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HANDOUT

MGMT615

Transportation & Logistics Management

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COMPREHENSIVE STUDY HANDOUT

MGMT615

Transportation and Logistics Management

Lecture-wise study notes prepared for Virtual University of Pakistan students. Covers all major topics with objectives, key definitions, summaries and exam pointers.

10 study units

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Unit 1: Logistics and Supply Chain Foundations

Learning Objectives

Objective 1: Define logistics and its role in the supply chain

Objective 2: Explain the value logistics creates

Objective 3: Identify key logistics activities

Logistics is the process of planning, implementing and controlling the efficient flow and storage of goods, services and information from origin to consumption. Within the supply chain (suppliers, manufacturers, distributors, retailers, customers), logistics is the execution arm: it moves and positions inventory so that the right product reaches the right place at the right time. The Council of Supply Chain Management Professionals' definition is the field's anchor.

Logistics creates time and place utility: a product has no value to a customer who cannot get it when and where needed. Effective logistics lowers total cost while raising service: the classic trade-off between cost and customer service sits at the heart of every logistics decision. Firms compete on logistics capability; retailers like fast-fashion chains win through superior distribution.

Key activities include transportation, warehousing, inventory management, order processing, material handling, packaging, and information systems. Very important: this course treats logistics as an integrated system, not isolated functions; examinations test the systems view (a transport saving that raises inventory cost may be no saving at all).

Key Definitions

Logistics is defined as planning, implementing and controlling efficient flow and storage of goods, services and information to meet customer requirements.

Supply chain is defined as the network of organizations linking supply to consumption.

Time and place utility is defined as the value created by having goods available when and where wanted.

Key Points to Remember

- Logistics = flow management from origin to consumption; the supply chain's execution arm.
- Creates time and place utility; central trade-off: cost vs customer service.
- Activities: transport, warehousing, inventory, order processing, handling, packaging, information.
- Systems view: optimize the total, not each function alone.

Unit Summary

Logistics moves and positions goods through the supply chain, creating time and place utility under a cost-service trade-off managed as a system.

Exam Pointer

Very important: define logistics (CSCMP wording) and explain the systems view with an example trade-off.

Unit 2: Transportation Modes and Selection

Learning Objectives

Objective 1: Compare the five transportation modes

Objective 2: Explain intermodal transportation

Objective 3: Apply mode-selection criteria

Five modes serve freight: road (flexible, door-to-door, fast for short haul, higher cost), rail (economical for bulk over land long-haul, slower, less accessible), water (cheapest per ton-km for bulk, slowest, port-dependent), air (fastest, most expensive, for perishables and high-value goods), and pipeline (for liquids/gases, continuous, inflexible). Each mode's profile differs on speed, cost, capacity, accessibility and reliability.

Intermodal transport combines modes (e.g. ship-rail-road) using standardized containers, capturing each mode's advantage: cheap ocean line-haul with flexible road delivery. Containerization revolutionized global trade by slashing handling costs and time. Dry ports and container freight stations extend the system inland.

Mode selection weighs product characteristics (value, perishability, bulk), shipment size, distance, speed requirements and cost. High-value electronics fly; iron ore sails; groceries truck. Very important: selection questions give a scenario and expect a justified mode choice with trade-off reasoning; practice these.

Key Definitions

Intermodal transport is defined as using two or more modes under one journey with standardized containers.

Containerization is defined as standardized container units enabling seamless intermodal transfer.

Line-haul is defined as the long-distance movement between terminals.

Key Points to Remember

- Modes: road (flexible), rail (bulk land), water (cheapest bulk), air (fastest, priciest), pipeline (fluids).
- Intermodal + containers: each mode's strength, minimal handling.
- Selection criteria: product value/perishability, volume, distance, speed, cost.
- Scenario justification with trade-offs is the exam format.

Unit Summary

Five modes with distinct profiles combine intermodally; selection matches mode strengths to shipment requirements under cost-service trade-offs.

Exam Pointer

Very important: compare modes in a table and justify a mode choice for a given scenario.

Unit 3: Freight Documentation and Incoterms

Learning Objectives

Objective 1: Identify key transport documents

Objective 2: Explain Incoterms 2020 rules

Objective 3: Describe the roles of freight forwarders and carriers

International freight runs on documents. The bill of lading (B/L) is the core: a receipt for goods, evidence of the carriage contract, and a document of title (negotiable). The air waybill serves air freight (non-negotiable). Commercial invoices, packing lists, certificates of origin, and insurance certificates complete the set. Letters of credit hinge on compliant documents; a single discrepancy can stall payment.

Incoterms 2020 allocate costs, risks and tasks between buyer and seller: EXW (buyer takes all), FOB (seller delivers aboard ship), CIF (seller adds cost, insurance, freight), DDP (seller delivers duty-paid). The risk-transfer point differs per term, and choosing wrongly leaves one party exposed. Any mode terms (EXW, FCA, CPT, CIP, DPU, DAP, DDP) versus sea-only terms (FAS, FOB, CFR, CIF) is the first classification.

Freight forwarders organize shipments for shippers; carriers physically move goods; 3PLs bundle forwarding with warehousing and value-added services. Very important: Incoterms questions test who bears risk and cost at each point; draw the transfer points.

Key Definitions

Bill of lading is defined as the transport document serving as receipt, contract evidence and document of title.

Incoterms is defined as standard trade terms allocating costs, risks and tasks between buyer and seller.

Freight forwarder is defined as an intermediary organizing shipments on behalf of shippers.

Key Points to Remember

- B/L: receipt + contract evidence + title document; air waybill is non-negotiable.
- Incoterms 2020: 11 rules; any-mode vs sea-only; risk-transfer points differ.
- Key terms: EXW, FOB, CIF, DDP; know who pays and who bears risk.
- Forwarders organize, carriers move, 3PLs bundle services.

Unit Summary

Freight documentation (B/L central) and Incoterms allocate the legal and commercial responsibilities of international transport.

Exam Pointer

Very important: compare FOB, CIF and DDP on cost/risk allocation; explain the B/L's three functions.

Unit 4: Warehousing and Distribution Centers

Learning Objectives

Objective 1: Explain warehousing functions and types

Objective 2: Describe warehouse layout and operations

Objective 3: Discuss distribution center strategies

Warehouses hold inventory to decouple supply from demand, consolidate shipments, and enable value-added services (labeling, kitting). Types include private, public (for-hire), contract, and bonded warehouses (duty-unpaid storage). Distribution centers differ by purpose: flow-through facilities prioritizing movement over storage, using cross-docking to transfer inbound goods directly to outbound vehicles.

Warehouse operations follow receive, put-away, store, pick, pack, ship. Layout balances space utilization against accessibility: ABC classification places fast movers near dispatch; slotting, aisle design and material-handling equipment (forklifts, conveyors, AS/RS) determine throughput. Warehouse management systems (WMS) direct every movement.

Location strategy weighs proximity to markets versus suppliers, transport access, labor and land costs, often via the center-of-gravity method. Very important: cross-docking versus traditional warehousing is a classic compare question; know which suits predictable, high-volume flows.

Key Definitions

Cross-docking is defined as transferring inbound goods directly to outbound vehicles with minimal storage.

Bonded warehouse is defined as a facility storing imported goods with duty payment deferred.

ABC classification is defined as ranking SKUs by usage value to prioritize warehouse placement.

Key Points to Remember

- Functions: decouple supply/demand, consolidate, value-added services.
- Types: private, public, contract, bonded; DCs emphasize flow (cross-docking).
- Operations: receive-put-away-store-pick-pack-ship; ABC slotting; WMS-directed.
- Location: center-of-gravity; cross-docking suits stable high-volume flows.

Unit Summary

Warehousing decouples and consolidates flows through designed layouts and systems, with distribution centers optimizing for movement via cross-docking.

Exam Pointer

Exam pointer: compare cross-docking with traditional warehousing; explain ABC slotting logic.

Unit 5: Inventory Management

Learning Objectives

Objective 1: Explain inventory types and costs

Objective 2: Apply EOQ and reorder-point logic

Objective 3: Describe JIT and modern inventory approaches

Inventory exists as raw materials, work-in-process and finished goods, plus pipeline and safety stocks. Holding it costs: capital tied up, storage, insurance, obsolescence and shrinkage. But stockouts cost more: lost sales, expediting, customer defection. Inventory management balances these; safety stock buffers demand and lead-time variability.

The economic order quantity (EOQ) minimizes total ordering-plus-holding cost: Q* = sqrt(2DS/H), where D is demand, S ordering cost, H holding cost. The reorder point triggers replenishment at lead-time demand plus safety stock. ABC analysis focuses control effort on high-value items; cycle counting maintains accuracy without full shutdowns.

Just-in-time (JIT) attacks inventory itself: produce only what is needed when needed, exposing problems and demanding quality and reliable suppliers. Vendor-managed inventory and collaborative planning (CPFR) share data across firms. Very important: EOQ numericals are standard; also know JIT's prerequisites, since JIT without quality and reliability fails.

Key Definitions

Economic order quantity (EOQ) is defined as the order size minimizing total ordering and holding costs.

Safety stock is defined as buffer inventory against demand and lead-time variability.

Just-in-time is defined as producing only what is needed, when needed, minimizing inventory.

Key Points to Remember

- Inventory costs: holding (capital, storage, obsolescence) vs stockout (lost sales, expediting).
- EOQ = sqrt(2DS/H); reorder point = lead-time demand + safety stock.
- ABC focuses control; cycle counting keeps records accurate.
- JIT needs quality + reliable suppliers; VMI/CPFR share data across firms.

Unit Summary

Inventory balances holding against stockout costs via EOQ, reorder points and ABC control, with JIT minimizing inventory through systemic discipline.

Exam Pointer

Very important: solve EOQ and reorder-point numericals; list JIT prerequisites.

Unit 6: Logistics Information Systems and Technology

Learning Objectives

Objective 1: Explain the role of information in logistics

Objective 2: Describe TMS, WMS and ERP integration

Objective 3: Survey emerging technologies

Information substitutes for inventory: accurate, timely data lets firms hold less stock while serving better. Logistics information systems provide order management, tracking and tracing, and performance measurement. EDI and APIs exchange documents electronically; a single data-entry error can misroute a container, so data quality is operational, not clerical.

Transportation management systems (TMS) plan routes, select carriers, and audit freight bills; warehouse management systems (WMS) direct put-away, picking and labor; ERP integrates these with finance and production. Visibility platforms aggregate carrier data for end-to-end tracking. Integration matters more than any single system.

Emerging technologies reshape the field: IoT sensors monitor condition (cold chain), blockchain pilots promise tamper-evident documentation, AI optimizes routing and demand forecasting, and autonomous vehicles and drones edge toward deployment. Very important: technology questions reward linking each tool to a logistics problem it solves.

Key Definitions

Transportation management system (TMS) is defined as software planning, executing and auditing freight movements.

Visibility is defined as end-to-end real-time tracking of shipments across the chain.

Electronic data interchange (EDI) is defined as structured electronic exchange of business documents.

Key Points to Remember

- Information substitutes for inventory; data quality is operational.
- TMS (transport), WMS (warehouse), ERP (integration); visibility platforms aggregate tracking.
- IoT (condition), blockchain (documents), AI (routing/forecasting), autonomy (vehicles/drones).
- Link each technology to the logistics problem it solves.

Unit Summary

Logistics information systems (TMS, WMS, ERP) create visibility and control, with emerging technologies solving condition, documentation and optimization problems.

Exam Pointer

Exam pointer: match each system/technology to its logistics function; explain 'information substitutes for inventory'.

Unit 7: Global Logistics and Trade

Learning Objectives

Objective 1: Explain the drivers of global logistics

Objective 2: Describe free-trade zones and trade blocs

Objective 3: Discuss risks in global supply chains

Global logistics moves goods across borders to exploit comparative advantage: sourcing where costs are lowest, selling where demand is highest. Drivers include trade liberalization, containerization, information technology, and multinational production networks. Pakistan's exporters (textiles, rice, surgical goods) depend on competitive sea freight and efficient ports like Karachi.

Trade facilitation shapes flows: free-trade zones (duty-free manufacturing/export areas), trade blocs (EU, and regional arrangements), and customs regimes. The WTO framework, rules of origin, and sanitary standards govern access. CPEC's transport corridors illustrate infrastructure's role in trade competitiveness.

Global chains face risks: longer lead times, currency fluctuation, political instability, port congestion, and disruptions (pandemics, conflicts, canal blockages). Resilience strategies include dual sourcing, nearshoring, safety stocks and supply-chain mapping. Very important: the efficiency-resilience trade-off is the contemporary theme; exams ask how firms balance lean global sourcing against disruption risk.

Key Definitions

Free-trade zone is defined as an area where goods are handled with reduced customs intervention.

Comparative advantage is defined as producing where opportunity cost is lowest, driving trade patterns.

Resilience is defined as a supply chain's ability to withstand and recover from disruptions.

Key Points to Remember

- Drivers: liberalization, containerization, IT, multinational networks.
- Facilitation: FTZs, blocs, WTO rules; infrastructure (ports, corridors) decides competitiveness.
- Risks: lead times, currency, politics, congestion, black-swan disruptions.
- Resilience: dual sourcing, nearshoring, buffers; efficiency vs resilience trade-off.

Unit Summary

Global logistics exploits comparative advantage through facilitated trade corridors, managed against cross-border risks with resilience strategies.

Exam Pointer

Very important: explain the efficiency-resilience trade-off with examples; list global risk categories.

Unit 8: Third-Party Logistics and Outsourcing

Learning Objectives

Objective 1: Define 3PL, 4PL and their services

Objective 2: Explain the outsourcing decision

Objective 3: Describe 3PL selection and contracts

Third-party logistics providers (3PLs) perform logistics functions for shippers: transportation, warehousing, freight forwarding, packaging and value-added services. Fourth-party logistics (4PLs) go further, managing and integrating the entire supply chain as a lead logistics partner, often asset-light and technology-driven. The 3PL industry lets firms convert fixed logistics costs to variable ones.

The outsourcing decision weighs cost (3PL economies of scale), capability (expertise, technology, networks), and focus (concentrating on core competencies) against risks: loss of control, dependency, and information leakage. Activities that are non-core, scale-sensitive and standardizable outsource best; customer-critical customization often stays in-house.

Selection follows RFQ processes evaluating capability, coverage, IT systems, financial health and references; contracts use service-level agreements (SLAs) with KPIs: on-time delivery, order accuracy, damage rates. Gain-sharing aligns incentives. Very important: outsourcing questions expect both sides argued before a recommendation; one-sided answers score poorly.

Key Definitions

3PL is defined as a provider performing logistics functions (transport, warehousing) for shippers.

4PL is defined as a lead partner integrating and managing the entire supply chain.

Service-level agreement is defined as a contract specifying performance standards and KPIs.

Key Points to Remember

- 3PL: executes functions; 4PL: integrates the whole chain (often asset-light).
- Outsource drivers: cost, capability, focus; risks: control loss, dependency, leakage.
- Best outsourced: non-core, scale-sensitive, standardizable activities.
- Selection: RFQ, capability/IT/financial checks; SLAs with KPIs (OTD, accuracy, damage).

Unit Summary

3PLs execute and 4PLs integrate logistics; outsourcing trades scale and expertise against control, governed by SLA-based contracts.

Exam Pointer

Exam pointer: argue both sides of an outsourcing decision, then recommend; list 3PL KPIs.

Unit 9: Transportation Costing, Pricing and Regulation

Learning Objectives

Objective 1: Explain transport cost components

Objective 2: Describe pricing mechanisms

Objective 3: Outline the regulatory environment

Transport costs divide into fixed (terminals, vehicles, administration) and variable (fuel, labor, maintenance) components; the mix differs by mode (rail and air are fixed-heavy, road more variable). Economies of scale (larger shipments cheaper per unit) and economies of distance (cost per km falls with distance) shape rate structures. Empty backhauls waste capacity, so balancing flows matters.

Pricing mechanisms include class rates (freight classification by density, handling, liability), commodity rates, negotiated contract rates, and spot market rates. Fuel surcharges pass through volatility. In shipping, charter parties (voyage, time) govern vessel hire; liner conferences and alliances set container rates. Incoterms interact with pricing by defining who pays which leg.

Regulation covers safety (hours of service, vehicle standards), economic licensing, customs compliance, and environmental rules (emissions standards, IMO 2020 sulfur cap). Deregulation trends increased competition in many markets. Very important: cost-structure differences explain mode economics; examiners ask why rail needs volume while trucking is flexible.

Key Definitions

Economies of scale (transport) is defined as lower unit cost from larger shipment sizes.

Charter party is defined as the contract for hiring a vessel (voyage or time charter).

Freight classification is defined as grouping goods by transport characteristics to set class rates.

Key Points to Remember

- Fixed vs variable mix differs by mode; rail/air fixed-heavy, road variable-heavy.
- Scale and distance economies shape rates; empty backhauls waste capacity.
- Pricing: class, commodity, contract, spot rates; surcharges; charter parties in shipping.
- Regulation: safety, licensing, customs, environment (e.g. IMO sulfur cap).

Unit Summary

Transport economics rests on mode-specific cost structures and scale economies, priced through class/contract/spot mechanisms within safety and environmental regulation.

Exam Pointer

Very important: explain mode cost structures and their implications; describe charter types.

Unit 10: Green Logistics and Performance Measurement

Learning Objectives

Objective 1: Explain green logistics practices

Objective 2: Describe reverse logistics

Objective 3: Outline logistics KPIs and balanced measurement

Green logistics reduces freight's environmental footprint: modal shift (road to rail/water), fuller loads and route optimization, fuel-efficient vehicles and alternative fuels, green warehousing (energy, lighting, solar), and packaging reduction. Regulation (emissions standards, carbon pricing) and customer pressure drive adoption; green practices often cut costs too (fuel being both).

Reverse logistics manages backward flows: returns, recalls, recycling, remanufacturing, disposal. E-commerce return rates make it strategic; effective reverse systems recover value and satisfy warranty and environmental obligations. The circular economy extends the logic: design for reuse from the start.

Performance measurement uses KPIs: on-time delivery, order fill rate, perfect order rate, transport cost per unit, warehouse throughput, inventory turns, damage rates, and carbon per ton-km. Benchmarking against best practice and balanced scorecards prevent single-metric distortion. Very important: the perfect order (complete, accurate, on time, undamaged, correctly invoiced) is the integrative service metric; know its components.

Key Definitions

Green logistics is defined as minimizing the environmental impact of freight and warehousing.

Reverse logistics is defined as managing backward flows: returns, recycling, remanufacturing, disposal.

Perfect order is defined as an order delivered complete, accurate, on time, undamaged and correctly invoiced.

Key Points to Remember

- Green levers: modal shift, fuller loads, efficient vehicles, green warehousing, less packaging.
- Reverse logistics: returns/recalls/recycling; strategic in e-commerce; circular economy extends it.
- KPIs: OTD, fill rate, perfect order, cost/unit, turns, damage, carbon/ton-km.
- Perfect order components are the integrative service measure.

Unit Summary

Sustainable logistics cuts emissions through modal and efficiency choices, manages reverse flows for value recovery, and measures performance through balanced KPIs.

Exam Pointer

Very important: list perfect-order components and green logistics levers; explain reverse logistics' strategic role.