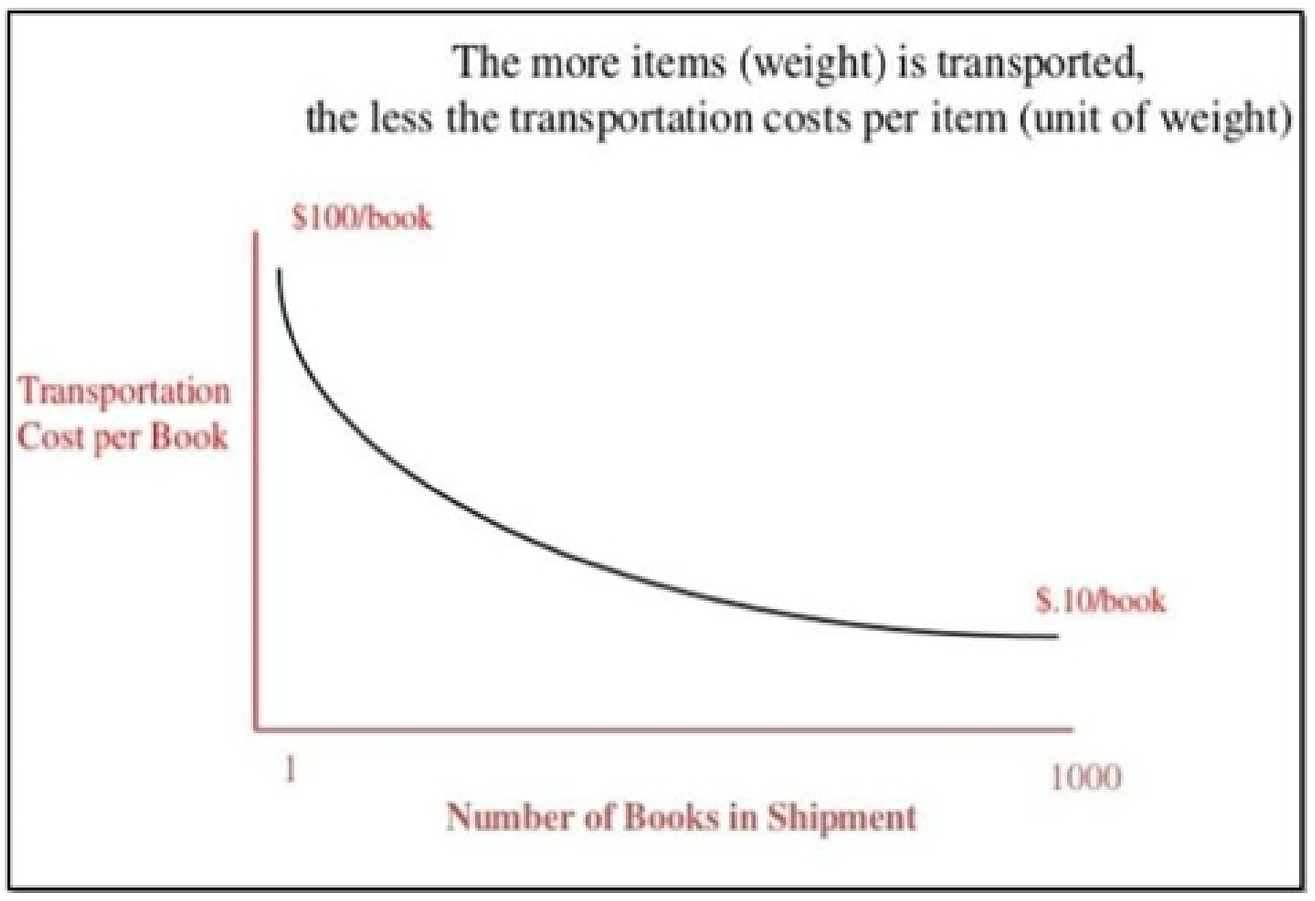
~ Ship the largest possible load.
~ Cover the longest possible distance.
~ While still satisfying customer service needs.

A) Economy of Scale

- Means that the cost per unit of weight decreases as shipment size increases.
- Larger shipments = lower unit cost because more goods are carried at once.
- Smaller vehicles require more trips for large volumes, which raises unit cost.
- Example: Rail or water transport is cheaper for bulk shipments compared to motor or air transport.
- Exists because fixed expenses (admin, invoicing, equipment, etc.) are spread over the entire load weight.
- This makes the cost per unit decrease as shipment size increases.
- Truckload (TL) shipments (full capacity) cost less per pound compared to Less-than-Truckload (LTL) shipments (partial capacity).

- Example:

~ Admin cost = RM10.00
~ Shipment = 10 kg → RM1.00 per kg
~ Shipment = 1,000 kg → RM0.01 per kg
~ ✅ Larger shipment (1,000 kg) shows clear economy of scale

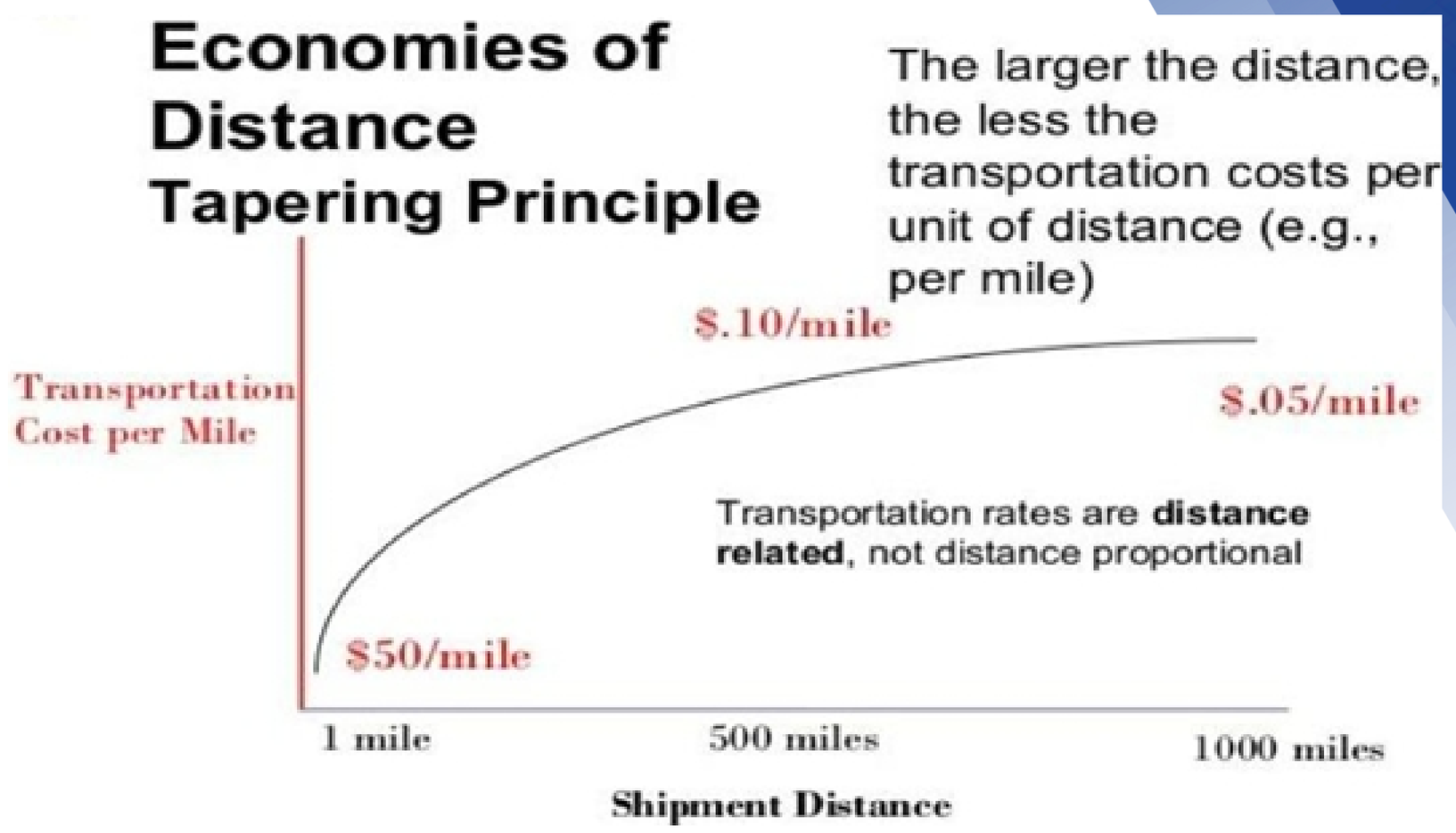


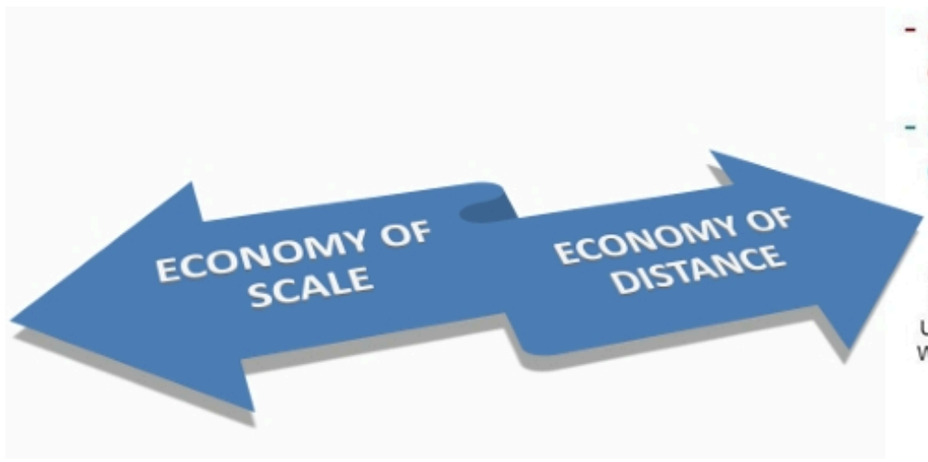
Topic 1 : Transportation Overview

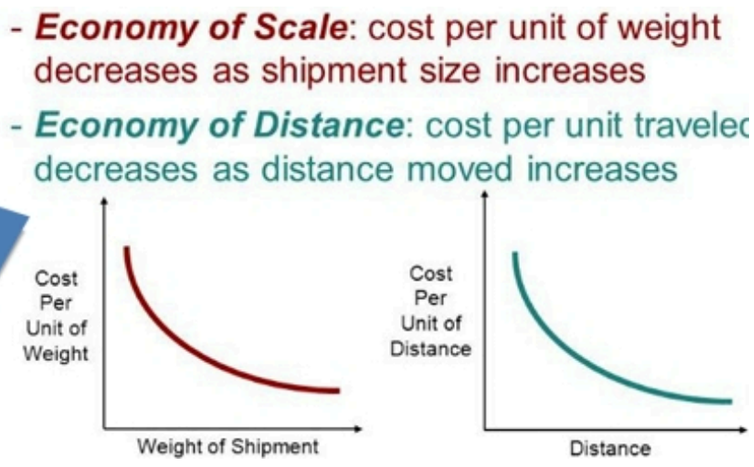
B) Economy of Distance

- Means transportation cost per unit of distance decreases as distance increases.
- Also called the tapering principle because rates taper (decrease) with longer distance.
- Reasoning: Fixed expenses (loading, unloading, paperwork, etc.) are spread over more miles, lowering the per-mile cost.
- Longer distance = lower cost per unit distance.
- Example:

~ One shipment of 1,000 km is cheaper per km than two shipments of 500 km each for the same weight.

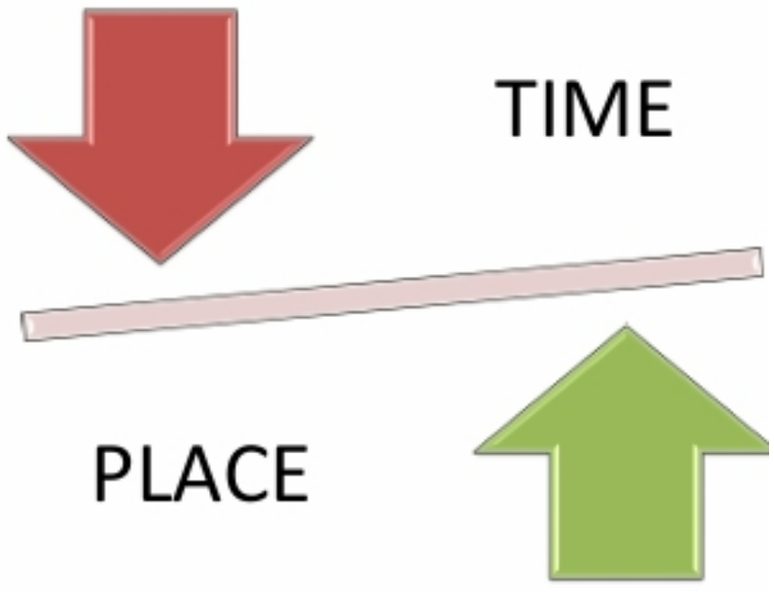






TRANSPORTATION UTILITIES

- Utility = usefulness / ability to give satisfaction.
- Transportation provides utilities to goods and firms.
- It improves customer service by creating:
- Place Utility → goods available where needed.
- Time Utility → goods available when needed.



A) Time Utility

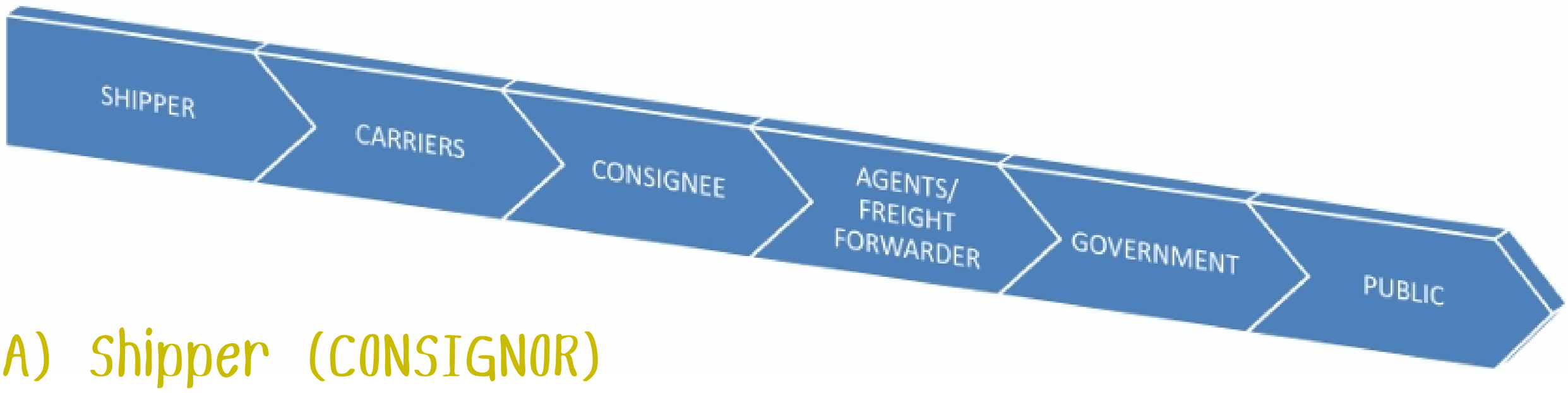
- Means products/services are available when customers need or want them.
- Achieved through business planning and logistics planning (manufacturing + delivery).
- For services → ensuring availability when most necessary/desirable for customers.
- Involves speed and consistency of product movement.
- Goods/services must be ready at the right time and place of demand.
- Added economic value by having goods/services at the demand point at the right time.
- Created through : Proper inventory maintenance and Strategic location of goods/services
- Example → making sure advertised products are available in stores at the exact time promised.

Topic 1 : Transportation Overview

B) Place Utility

- Meaning: Economic value added by making goods available at the place where demand exists.
- How it's created:
- Logistics moves goods from surplus areas → demand areas.
- Transportation extends the market reach by bridging distance.
- Key idea: Movement across space adds value to products.
- Example:
- Moving farm produce by truck/rail to markets.
- Delivering steel to a factory for further production.

TRANSPORTATION PLAYERS



A) Shipper (CONSIGNOR)

- A merchant / trader who sends consignments goods (usually the supplier or owner).
- Can be exporter / seller / originating party.
- Role:

~ Organizes and arranges transport of goods.

~ Chooses a carrier to move goods from origin → destination.

- Process : Buyer orders → consignor receives info → consignor arranges shipment.

B) Carrier

- Meaning : The party that transports goods.
- Role:

~ Coordinates pickup & delivery.

~ Consolidates freight from many shippers to achieve economy of scale & distance.

- Types of Carriers:

1. Common Carrier :

- For-hire carrier – serves general public at reasonable charges.
- Provides transport on fixed routes & schedules.
- No discrimination among shippers, goods, or locations.
- Responsible for loss/damage during transport.
- Backbone of the transportation industry.

Topic 1 : Transportation Overview

2. Contract Carrier :

- For-hire carrier – serves specific shippers only under a contract.
- Provides specialized services (e.g., special equipment, scheduled pickups/deliveries).
- Operates based on a contract of carriage (binding agreement with rights & obligations).

3. Private Carrier :

- Company's own transport (not for hire).
- Main business is not transportation.
- Used only for the firm's own deliveries.

C) Consignee (Buyer)

- A merchant/trader who receives goods (by any transport mode).
- Acts as the importer / buyer.
- The receiver / destination party, not necessarily the owner of goods.
- Anyone receiving consigned goods = consignee.

D) Agents / Freight Forwarder

- Manage the full transport process: packaging → shipping → door-to-door delivery.
- Assist in distribution & marketing of goods.
- May own fleets or use networks with air, sea, rail carriers to secure lower rates.
- Specialize in international shipping, using multi-modal transport.
- Usually sign multiple contracts/agreements with carriers
- Consultation services before pickup (e.g., advice on packaging for perishable goods).
- Handle international freight : Customs regulations of different countries, Prepare customs documents and Pay taxes, consular fees, freight charges.
- Take physical possession of cargo → must comply with legal rules.
- Provide insurance packages for customer protection.
- Must be registered with government logistics authority (legal requirement).

Topic 1 : Transportation Overview

E) Government

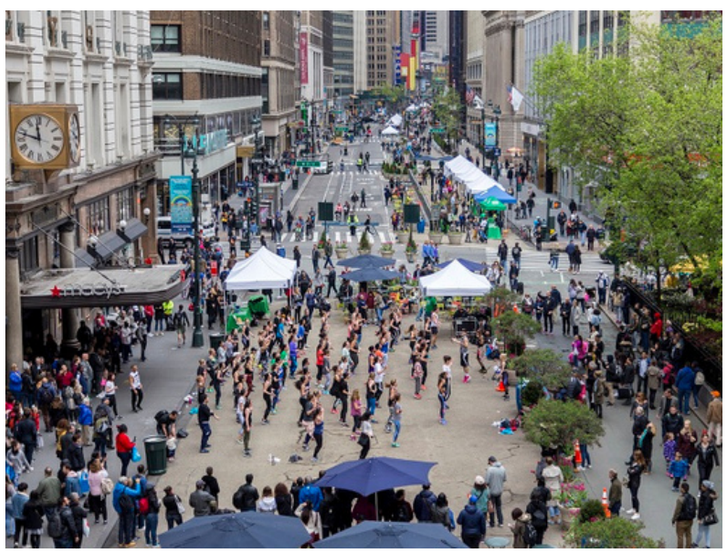
- Stakeholder in the transport system.
- Interested because transport is vital for economy & society.
- Aims for a stable, efficient system to support economic growth.
- Involvement through regulation & oversight.
- Main reasons for involvement:

~ Control excessive competition.

~ Coordinate transportation.

~ Integrate transport with economic policy.

~ Ensure safety, security & order.



E) Public

- Includes individuals & businesses.
- Indirectly creates demand by buying goods.
- Expect transportation to be : Accessible, Affordable & competitive rates, Secure & safe.
- Consumers want low costs, safe transport, and less environmental impact.

Summary

1.1 Examine Transportation Logistics

Transportation logistics involves the efficient movement of goods and people from one location to another. It is a crucial part of the supply chain, ensuring that products are delivered in the right quantity, at the right place, and on time.

- **1.1.1 Core Components of Transportation**

The main components include infrastructure (roads, ports, railways, airports), vehicles (trucks, ships, trains, aircraft), operations (planning, scheduling, and routing), technology (tracking systems, communication tools), and regulations (safety, customs, environmental laws). These elements work together to facilitate smooth and cost-effective transport.

- **1.1.2 Transportation Roles in the Logistics System**

Transportation serves as the link between supply chain activities, connecting suppliers, manufacturers, distributors, and customers. Its key roles include product movement, inventory management, customer service
enhancement, and geographical expansion of business operations.

1.2 Apply Transportation Concepts

Transportation concepts help organizations plan and manage their logistics operations effectively, focusing on efficiency, reliability, and cost optimization.

- **1.2.1 Transportation Functionality**

Refers to the primary functions of transportation—product movement (physical transfer) and product storage (in-transit holding). Efficient functionality supports inventory control and timely delivery.

- **1.2.2 Transportation Principles**

Core principles include economies of scale (lower cost per unit when shipping large volumes), economies of distance (cost efficiency over longer distances), consolidation, and routing optimization. These principles aim to
reduce cost and improve service levels.

Summary

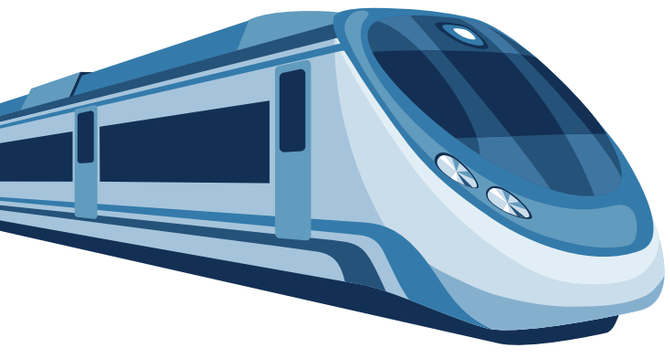
1.2 Apply Transportation Concepts

- **1.2.3 Transportation Utilities**

Transportation creates key economic utilities:
~ Time utility (delivering goods when needed),
~ Place utility (making goods available where needed),
~ Possession utility (enabling ownership transfer).
~ These utilities increase product value and customer satisfaction.

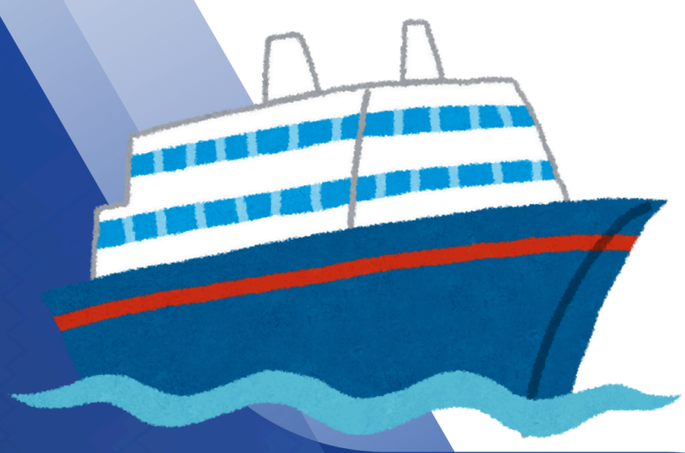
- **1.2.4 Transportation Players**

The main players include shippers (send goods), carriers (provide transport services), consignees (receive goods), third-party logistics providers (3PLs), government agencies, and customers. Each plays a specific role in ensuring the smooth flow of transportation activities.



C o n c l u s i o n

Transportation is the backbone of logistics, connecting all supply chain components. It integrates infrastructure, operations, and technology to deliver products efficiently. Understanding its functions, principles, and key players helps businesses improve logistics performance, reduce costs, and meet customer expectations.



Topic 2 : Transportation Modes

LEARNING OUTCOMES

At the end of this chapter, student should be able to;

- Categorize transportation modes
  - Road transport
  - Rail Transport
  - Air Transport
  - Sea Transport
  - Pipeline
- Expose transportation modes variation
  - Transportation modes characteristics

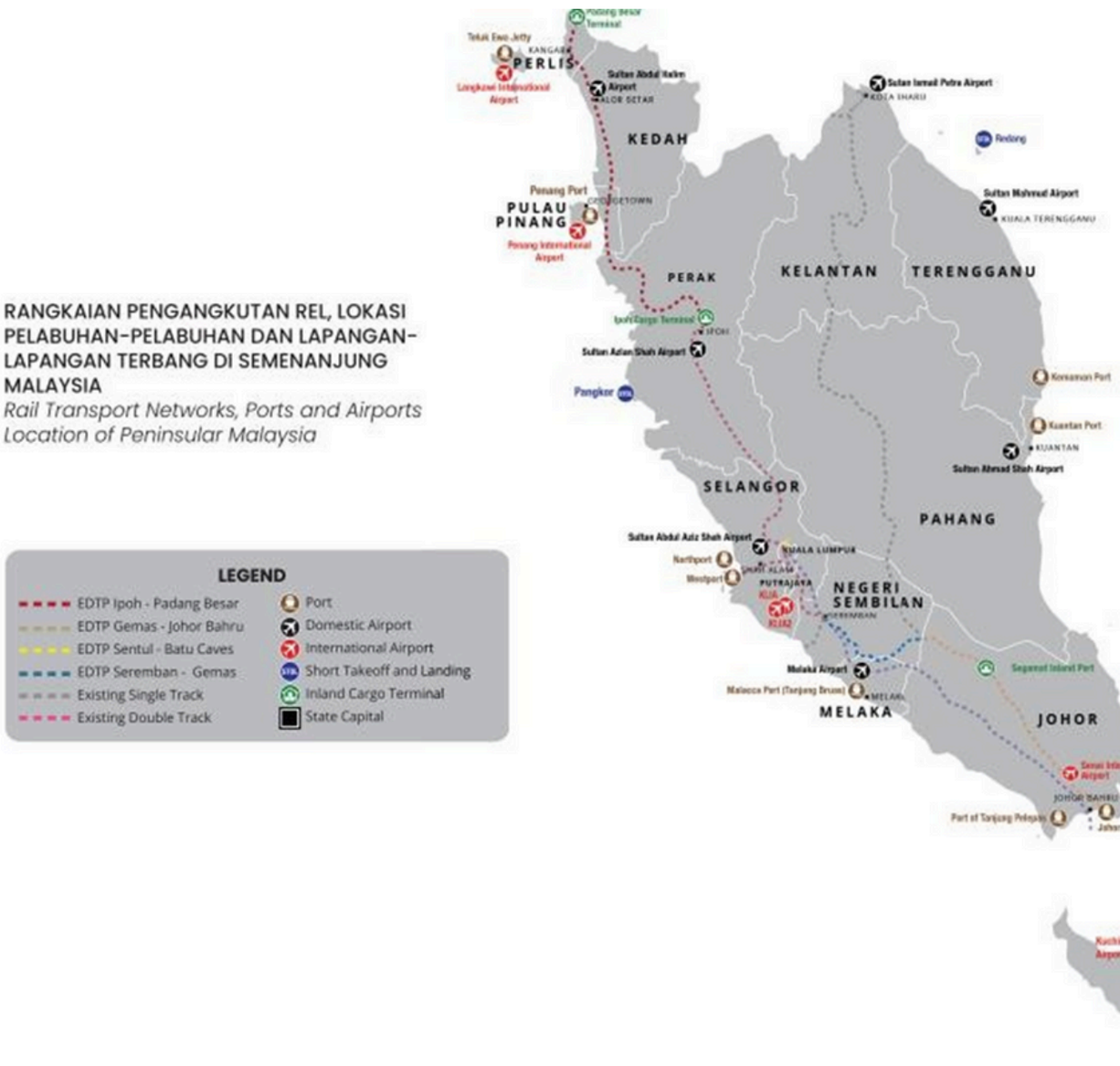
INSIGHT : STATISTIC OF TRANSPORTATION SECTOR

Source :
Statistik Pengangkutan Malaysia 2022

Topic 2 : Transportation Modes

TRANSPORTATION IN MALAYSIA

RANGKAIAN PENGANGKUTAN REL, LOKASI PELABUHAN-PELABUHAN DAN LAPANGAN-LAPANGAN TERBANG DI SEMENANJUNG MALAYSIA
Rail Transport Networks, Ports and Airports Location of Peninsular Malaysia



RANGKAIAN PENGANGKUTAN REL, LOKASI PELABUHAN-PELABUHAN DAN LAPANGAN-LAPANGAN TERBANG DI SABAH DAN SARAWAK
Rail Transport Networks, Ports and Airports Location of Sabah and Sarawak

TYPES OF MODE (MODAL / MEAN)

TRUCKING

- Flexible (truck load vs. less-than-truckload)
- Drivers in demand
- Creates highway congestion

RAILROADS

- Ideal for bulkier products or containers
- Cost effective over distances
- Energy efficient

AIRFREIGHT

- Ideal for small & light products
- Prioritizes speed over cost
- Reliable
- Air pollutant

WATERWAY

- Ideal for low cost, heavy products
- Very common
- Inexpensive

PIPELINE

- Used for crude oil, gas, petroleum
- Once built, very cost effective
- Land and water pollutant

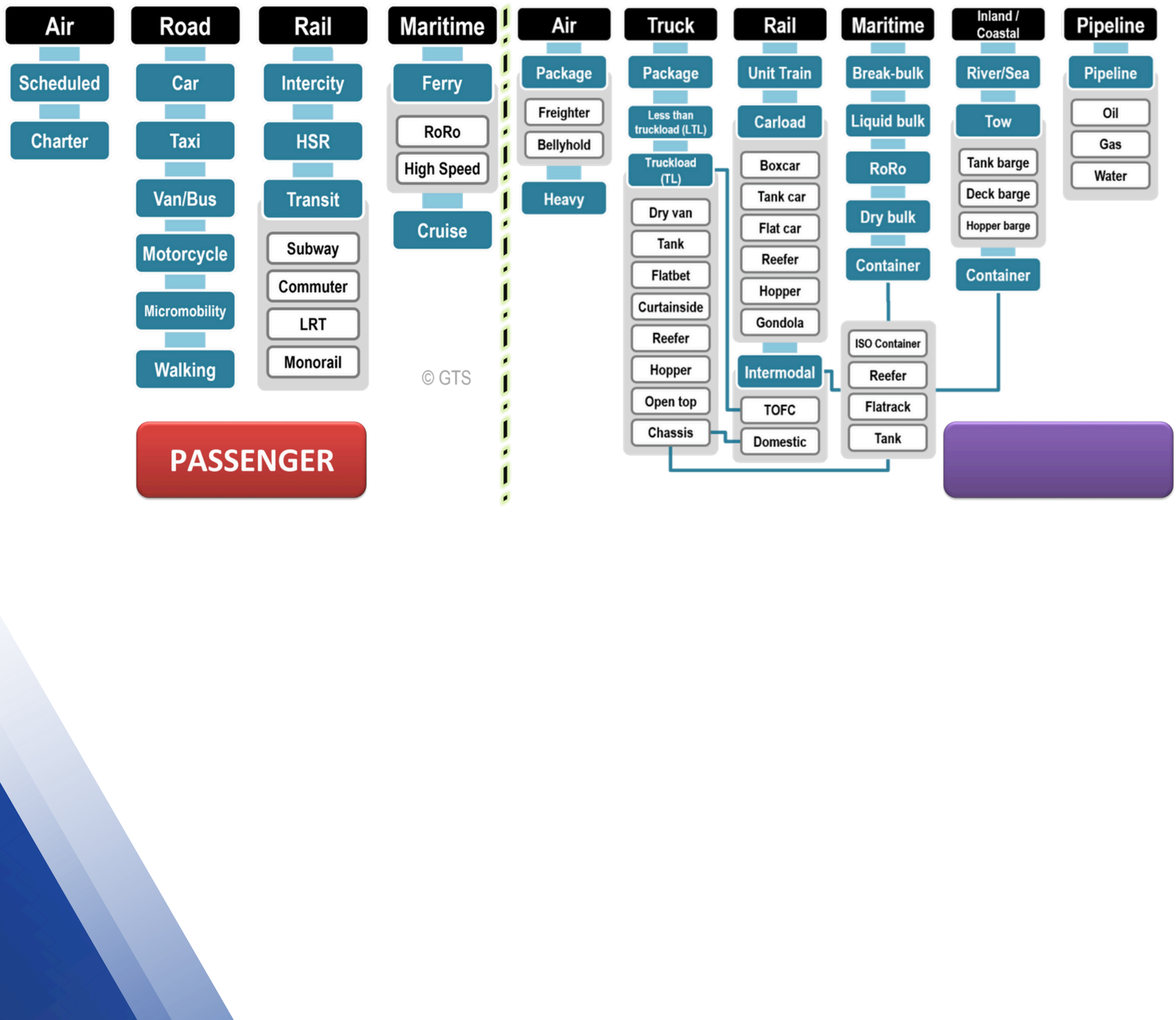
MULTIMODAL

- Uses a combination of modes through a carrier
- Products secured in containers
- Contractual with a single carrier

TRANSPORT

• Transport refers to the activity that facilitates physical movement of goods as well as individuals from one place to another.
• In business, it is considered as an auxiliary to trade, that means, it supports trade and industry in carrying raw materials to the place of production and distributing finished products for consumption.
• Importance;
  - Makes available raw materials to manufacturers or producers
  - Makes available goods to customers
  - Helps during emergencies and natural calamities
  - Helps in creation of employment
  - Helps in bringing nations together

MAIN PASSENGER / FREIGHT MODAL OPTIONS



MODAL CLASSIFICATION

CATEGORY	CHARACTERISTICS	REMARKS
SPEED	Refers to elapsedmovement time.	**Air** is the fastest
ACCESSIBILITY	Refers to the ability of a mode to service any given pair of locations.	**Road** is the best since they can drive from origin to destination
CAPACITY	Refers to the ability of a mode to handle any transport requirement, such as load size.	**Sea** is the best since they can handleall types and size of cargo
TRANSIT TIME	Refers to the time that needed to deliver the goods.	**Air** is the low transit time over long distances
RELIABILITY	Refers to the ability of a mode to transportthe goods to the final destination.	**Road** is the best since they can drive door-to- door service
SAFETY AND SECURITY	Refers to the how safe the goods during the movement to the final destination. It is including in term of pilferage, loss and damage of the goods due to multiple handling.	**Air** is the highestsecurities

CATEGORIZE TRANSPORTATION MODES

CATEGORIZE TRANSPORTATION MODES

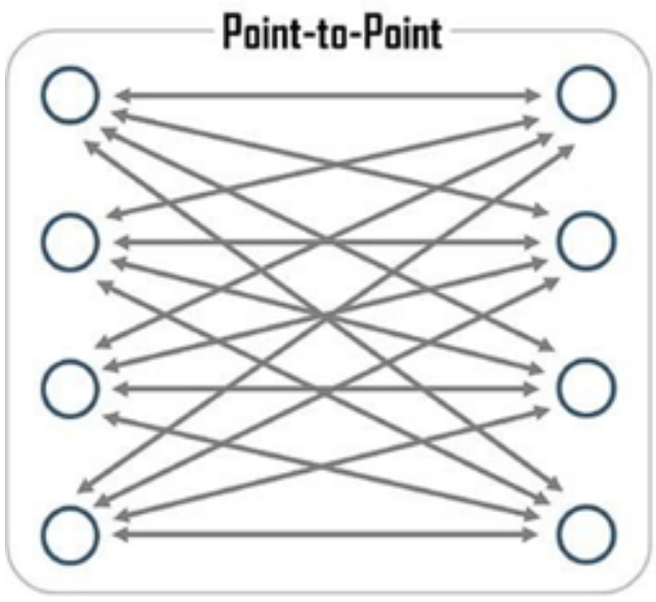
A) ROAD TRANSPORT

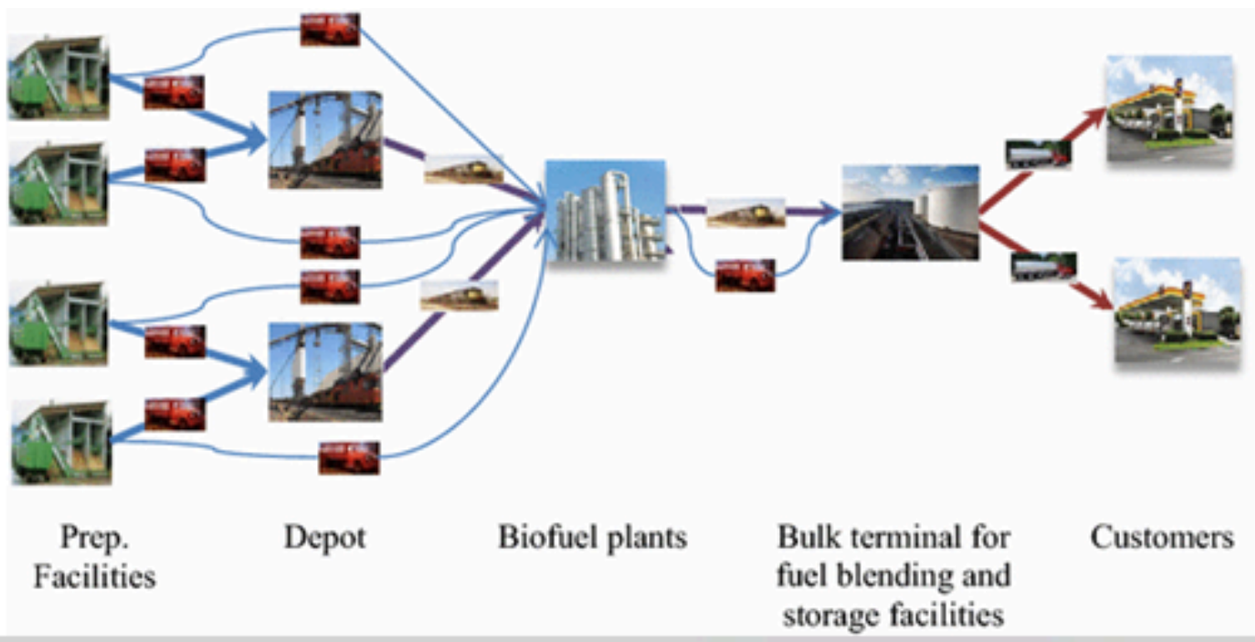
- Most common mode of transportation in logistics.
- From walking to horses to wagons to bikes to cars to trucks, road transportation has been around longer than mode and is utilized the most of any mode in logistics.
- Road transport system have high maintenance costs, both for the vehicles and infrastructures.
- This attribute of road transport makes it the preferred mode for smaller loads over a shorter distances.
- Road is the only mode that performs door-to-door deliveries.
- Most shipments that initially were carried by another mode of transportation are completed by road transportation.
- The main downside to road transport is the external influences that play into its effectiveness, primarily weather, traffic and road regulations, three things that mostly don't influence other modes.
- Small packages (or parcel) can be transported in a vehicle no larger than personal car.
- Shipments larger than 150lbs are considered freight and require a truck. The two main forms of road transport are Less-Truck-Load(LTL) and Full-Truck-Load (FTL).

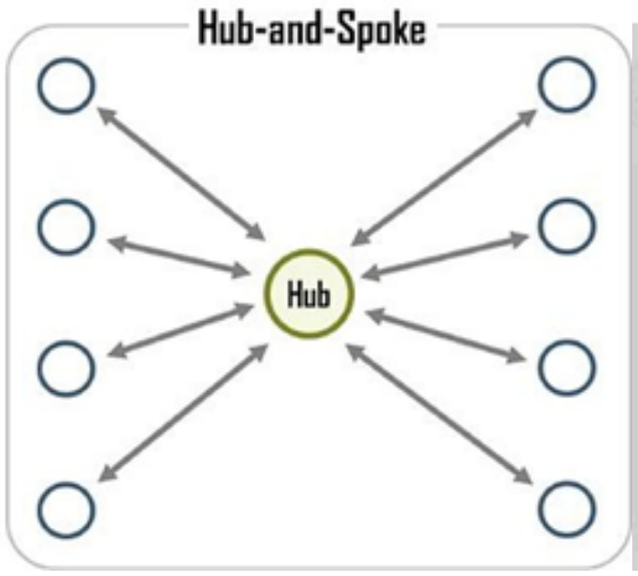
Topic 2 : Transportation Modes

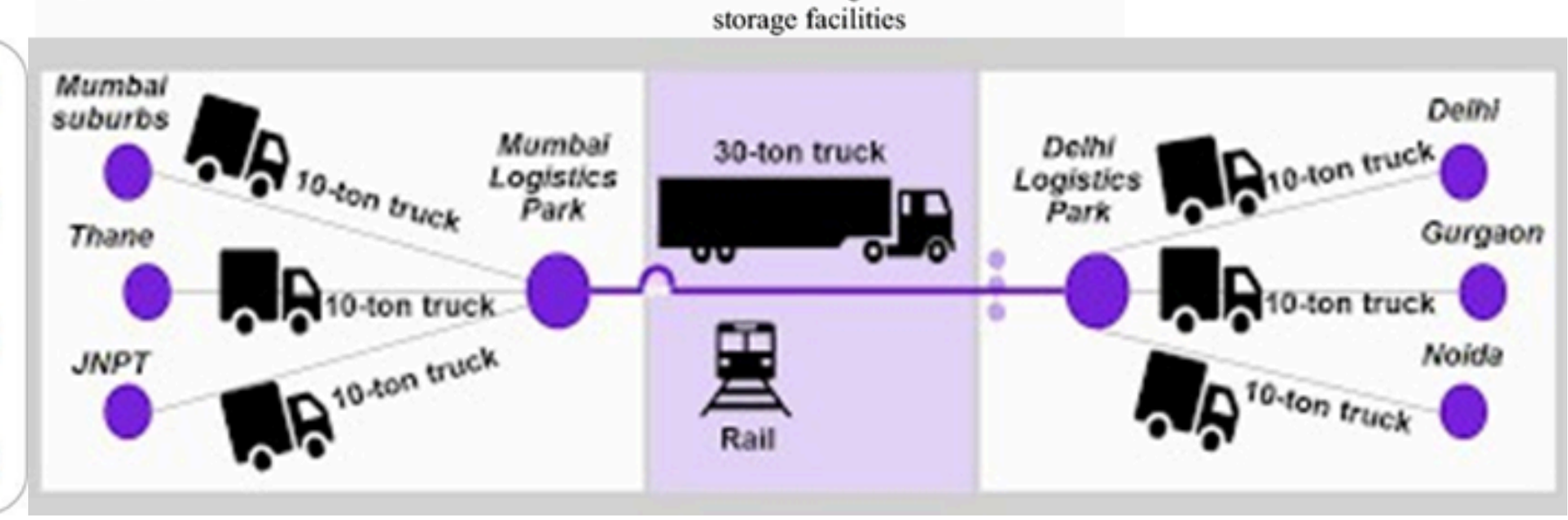
LESS-TRUCK-LOAD (LTL)

•Smaller shipments (primarily palletized shipments) to their respective locations along a specified route.
•The route begins and ends at a specified hub of origin and makes various stops according to the number of different shipments it is carrying.
•This system of transportation is known as the Hub and Spoke Model.
Advantages of LTL – shipper only pays for the portion of the truck occupied by their freight while the rest is payed for by the shippers using the rest of the truck.
•Disadvantages of LTL – multiple stops and transfers that the shipment undergoes end route to its destination.









LESS-TRUCK-LOAD (LTL) - Hub and Spoke Model.

• This methodology consolidates the transportation assets through a central location, aka a ‘hub’, and connects them to multiple locations within a network, aka the ‘spokes’.
• A delivery would therefore start in one of the locations and be taken to the central hub whereby it would either be stored or distributed directly to another location within the network.

TRUCK-LOAD (TL)

•Much faster than LTL because it does not operate on a hub and spoke model.
•The truck will go from origin to destination with no additional stops or transfers along the way.
•The drawback to TL is that a shipper must ship a lot of freight in order to make the shipment economical.

Topic 2 : Transportation Modes

A) ROAD TRANSPORT

ROAD TRANSPORT OPERATION

• Container haulers help to transport containers to from the warehouses or ports
• They offer on-time container delivery to the customer and they provide a diverse range of container haulers such as container chassis and side loaders for 20 and 45-foot units

CATEGORIZE TRANSPORTATION MODES

B) CHARACTERISTICS OF ROAD TRANSPORT

CATEGORY	CHARACTERISTICS
SPEED	Trucks travel at an average speed of about 50 miles per hour, offering quick delivery for short to medium distances. Trucks are also very good at delivering at a precise or specific time.
ACCESSIBILITY	Many carriers provide visibility into shipment's journey. Most trucks are equipped with GPS tracking devices to pinpoint the exact location of your shipment in real time.
CAPACITY	Fairly large amount of goods to ship. However limited a bit depending on the size and weight of shipment and the capacity of the truck, in addition to federal and state weight requirements.
TRANSIT TIME	Trucking is the only mode that can pickup and delivery door to door almost anywhere even reaching very remote areas.
RELIABILITY	Barring any major traffic, construction or weather delays,truck shipments for the most part are typically reliable and can be expected to arrive within a pre-determined timeframe. On-time performance can exceed 97%
SAFETY AND SECURITY	While fast for short trips, trucks are much less fuel efficient and contribute to a greater percentage of total greenhouse gas emissions than other shipping modes

Topic 2 : Transportation Modes

B) STRENGTHS AND LIMITATIONS OF ROAD TRANSPORT

STRENGTHS	LIMITATIONS
Flexibility: It offers complete freedom to the road users. (Adaptable)	Speed is related to accidents and more accidents results due to higher speed.
It requires relatively smaller investments and cheaper in construction with respect to other modes.(Secure few transfers)	Not suitable for long distance travel
Its serves the whole community a like the other modes. (Fast on door to door basis)	Power required per tones is more
For shorts distance travel it saves time	Due to limited carrying capacity road transport is not economical for long distance transportation of goods.
These are used by various types of vehicles.	Transportation of heavy goods or goods in bulk by road involves high cost.

Topic 2 : Transportation Modes

CATEGORIZE TRANSPORTATION MODES

A) RAIL TRANSPORT

- Rail transport moves passengers and goods using wheeled vehicles (trains) on steel tracks.
- Tracks are made of steel rails placed on ties with ballast to support trains.
- Best for carrying heavy and bulk goods across long distances.
- Cost-effective and commonly used for commuting and transporting goods.
- Connects cities through large areas of empty land, making it ideal for long-distance travel.
- Not affected by road traffic or diversions, so it’s reliable and causes minimal damage to goods.
- Often used to transport bulk items like coal, corn, iron ore, and wheat.
- Has the highest land transport capacity, with trains able to carry up to 24,000 tons in one trip.

Topic 2 : Transportation Modes

2 Types of Train – Passenger & Freight

1. PASSENGER

• A passenger train travels between stations where passengers may embark and disembark. Passenger trains are part of public transport.
• Passenger trains provide long-distance intercity travel, daily commuter trips, or local urban transit services, operating with a diversity of vehicles, operating speeds, right-of way requirements, and service frequency.
• Intercity trains are long-haul trains that operate with few stops between cities.
• High-speed rail are special inter-city trains that operate at much higher speeds than conventional railways, the limit being regarded at 200 to 350 kilometers per hour (120 to 220 mph).

2. FREIGHT

• A freight trains hauls cargo using freight cars specialized for the type of goods.
• Freight trains are very efficient, with economy of scale and high energy efficiency.
• Bulkhandling represents a key advantage for rail transport.
• Low or even zero transshipment costs combined with energy efficiency and low inventory costs allow trains to handle bulk much cheaper than by road.
• Typical bulk cargo includes coal, ore, grains and liquids.

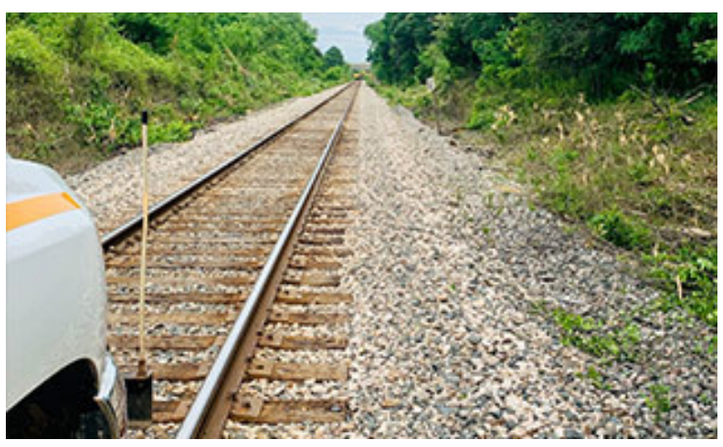
Topic 2 : Transportation Modes

RAIL TRANSPORT INFRASTRUCTURE

1. STATION

• A train station, railway station, railroad station or depot is a railway facility or area where trains regularly stop to load or unload passengers or freight or both.

• It generally consists of at least one track-side platform and a station building (depot) providing such ancillary services as ticket sales, waiting rooms and baggage /freight services



2. RIGHT–OF–WAY

- Laid upon land owned or leased by the railway company

3. TRACK

- Consists of two parallel steel rails, anchored perpendicular to members called ties (sleepers) of timber, concrete, steel or plastic to maintain a consistent distance apart or rail gauge.

4. TRAIN INSPECTION SYSTEMS

- Railway equipment is essential for the safe movement of trains. Many types of defect detectors are in use on the world’s railroads.

5. SIGNALLING

– A system used to direct railway traffic and keep trains clear of each other at all times

B) CHARACTERISTICS OF RAIL TRANSPORT

	CHARACTERISTICS
SPEED	Trains are fast and the least affected by usual weather. Trains are less susceptible to traffic congestion and road construction delays and have ability to move shipments over long distances quickly and efficiently.
ACCESSIBILITY	Terminal-to-terminalonly. Travel over rail tracks. Railroad scan help coordinate a door-to-door solution through intermodal transport or trans loading
CAPACITY	Rails offers huge carrying capacities that can adjust as business grows or shipping needs change. Rail can also accommodate shipments of many shapes and sizes, from grain to wind turbine blades
TRANSIT TIME	Moderate, depends on route or destination.
RELIABILITY	High. It has fixed routes and schedules. Its services are more certain, uniform and regular compared to other modes of transport. Railways have standardized transit schedules and don't share their tracks with the public like trucks do with the road. Weather delays can have an impact on rail shipments.
SAFETY AND SECURITY	Railways is the safest form of transport. The chances of accidents and breakdowns of railways are minimum as compared to other modes of transport. Moreover, the traffic can be protected from the exposure to sun, rains, snow etc. safety measures are strict operating rules, e.g. railway signaling and gates or grade separation at crossings.

C) STRENGTHS AND LIMITATIONS OF RAIL TRANSPORT

STRENGTHS	LIMITATIONS
Cost effective	Not door-to-door (terminal-bound), needs to be supplemented
Comparable speed to truck	Limited reach in some instances
Ability to transport large volumes at one time	Very small shipments often do not yield tremendous cost saving
Reliable transit times and schedules	Needs robust packaging, high damage record
Exclusive right of way	Requires high capital investment

CATEGORIZE TRANSPORTATION MODES

A) AIR TRANSPORT

- Known for innovation and speed.
- Important in both domestic and international trade.
- Handles 34% of world trade (by value).
- Fastest-growing and most time-efficient transport mode.
- Greatly reduces travel time and distance.
- Started with mail service, then expanded to passenger and cargo.
- Mixes both passenger and cargo transport.
- Has the highest emissions among all transport modes.
- Also the most expensive way to ship.
- Suitable for remote, hilly, desert, or hard-to-reach areas.
- Useful in emergencies and disaster relief (floods, earthquakes, etc.).
- Due to nature of air travel, freight weight/volume must be minimal for safety.

Topic 2 : Transportation Modes

A) AIR TRANSPORT

Cargo characteristics : high value, low density, get somewhere fast, light, costly and perishable goods.

MEDICAL AIR SERVICES - Human Organ for Transplant

- Can reach the patient in the shortest time possible.
- Air ambulances enables to supply an aircraft with a lead time of 6 minutes in almost any part of the world for the transportation of organs or other urgent medical freight.
- Speedy transfer of plasma and frozen section samples.
- Experienced personnel and the latest equipment are used for transporting organs and other urgent medical supplies.
- Open 24/7 to facilitate international organ transport by day and by night as quickly as possible.

AIR CARGO OPERATION

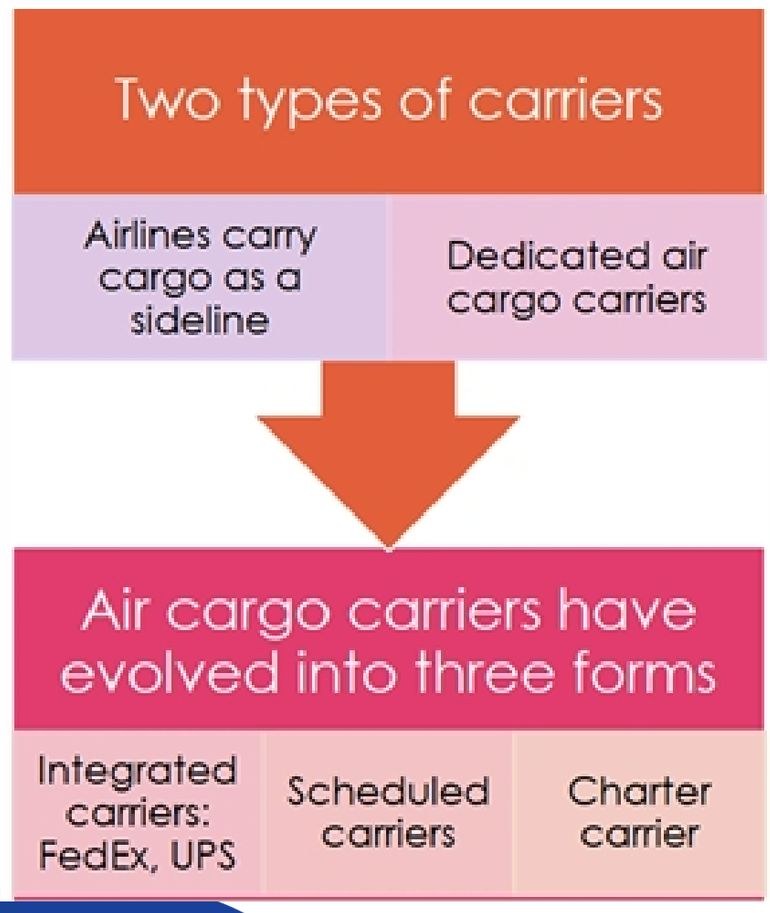
Cargo and passengers have different characteristics.

- People do not follow the same paths as cargo.
- Passenger seasonal traffic have very little correlation to cargo traffic seasons.

Security is a major concern.

- Luggage can be associated with a specific passenger, cargo flies without anybody.
- Hazardous cargo.
- Highly restricted if it moves by air.
- Rules concerning the transport of hazardous goods are developed by the ICAO, but need to be controlled and enforced by national law.

Air Cargo Operation



Topic 2 : Transportation Modes

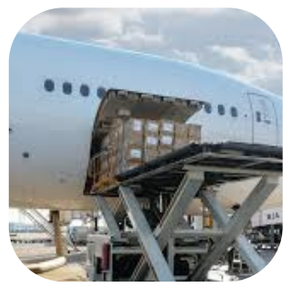
A) AIR TRANSPORT

AIR CARGO OPERATION

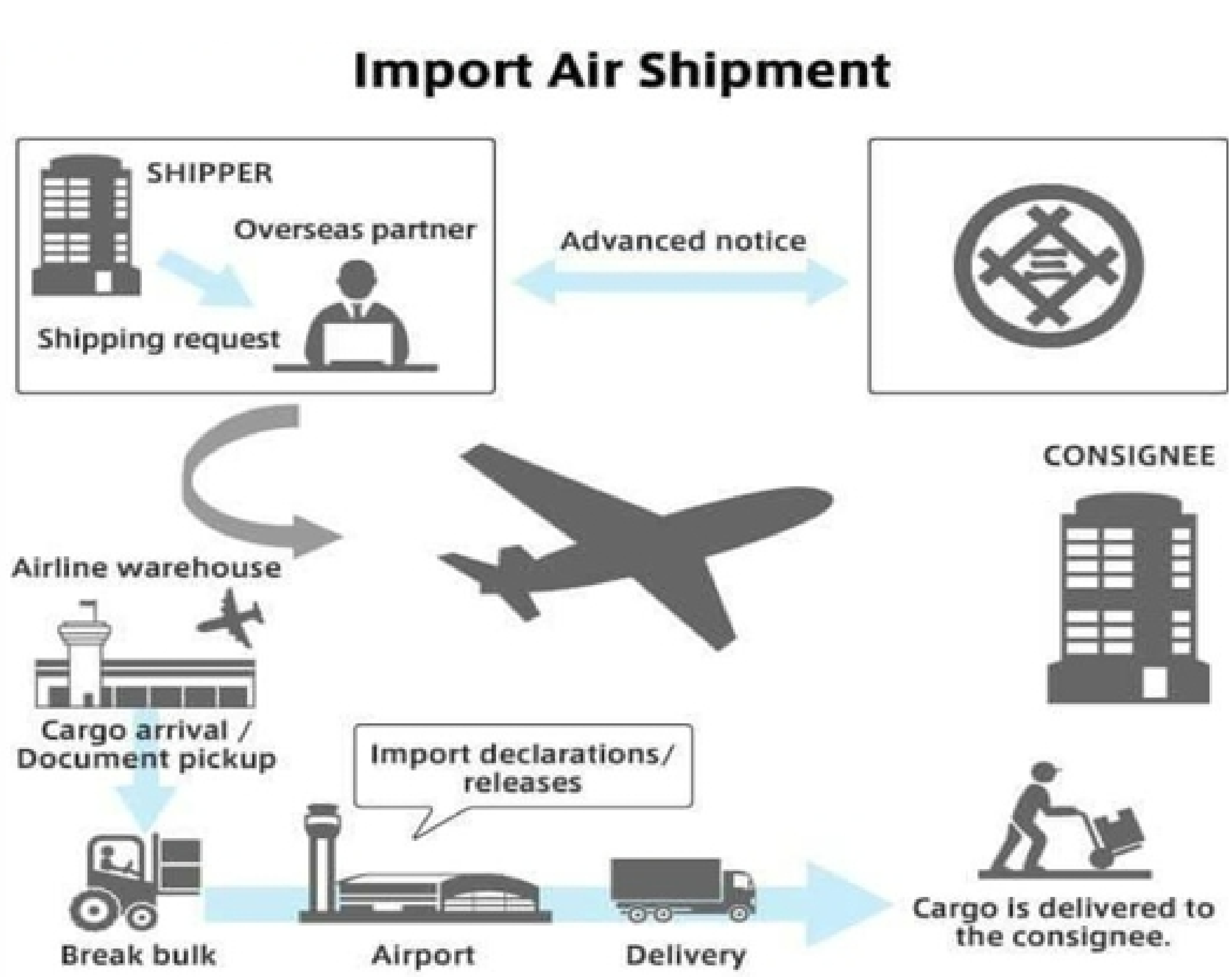
1.MAIL - Normally the monopoly market of the official postal service in a given country. Defined by the size of the letter.

2.EXPRESS TRANSPORTATION - Defined by FedEx, emphasis on speed. The package is promised to be delivered at a certain time.

3. COURIER - An extension of air express. Courier service means either same day service or next flight out. The package requires that someone fly with it.



4. FREIGHT - Cover everything else that moves air cargo. Is mostly the larger package that would be too expensive to be sent air express.



Topic 2 : Transportation Modes

A) AIR TRANSPORT

AIR TRANSPORT INFRASTRUCTURE

- **integrates all the ground facilities needed to support airline services with the adequate levels of safety, reliability and economy.**
- **the two main elements of those facilities are airports air navigation services.**

1. AIRPORT INFRASTRUCTURE

- **AIRPORT -** area of land or water (including any buileings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft and open for commercial air transport operations.
- The airports included in this domain are those reporting more than 15,000 passenger movements per year. Main airports are those reporting more than 150,000 passenger movements per year.

2. AIRPORT RUNWAYS

=> A defined rectangular area on an airport prepared for the landing and take-off of aircraft.

- **TAKE-OFF RUN AVAILABLE -** The length of runway declared available and suitable for the ground run of an aircraft taking off.
- **LANDING DISTANCE AVAILABLE -** The length of runway which is declared available and suitable for the ground run of an aircraft landing.

3. CHECK-IN FACILITIES

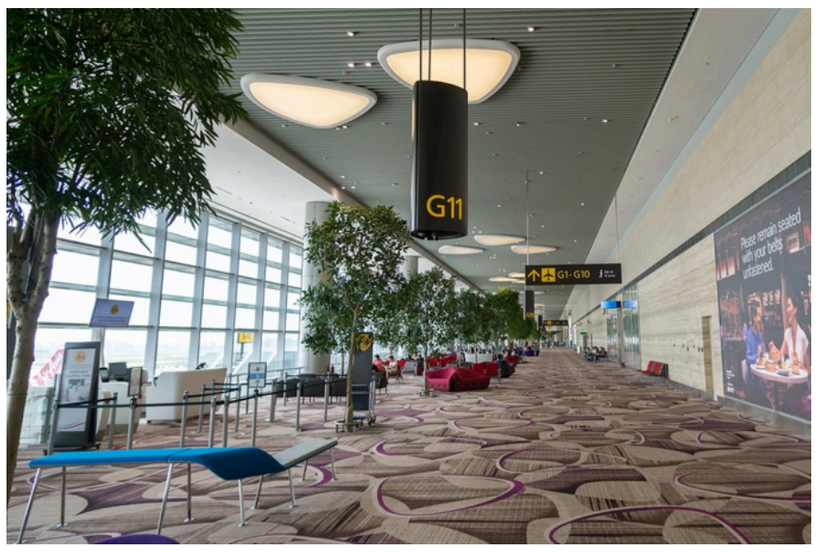
- **CONVENTIONAL -** A conventional check-in facility where airline staff handle ticket processing, luggage labelling, including fast bag drops, and issue of boarding cards directly.
- **SELF SERVICE CHECK-IN KIOSKS -** A kiosk providing check-in facilities and offering automatic ticket processing, boarding cards and, in some cases, luggage label printing.

Topic 2 : Transportation Modes

4. PASSENGER GATE

=> An Area of a passenger terminal where passengers gather prior to boarding their aircraft.

- **WITH FINGER BRDGES (JETBRIDGES OR JETWAYS) -** A gate with a finger bridge connecting to the aircraft to allow boarding without descending to ground level and using steps to board.
- **OTHER -** Gates other than those with finger bridges.



5. AIRPORT CAR PARKING

=> Parking facilities provided at the airport.

- **SHORT STAY -** Parking where the maximum permitted duration of stay is less than 24 hours.
- **MEDIUM AND LONG STAY (LONG TERM) -** Parking where the maximum permitted duration of stay is 24 hours or more.

6. TRANSPORT EQUIPMENT (FLEET)

- **AIRCRAFT -** Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of air against the earth's surface.

7. PASSENGER AIRCARFT

- **AN AIRCRAFT -** Configured for the transport of passenger and their baggage. Any freight, including mail, is generally carried in cargo holds in the belly of the aircraft.

8. CARGO AIRCRAFT

- An aircraft configured solely for the carriage of the freight and/or mail. Persons accompanying certain kinds of cargo, such as livestock, may also be carried.

Topic 2 : Transportation Modes

9. COMBI AIRCARFT

- A passenger aircraft with enhanced capabilities for carriage of freight on the passenger deck.

B) CHARACTERISTICS OF AIR TRANSPORT

	CHARACTERISTICS
SPEED	Air transport is the fastest but most expensive mode, ideal for long-distance and perishable goods, with 24–48 hour transit time, high emissions, and vital use in trade and emergencies.
ACCESSIBILITY	Air transport is airport-to-airport only, arriving in a short time but still depending on other transport for final delivery.
CAPACITY	Air transport is suitable for perishable or high-value goods over long distances, ensuring timely delivery for fresh, seasonal, rescue, or emergency items.
TRANSIT TIME	Fast air transport shortens transit time, reduces risks, allows quick delivery, and helps lower business inventory needs.
RELIABILITY	Air transport uses the sky without geographical limits, free from physical barriers, but flights can be delayed by weather.
SAFETY AND SECURITY	Air transport offers high security, safety, and accuracy with less cargo damage and lower insurance costs, but prices are higher than other modes.

C) STRENGTHS AND LIMITATIONS OF AIR TRANSPORT

STRENGTHS	LIMIATIONS
Air transport is the fastest mode, suitable for long-distance goods as it requires less time.	Even minor accidents in air transport can cause major losses to goods, passengers, and crew.
Short transit time	Air transport is more costly compared to other modes of transportation.
Reliable	Air transport is not suitable for bulky or low-value goods.
High goods security	Air transport is unreliable at times as it depends on weather, with flights often delayed during uncertain conditions.
Low packaging cost	Air transport requires huge investment for construction and maintenance, as well as skilled and experienced personnel, making it costly.

CATEGORIZE TRANSPORTATION MODES

A) SEA TRANSPORT

- Maritime transport carries about 90% of international trade through long-established routes, using cargo ships that travel major waterways to move large volumes of bulky goods like oil, coal, iron ore, cereals and bauxite at the lowest cost; although it is the slowest mode, it remains the most cost-effective, being 2–3 times cheaper than rail for long distances.
- The main routes include oceans, seas, rivers, lakes, coasts, and channels. However, maritime transport requires huge investment in ports and ships for construction, maintenance, and operation. It also has a high environmental impact, with one ship producing emissions equal to 50 million cars.
- Still, it remains widely used because it can transport a wide variety of goods at relatively low cost and most shipments are not time-sensitive.

~ OCEAN SHIPPING BUSINESS ~

1. TRAMP TANKER SHIPPING

A. TRAMP-TANKER BUSINESS :

- Tramp-tanker business is a private shipping service where vessel owners rent out their ships to carry bulk (dry or liquid) or break bulk cargo anywhere in the world, based on a contract called a charter party.

B. TRAMP SHIPPING :

- Tramp trade includes all kinds of ships, such as bulk carriers and tankers. These ships don’t work on fixed schedules like liners. Instead, they go wherever cargo is available and needed.
- Flexibility : Tramp ships can serve different markets depending on supply and demand. Some are combined carriers (oil, bulk, ore) to handle various cargoes.
- Own Equipment : They often bring their own loading gear (cranes, booms, derricks) in case a port doesn’t have the right facilities.
- No Fixed Route : Trampers don’t follow fixed port rotations. They load cargo from any port and deliver it to any port. (The ship follows the cargo, not the other way around.)
- Cargo Types : Usually carry break bulk or bulk cargo like coal, cereals, ores, but also other goods like containers, oil, gas, wood, cars, and frozen products.
- Global Role : Tramp trade moves around 4.5 billion tons of goods every year, including raw materials (steel, cement, etc.), agricultural, forestry, and mining products.
- How It Works : Tramp shipping is based on contracts (charter party) between the ship owner and the charterer (the one hiring the ship).
- Freight rates depend on supply and demand.
- **Three types of charters:**
- A. Voyage Charter – hire the ship for a single trip.
- B. Time Charter – hire the ship for a period of time.
- C. Demise Charter – hire the ship including full control (like renting it).

Topic 2 : Transportation Modes

C. CHARTERED VESSEL :

a. Chartering :

- In shipping, chartering means a shipowner rents out their vessel to another party (the charterer).
- The agreement between them is called a charterparty (shipping contract).
- Types of Charter :

A. Demise Charter – Charterer takes full control of the ship (like renting it completely).

B. Voyage Charter – Ship is hired for one specific journey from port A to port B.

C. Time Charter – Ship is hired for a certain period of time.

b. Voyage Charter :

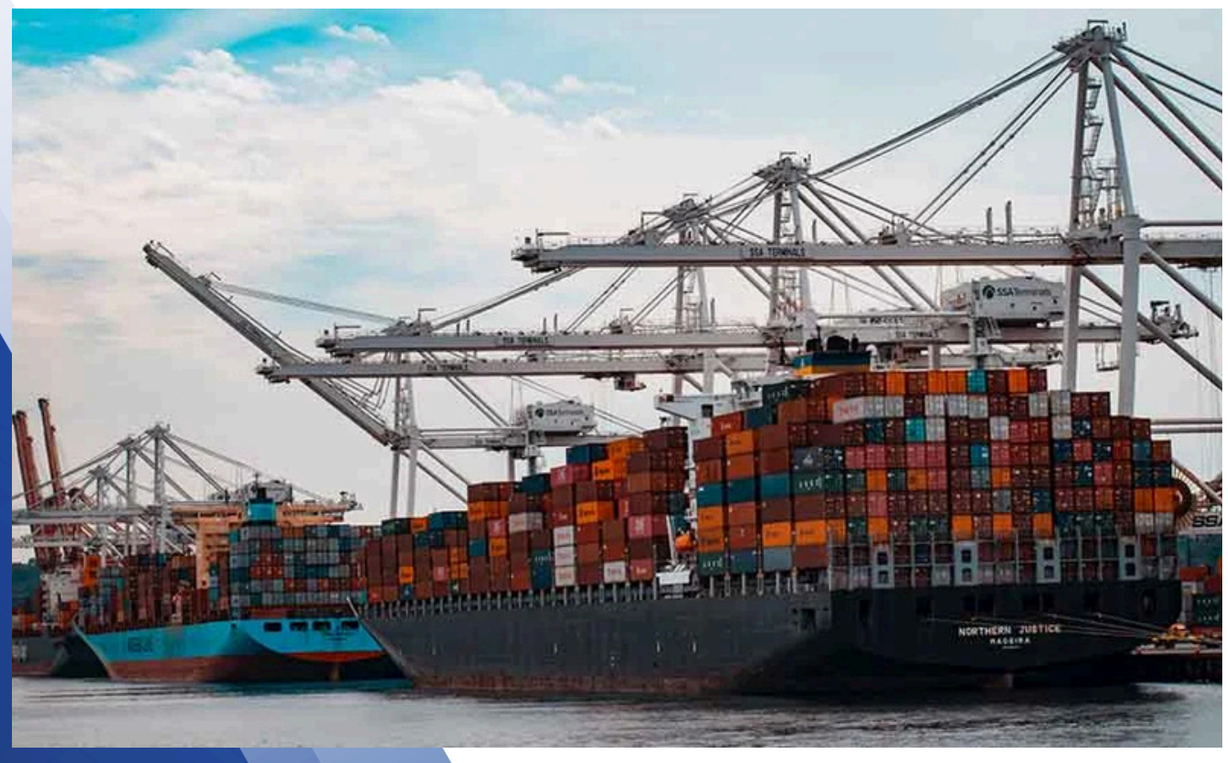
- Contract of carriage in which the charterer pays for the use of a ship's cargo capacity for one, or sometimes more than one voyage
- Shipowner pays for all ship operating costs : Fuel (bunkers), Canal & port charges, Pilotage & towage, Ship's agency fees
- Cargo handling charges → decided by agreement between both parties.
- The most common charter in trap shipping.

c. Time Charter :

- The ship is hired for a specific period of time (not just one trip).
- Shipowner provides : Ship itself (seaworthy condition), Crew, Stores & provisions (basic supplies)
- Charterer pays for : Fuel (bunkers), Voyage-related expenses (canal tolls, port charges, etc.)
- Charterer decides where the ship goes during the agreed time.

d. Bare-boat / Demise Charter :

- The ship is leased empty (without crew, fuel, or supplies) for a set period of time and fee. The shipowner gives up almost all rights and responsibilities for the vessel during this time.
- The charterer acts like the owner of the ship. Charterer is responsible for : Hiring and paying crew, Insurance, All operating expenses.



Topic 2 : Transportation Modes

C. CHARTERED VESSEL :

Chartered vessel

Responsibility	VOYAGE	TIME	DEMISE
Basis of charter hire	Cargo Tonnage	Ship Capacity	Ship Capacity
Duration of Charter Party	Specif. voyage(s)	Period of time	Period of time
Geographic Limits	Port to port	By area	By area
Maintenance of Seaworthiness	owner	owner	charterer
Possession, command, operation & navigation (demise)	owner	owner	charterer
Employer of crew	owner	owner	charterer
Master under direction of	owner	charterer	charterer
Fuel costs, Port & Harbor fees	owner	charterer	charterer
Hull & Machinery Insurance	owner	owner	negotiable
Protection & Indemnity (P&I)	owner	owner	charterer
Payment to shipowner	End of voyage	Monthly	Monthly
Legal term for compensation	Freight	Hire	Hire

	Liners
SERVICE	Regular & consistent, whether cargo is available or not Slot/hold/container/pallet
CARGO	General cargo (high volume-high value) , High variety, Heterogenous, Partly loads
SHIPPER	More than one
SHIP TYPES	Conventional liners Roro Container
VOYAGE	Mostly more than two ports
FREIGHT MARKET	Determined
SERVICE COST	Expensive
PROFIT	More determined
ROUTE	Fixed
TIMETABLE	Follow

2. LINER SHIPPING

Red Sea crisis forces vessels to avoid the Suez Canal

- Transport service using large cargo/container ships that run on regular routes and fixed schedules (like a bus or train service, but for ships).
- Cargo carried : Mainly manufactured or partly manufactured goods and Goods are usually in 20- or 40-foot containers.
- **Key features :**

A. Operates as a common carrier (open service to all customers).

B. Goods follow the vessel → cargo moves according to the ship's published timetable.

C. Fixed schedules & routes (ports are announced in advance).

D. Fixed freight rates & conditions (called liner terms).

- **Types of liner vessels (specialization) :**

1. Container vessels
2. General cargo vessels
3. Ro-Ro vessels (Roll-on/Roll-off for vehicles)
4. Multi-purpose vessels

- **Characteristics :** Common carrier, Fixed schedule, Fixed route.

Topic 2 : Transportation Modes

a. Common Carrier

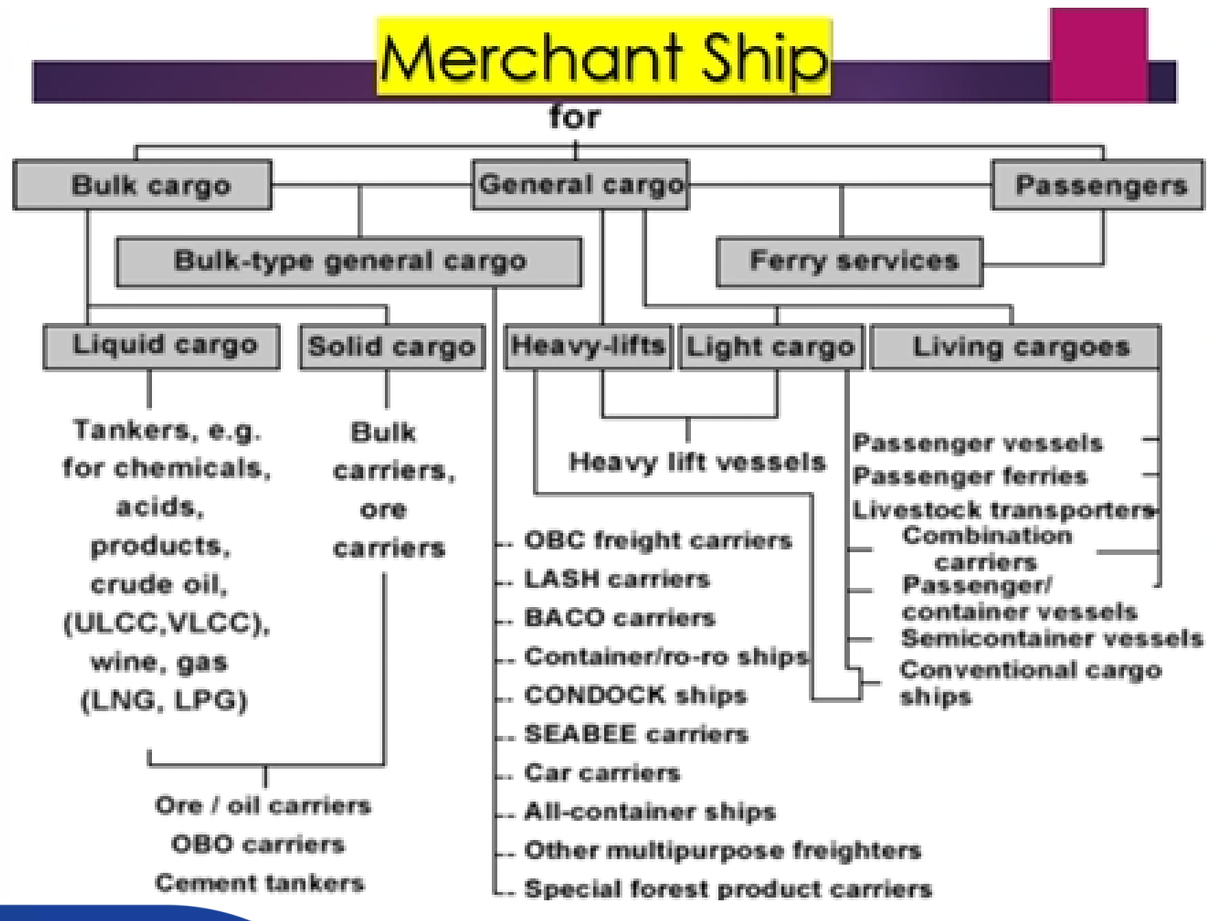
- A cargo liner = a ship that provides regular, scheduled services.
- It transports goods for payment and offers space to any customer who needs it.
- When a vessel operates on a fixed route and fixed timetable, it is said to be providing a liner service.

b. Fixed Route :

- In liner shipping, a fixed schedule always follows a fixed route.
- Ships must call at specific ports according to a set timetable.
- They cannot skip or change the route, even if there is no cargo at a port.

c. Fixed Schedule :

- A liner vessel must follow a fixed sailing schedule.
- If a ship is expected at a port (for loading or unloading), it must arrive as scheduled, even if there is no cargo to load.
- Example: If ETA is 01-02-2008, the vessel must call at that port on that date.
- Delays (due to bad weather or technical problems) do not change the principle of fixed scheduling, since these are beyond the operator's control.



Topic 2 : Transportation Modes

	Liners	Tramps
SERVICE	Regular & consistent, whether cargo is available or not Slot/hold/container/pallet	Irregular and discontinuous if cargo is not available Whole ship
CARGO	General cargo (high volume-high value) , High variety, Heterogenous, Partly loads	Bulk cargo (low value) Low variety, Homogenous, Shiploads
SHIPPER	More than one	Generally one
SHIP TYPES	Conventional liners Roro Container	Bulk carrier Tankers Combined vessel
VOYAGE	Mostly more than two ports	Mostly between two ports
FREIGHT MARKET	Determined	Flexible & may change daily
SERVICE COST	Expensive	Cheap
PROFIT	More determined	Fluctuating due to market conditions
ROUTE	Fixed	No fixed
TIMETABLE	Follow	No firm timetable

3. TYPES OF SHIP

a. General Cargo Ship

- A ship with one or more decks.
- Can carry different types of goods such as : Boxed cargo, Palletized cargo, Refrigerated (perishable) goods, Bulk materials (e.g., grain).

b. Bulk Carrier Ships

- Special ships designed to carry dry cargo in bulk (loose form, no packaging).
- Common cargoes include : Food grains (wheat, rice, corn), Ores (iron ore, bauxite, etc.), Coal, Cement.
- Bulk carriers are often used in tramp trade → ships with no fixed schedule or route, carrying cargo wherever needed.

c. Tanker Ships

=> Special ships built to carry large amounts of liquid cargo.

- Main Types:

A. Oil Tankers – Carry crude oil and petroleum products.

B. Liquefied Gas Carriers – Transport gases in liquid form (LPG, LNG, chemical gases).

C. Chemical & Product Carriers – Carry chemicals and other liquid products in bulk.

- Other Types : Juice tankers, Wine tankers, Integrated tug-barges (specialized designs).

Topic 2 : Transportation Modes

d. Container Ships

- Ships specially designed to carry large amounts of cargo in containers (20- or 40-foot).
- Containers make loading, unloading, and transport faster and more efficient.
- Types of Container Ships (by size):

1. Panamax – Maximum size that can pass through the Panama Canal.
2. Post-Panamax – Too large for the old Panama Canal, but can pass through newer, bigger locks.
3. Suezmax – Maximum size that can pass through the Suez Canal.
4. Post-Suezmax – Bigger than Suezmax, cannot pass through Suez Canal.
5. Post-Malaccamax – Too large for the Strait of Malacca.

e. Roll-On Roll-Off Ships

- Ro-Ro = Roll-On/Roll-Off.
- Ships designed to carry wheeled cargo (cars, trucks, trailers, railroad cars).
- How they work : Vehicles roll on the ship via ramps at loading, vehicles roll off the ship at unloading, and use multiple ramps for fast loading/unloading.
- Mainly used as : Car carriers, Truck/trailer carriers and Vehicle ferries
- Speed: Can travel around 20 knots across the sea.

f. Barge Carriers

- A barge = a flat-bottomed boat, mainly used in rivers and canals.
- Built to transport heavy goods (like coal, sand, timber, or machinery).
- Can also be carried by larger barge carrier ships for long-distance sea transport.

g. Tugboat

- A small but powerful boat.
- Main job : help larger ships move by pushing or towing them.
- Commonly used in ports, harbors, and canals to guide big vessels during docking or navigation.

Topic 2 : Transportation Modes

h. Sea Transport Infrastructure

- Port Infrastructure: depth of water, bridge clearance, cranes, warehousing, land connections, port capacity, operations.
- Canals & Waterways: man-made/natural routes connecting seas & rivers (e.g., Suez, Panama).

i. A Containership Berths at the Quay

- Berth facilities → must have enough length, width, and depth for the ship.
- Types of ships → general cargo, bulk carrier, container ship, tanker.
- Tugboats → help the ship move and dock safely.
- Cargo handling → depends on the type of ship (containers, oil, bulk, etc.).
- Navigation aids → things that guide ships :

1. Fixed : lighthouse, beacon lights
2. Floating : buoys, lightship.

C) CHARACTERISTICS OF SEA TRANSPORT

	CHARACTERISTICS
SPEED	Ships that carry raw materials move slowly at about 13–14 knots, while container ships are faster at 18–25 knots.
ACCESSIBILITY	Sea transport works port-to-port only and is limited to areas with deep canals and rivers.
CAPACITY	Sea transport benefits from economies of scale as large ships reduce cost per unit, making it suitable for low-value, high-volume cargo, not ideal for perishables, but able to carry all types and sizes of goods.
TRANSITT TIME	Sea transport is used for long distances, with transit time usually ranging from 20 to 45 days depending on distance, route, mode, and season.
RELIABILITY	Sea transport faces dangerous weather threats like hurricanes, squalls, typhoons, and tropical cyclones, which can seriously damage or even sink ships.
SAFETY AND SECURITY	The risks of accidents and breakdown are minimum compared to other mode. Safeand secure service

C) CHARACTERISTICS OF SEA TRANSPORT

STRENGTH	LIMITATIONS
The cheapest or easiest means of transportation.	Speed of service, slowest mode for dry cargoes.
Large volumes over long distances.	Performance is affected by seasonal variations.
Promotes foreign or international trade.	Weather related service disruptions-vulnerable to ice, flood and drought condition.
Easily carry a huge quantity of goods such as timber and coal.	Accessibility limitation used in a limited area of operations because it can only run on seas or oceans.
In comparison to other transport, the risks capacity is very low.	Packaging requirements for high-value goods.

CATEGORIZE TRANSPORTATION MODES

PIPELINE

- A unique mode of transportation.
- Used to transport crude oil and natural gas from source to refineries or other transport modes.
- Can move large volumes of fluids over long distances at relatively low cost.
- Environmentally friendly, reliable, and operates continuously.
- Can be laid across different terrains with little difficulty.
- Main types: oil pipelines and natural gas pipelines.

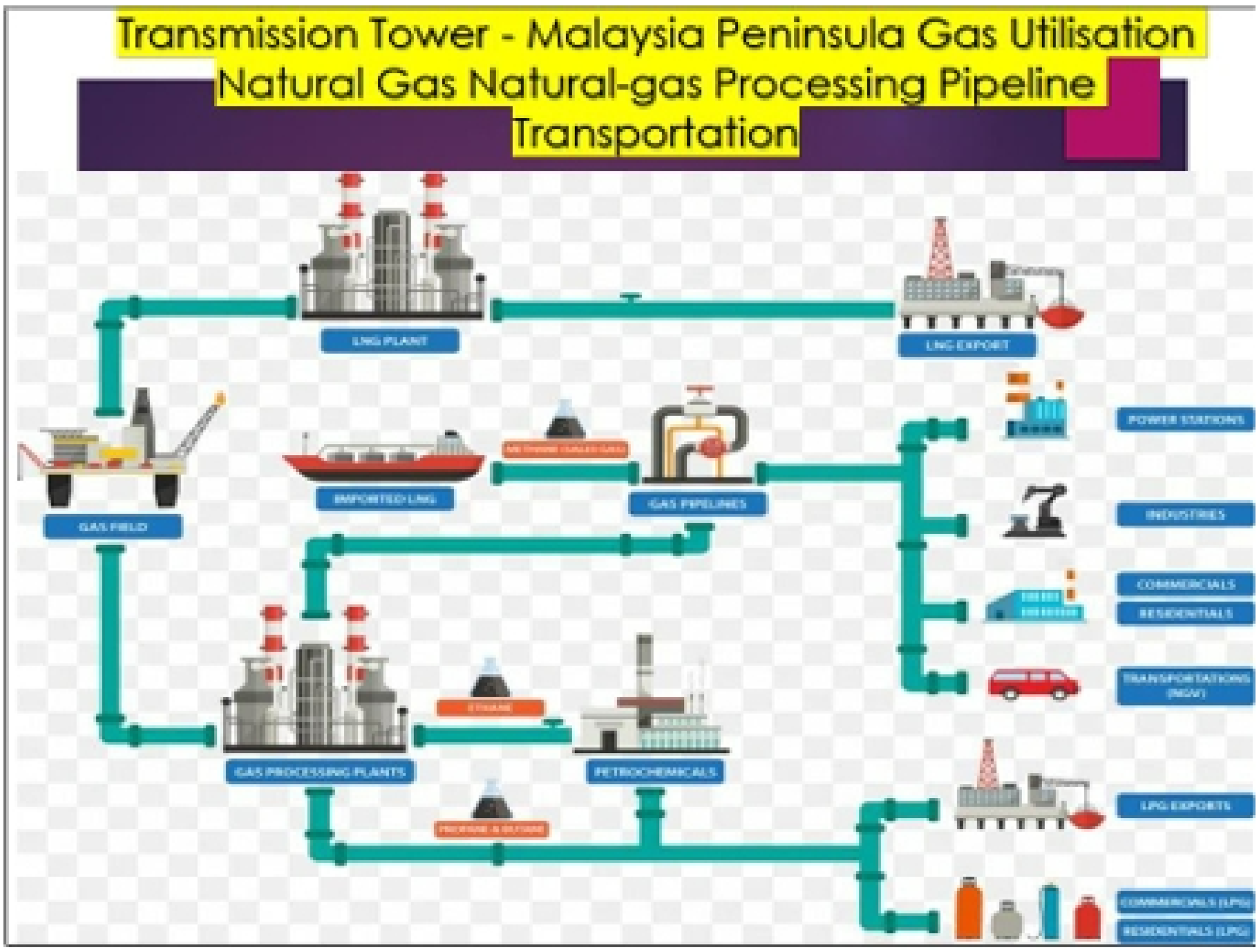
LIQUID PETROLEUM PIPELINES	NATURAL GAS PIPELINES
Crude Oil Lines	These are a network of natural gas pipelines
Carbon Dioxide Lines	-
Refined product Lines	-
Highly Volatile Liquid Lines	-

- Cost depends on construction, pipeline diameter, and fluid viscosity.
- Can be built above ground, underground, or underwater (ideal for offshore drilling).
- Routes are flexible – can be laid on land or underwater.
- Purpose: transport liquids like petroleum over long distances at low cost.
- Pipelines need their own right-of-way (buy/lease land and build pumping stations).

Topic 2 : Transportation Modes

- **Applications of Pipelines:**

1.Domestic : Carry natural gas and water to homes for cooking, heating and drinking water.
2.Commercial: Supply jet fuel directly to airports.
3.Industrial : Transport crude oil and petroleum fuels to refineries or factories over long distances.



Environmentally Friendly Pipelines :

- Pipelines are more eco-friendly than rail or ship transport.
- They are sealed and usually underground, so they cause less environmental damage and reduce carbon footprint.
- Operate 24/7, with only short breaks for maintenance or product change.
- Flow is monitored and controlled by computer systems.

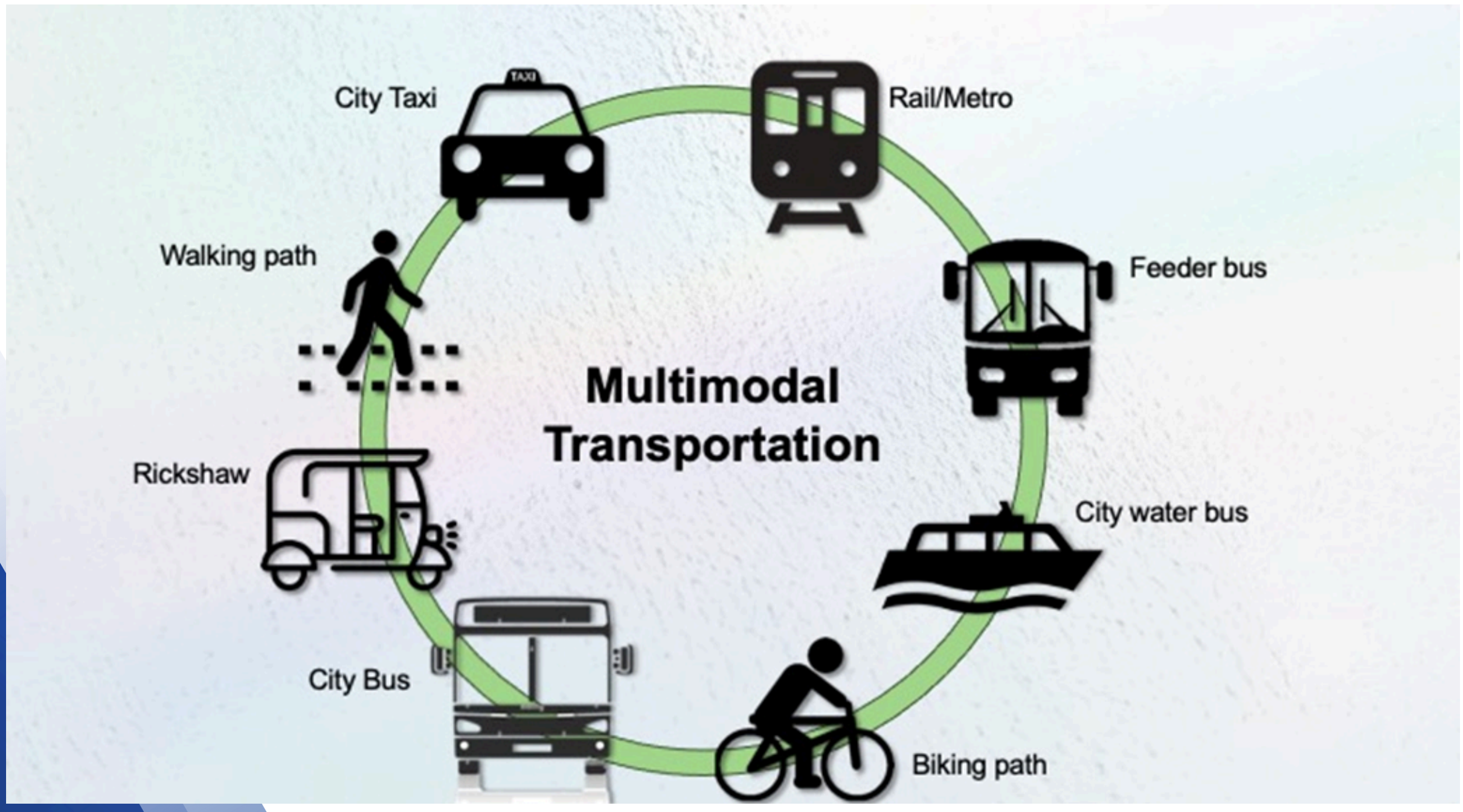
C) CHARACTERISTICS OF PIPELINE TRANSPORT

	CHARACTERISTICS
SPEED	Slow speed limit. Product move slowly but continuously
ACCESSIBILITY	Pipelines usually provide direct tank-to-tank service, mainly owned by large companies to move their own high-volume materials
CAPACITY	Pipelines are not flexible, as they can only transport gas or liquid products
TRANSIT TIME	Pipelines provide continuous long-distance transport, with capacity depending on the pipeline's diameter and the fluid's viscosity
RELIABILITY	Pipelines can transport huge amounts of oil and gas more efficiently than rail, trucks, or ships, without road/rail obstacles or weather delays
SAFETY AND SECURITY	Safer pipelines reduce explosion risks, and being mostly underground, they are less exposed to natural elements.

D) STRENGTHS AND LIMITATIONS OF PIPELINE TRANSPORT

STRENGTHS	LIMITATIONS
Environmentally friendly	High initial construction cost
Pipelines are a unique mode of transport where the equipment is fixed, and products move through them in high volumes	Pipelines can only transport a limited range of commodities, mainly gases and liquids
Pipeline construction cost is lower compared to railway transportation.	Fixed routes and terminals
Pipelines may be affected by climatic factors like typhoons but can still provide long-term stable and continuous transportation.	Potentially to the environmental damage
Pipelines allow centralized control and management, ensuring high production efficiency.	Pipelines are at risk of damage from road repairs or other excavation activities.

EXPOSE TRANSPORTATION MODES VARIATION



Topic 2 : Transportation Modes

A) Compare Transportation Modes Characteristics

CHARACTERISTICS	ROAD	RAIL	WATER	AIR	PIPELINE	REMARKS
SPEED	3	4	5	1	2	1 = best to 5 = worst
AVAILABILITY / ACCESSIBILITY	1	2	5	4	3	1 = best to 5 = worst
TRANSIT TIME	2	3	4	1	5	1 = best to 5 = worst
RELIABILITY	2	3	4	5	1	1 = best to 5 = worst
SECURITY	3	4	5	2	1	1 = best to 5 = worst
COST	3	4	5	1	2	1 = lowest cost to 5 = highest cost
CAPABILITY	3	2	1	4	5	1 = best to 5 = worst
EXAMPLES OF GOODS SHIPPED	Manufactured goods : machinery & equipment, vehicles	Raw material, agriculture, chemicals, forest product	Petroleum products, grains, vehicles	Pharmaceutica, aerospace, high tech, fresh food, fashion	Oil, natural gas	
ATTRIBUTES	Most flexible delivery option, best way for small cargo, mainland delivery	Cheaper than road and air : large cpacity	Cheapest option : large capacity, bulk cargo delivery, not urgent order	Most expensive, fastest, but less capacity, for valuable cargo, urgent request		

Topic 2 : Transportation Modes

B) Pros and Cons of different transportation modes

	Cost	Capacity	Speed	Reach	Reliability	Environmental Impact
Truck	Good for short distances	Limited by truck size	Fast for short to medium distance	Extensive market reach	Typically reliable	Least fuel efficient
Rail	Effective for large volumes and long distances	Good for large volumes	Comparable to truck	Reaches major areas but needs first/last mile	Reliable to arrive within time-frames	Environmentally responsible and fuel efficient
Ship and Barge	Least expensive shipping model	High carrying capacity with some restrictions	Slow transit time	Requires navigable waterways	Can be difficult to predict transit times	Environmentally responsible and fuel efficient
Air	Most expensive shipping mode	Low carrying capacity	Fast for long distances	Needs airport infrastructure	Susceptible to weather delays	Very fuel intensive

FREIGHT @ HUB	DISTANCE LESS THAN 400KM	DISTANCE MORE THAN 400KM	OVERSIZE OR HEAVY LOADS	SPECIAL REQUIREMENTS (HAZMAT, REFRIGERATED ETC)	CROSS - BORDER	OVERSEAS
Ship		●	●	●	●	●
Plane		●		●	●	●
Train		●	●	●	●	
Truck	●			●	●	

	Air Freight	Ocean Freight
Cost	$$$$	$$
Speed	Faster transit time with less lead time	Slower transit time with variable lead time
Schedules	Frequent departures, precise arrivals	Scheduled departures, estimated transit times
Fees	Flat $20 fee	Includes line-item charges like handling fees, terminal fees, drayage, etc.
Size	Limited	Can accommodate larger cargo
Weight	Expensive for heavy items	Suitable for heavier cargo
Handling	Minimal	Can be considerable; requires careful packaging
Hazardous Materials	Significant restrictions	Possible, with proper labeling and handling

Topic 2 : Transportation Modes

c) Choose the right International Shipping Method

1 BY SEA

Transit time: 8 - 12 weeks

Your belongings share container space with other consignments bound for the same destination, making this an affordable method to ship larger possessions.

2 BY AIR

Transit time: 10 - 12 days
Fast courier: 5 - 7 days

Unaccompanied airfreight is much more cost-effective than paying for excess baggage if you only need to ship a few items.

3 BY ROAD

Transit time: 10 - 14 days from the UK to European destinations

If you're sending goods to a European destination, a road trailer service is both fast and affordable.

SEA FREIGHT VS AIR FREIGHT

Parameters	Sea Freight	Air Freight
Cost	🟢	🔴
Speed	🔴	🟢
Cargo Volume	🟢	🔴
Environmental Impact	🟢	🔴
Cargo Safety	🟢	🟢
Restrictions	🟢	🔴

Topic 2 : Transportation Modes

c) Choose the right International Shipping Method

1) Potential for Goods Damage

- Goods can be damaged due to movement and acceleration forces.
- Handling at terminals, depots, or rail yards causes high impact.
- At sea → steady forces (rolling & pitching).
- Rail/road → irregular forces (braking, turning, engine start, etc.).

2) Transit Time

= A study conducted on freight transports between Sydney and Perth found the average door-to-door transit time for each of the following transport modes :

- Road = 2 - 4 days
- Rail = 7 days
- Maritime = 10 - 14 days

3) Fuel Efficiency

- Maritime transport is slightly more fuel-efficient than rail in terms of fuel use and CO2 emissions.
- Both maritime and rail are about 50% more efficient than road transport.
- This efficiency is achieved when loads are large (e.g., 500 containers per ship, 40 per train).

4) Levels of Safety

- Road freight is the most dangerous, with the highest number of serious accidents and fatalities.
- Trucks, although only 2.5% of vehicles, cause about 20% of all road deaths in Australia.

MODE	FIXED & CAPITAL COSTS	OPERATING COSTS
Road	• Land, Roads, Parking, Ramps, Bridges, Tunnels, Signalization • Vehicles and trailers	• Maintenance, Labor, Fuel
Rail	• Land, Tracks, Bridges, Tunnels, Signalization • Locomotives and Wagons • Rail yards and Terminals	• Maintenance, Labor, Fuel
Pipeline	• Land, Pipes • Pumping stations and Tanks	• Maintenance, Energy
Air	• Land, Field, Terminal • Aircraft	• Maintenance, Fuel, Labor, Airport charges
Maritime	• Land for port terminals • Cargo handling equipment • Ships	• Maintenance, Fuel, Labor, Port Charges
Telecommunications	• Towers, Hubs, Poles, Cables • Exchanges, Servers	• Maintenance, Energy

Summary

2.1 Categorize Transportation Modes

2.1 Categorize Transportation Modes

Transportation modes refer to the various methods used to move goods and passengers from one place to another. Each mode has its own features, advantages, limitations, and suitability depending on distance, cost, and type of cargo.

- ***2.1.1 Road Transport***

Involves the movement of goods and people using vehicles such as trucks, vans, and cars on highways or local roads.
Advantages: High flexibility, door-to-door service, suitable for short to medium distances.
Limitations: Affected by traffic, weather, and limited capacity for bulky goods.

- ***2.1.2 Rail Transport***

Uses trains running on fixed tracks to move large volumes of goods over long distances.
Advantages: Cost-effective for bulk and heavy goods, energy-efficient, reliable schedules.
Limitations: Less flexible due to fixed routes and longer transit times compared to road or air.

2.1 Categorize Transportation Modes

- **2.1.3 Air Transport**

Involves aircraft carrying passengers and goods through air routes.
Advantages: Fastest mode, ideal for long distances and perishable or high-value goods.
Limitations: Very expensive, limited cargo space, weather-dependent.

- **2.1.4 Sea Transport**

Uses ships and vessels to carry goods across oceans and seas.
Advantages: Best for international trade, large cargo capacity, low cost per ton.
Limitations: Slow speed, affected by weather, requires port infrastructure.

- **2.1.5 Pipeline Transport**

Moves liquids and gases (like oil, natural gas, and water) through networks of pipes.
Advantages: Reliable, low operating cost, minimal environmental impact.
Limitations: Limited to specific types of goods and high initial construction cost.

Summary

2.2 Expose Transportation Modes Variation

- **2.2.1 Transportation Modes Characteristics**

Each mode differs in terms of speed, cost, capacity, reliability, flexibility, safety, and environmental impact.

~ Road: High flexibility, moderate cost, suitable for short hauls.
~ Rail: High capacity, good reliability, best for bulk shipments.
~ Air: Fastest but most expensive, best for time-sensitive goods.
~ Sea: Economical for international trade, slower speed.
~ Pipeline: Continuous, cost-efficient, limited product types.

Selecting the right mode depends on factors such as cargo type, delivery urgency, distance, and budget.

Summary

Transportation modes form the foundation of global logistics. Each mode : road, rail, air, sea, and pipeline has unique characteristics that influence cost, speed, and reliability. Understanding these differences enables logistics managers to select the most efficient and cost-effective mode for transporting goods, ensuring smooth and timely delivery across the supply chain.

Exercise

Exercise Chapter 1 (Transportation Overview)

1)What are the core components of transportation logistics?
2)What role does transportation play in a logistics system?
3)What are the two main functions of transportation?
4)List and explain the three transportation utilities.
5)Who are the main players in transportation logistics?

Exercise Chapter 2 (Transportation Modes)

1)What are the five main modes of transportation?
2)What are the main advantages and disadvantages of road transport?
3)Which mode of transportation is most suitable for heavy and bulk goods, and why?
4)What factors influence the selection of a transportation mode?
5)Explain the main characteristics of air and sea transport.

Answers

Answer to Exercise Chapter 1 : Transportation Overview

Question 1 :
The core components include infrastructure (roads, ports, railways, airports), vehicles, operations, technology, and regulations that together support the efficient movement of goods and people.

Question 2 :
Transportation acts as a link between supply chain activities, enabling product movement, inventory management, and customer service while supporting geographical market expansion.

Question 3 :
The two main functions are product movement (the physical transfer of goods) and product storage (holding inventory while in transit).

Question 4 :

1. Time Utility – Ensures products arrive when needed.
2. Place Utility – Makes products available where required.
3. Possession Utility – Enables customers to own and use the products.

Question 5 :
The main players are shippers, carriers, consignees, third-party logistics providers (3PLs), government agencies, and customers, all of whom contribute to efficient logistics operations

Answer to Exercise Chapter 2 : Transportation Modes

Question 1 :
The five modes are road, rail, air, sea, and pipeline transportation.

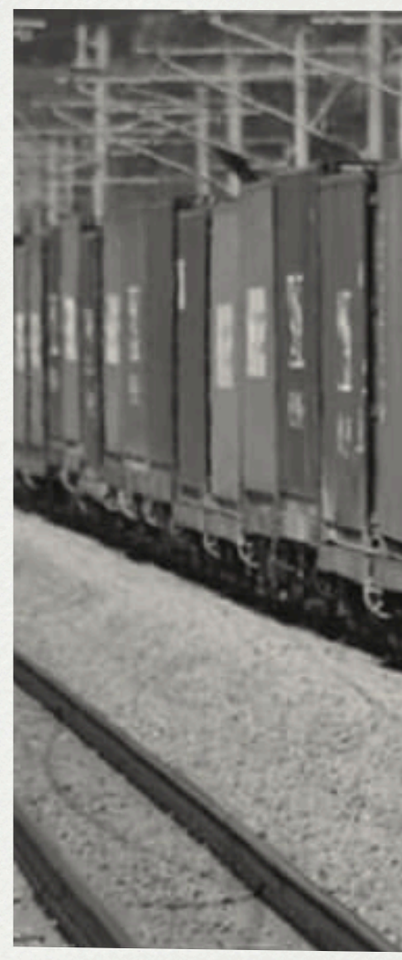
Question 2 :
Advantages: Flexible, provides door-to-door service, suitable for short distances.
Disadvantages: Limited cargo capacity, traffic congestion, and weather delays.

Question 3 :
Rail transport is most suitable because it can carry large volumes of goods efficiently over long distances at a lower cost.

Question 4 :
Key factors include cost, speed, distance, reliability, cargo type, flexibility, and environmental impact.

Question 5 :

- Air Transport: Fastest mode, best for long distances and high-value or perishable goods, but very expensive.
- Sea Transport: Slow but economical, ideal for international trade and large shipments.



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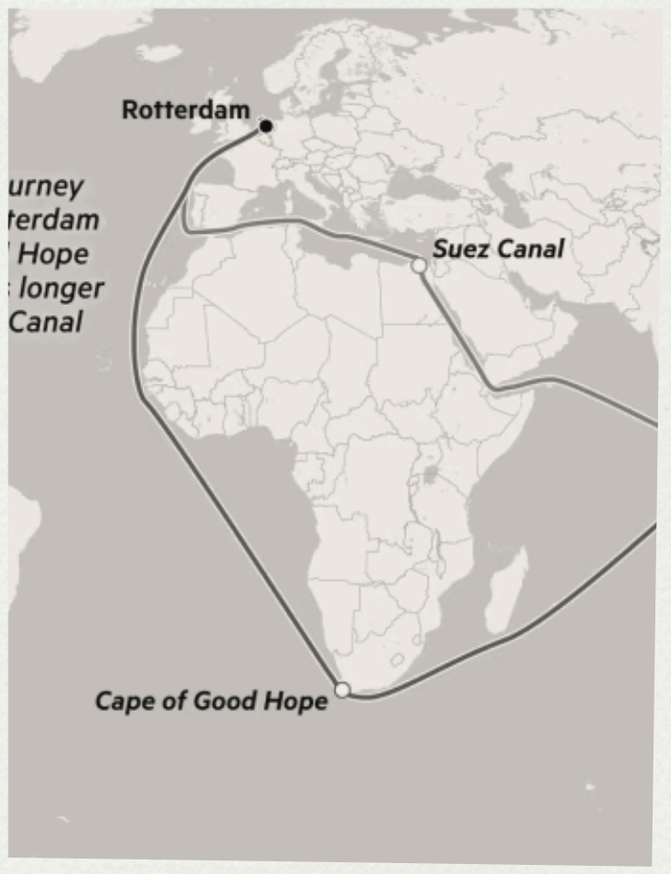

TRANSPORTATION INSIGHT

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