

Transportation

Managing the flow of the supply chain

EE381/382

Learning Objectives

- Explain the role transportation plays in the supply chain
- Discuss the service and cost characteristics of the primary transportation mode
- Discuss the key activities involved in transportation planning and execution
- Explain current transportation management strategies used to improve supply chain performance

The role transportation plays in the supply chain management (SCM)

- Provide critical links between these organizations, permitting goods to flow between their facilities
- With efficient, effective transportation capabilities, organizations can build global supply chains that leverage low-cost sourcing opportunities and allow them to compete in new markets
- Cost-effective transportation helps companies gain access to higher quality, lower priced materials and realize economies of scale in production

- High-quality, customer-focused transportation has a direct impact on an organization's ability to provide the “Seven Rs of Logistics”
- Getting the **right product** to the **right customer**, in the **right quantity**, in the **right condition**, at the **right place**, at the **right time**, and at the **right cost**

Transportation plays a key role in supply chain design, strategy development, and total cost management

- Transportation service availability, capacity, and costs influence decisions regarding the number and location of supply chain facilities
- Transportation capabilities must align with the company's goals
- Intentional tradeoffs should be made between transportation and related activities to optimize supply chain efficiency

Modes of transportation

- Motor Carriers
- Railroads
- Air carriers
- Water carriers
- Pipelines

U.S. Domestic Freight Shipments by mode: 2007

Mode of transportation	Value of goods	Tons (millions)	Ton-miles (billions)
Truck	71.3%	70.0%	40.1%
Rail	3.7%	14.8%	40.2%
Water	1.0%	3.2%	4.7%
Air	2.2%	<1%	<1%
Pipeline	3.4%	5.2%	*
Multiple modes	16.0%	4.6%	12.5%

*Accurate data unavailable

Source: Bureau of Transportation Statistics, Pocket Guide to Transportation (2011):32

Motor Carriers

- The most widely used mode of transportation in the domestic supply chain
- The economic structure of the motor carrier industry contributes to the vast number of carriers in the industry
 - No significant cost economies of scale that make it impossible for small carriers to compete
 - Most expenses are incurred as the result of moving freight – trucking is a high variable cost, low fixed cost business

- Three general types of for-hire carriers
 - Truckload (TL) carriers
 - Handle single large shipments per trailer that exceed 15,000 pounds or use the full cubic capacity of a trailer
 - Provide direct service, picking up the load at the origin point and delivering it directly to the destination without stopping at freight-handling terminals
 - Less than truckload (LTL) carriers
 - Move multiple shipments ranging from 150 pounds up to 15,000 pounds in each trailers
 - National LTL carriers use a hub-and spoke network of local and regional terminal facilities to sort and consolidate shipments moving to a particular market area
 - Small package carriers
 - Handle shipments up to 150 pounds and move multiple shipments on a single van or truck

Railroads

- A significant volume of freight in the United States
- Primary used for the long-distance movement of low value raw materials and manufactured products
- Handle some high-value goods, primarily automobile, and intermodal containers filled with imported finished goods

- Two carrier types
 - Linehaul freight carriers
 - Provide service between major markets and customers within those markets
 - Carriers move freight in container, carload, and unit train quantities
 - Shortline carriers
 - Provide the local and regional links between individuals customers and national rail network of the Class I railroads

- Rail equipment can be organized into loads and transported
 - Manifest trains contain a mixture of equipment and freight for multiple customers
- Unit trains move an entire block of railcars carrying a single commodity from the origin to a single destination
- Intermodal trains focus on the long-distance or linehaul movement of intermodal containers and trailers
 - Move products from ports and other high-volume origin points to major market areas where the containers are offloaded and given to trucking companies for final customer delivery

Air carriers

- High variable costs in proportion to fixed costs
- Pay variable lease payments and landing fees for their use
- Ship small quantity of high-value, low-weight semi-finished and finished goods

- Two carrier types
 - Combination carriers
 - Move freight and passengers
 - Air cargo carriers
 - Focus exclusively on the movement of letters, packages, and freight
 - Integrated carriers
 - door to door service, a consistent schedule of pickup and delivery windows, and standard expedited service through their hub and spoke networks
 - Nonintegrated carriers
 - on demand, air only service from airport to airport
 - Advantages of these carriers are the speed and flexibility of unscheduled direct service and the potential for same-day cargo movement

Water carriers

- Pay user fees for these port services only when used
- Government entities known as port authorities provide unloading and loading services, storage areas, and freight transfer facilities
- Large oceangoing ships require significant capital investments but cost is spread over a large volume of freight transported during the lengthy lifespan of most ships

- Two carrier types
 - Line services
 - Employ a wide variety of ships in their fixed-route, published schedule service
 - Charter services
 - Lease ships to customers on a voyage or time basis and follow routes of the customer's choosing

Pipelines

- Fixed in place and the product moves through it in high volume
- Protect the product from contamination and provide a warehousing function
- The most economical form of transportation with lowest cost per ton of any mode

- Three primary types
 - Gathering lines
 - Very small pipelines
 - Move oil from both onshore and offshore oil wells to trunk lines
 - Trunk lines
 - Bring crude oil from extraction points to refineries
 - Refined produce pipelines
 - Carry petroleum products from refineries to large fuel terminals with storage tanks

Intermodal transportation

- The use of two or more carriers of different modes in the origin to destination movement of freight
- Shifting freight between modes may seem inefficient and time consuming, but the improved reach and combined service advantages created by intermodal transportation offset these issues

Benefits of intermodal transportation

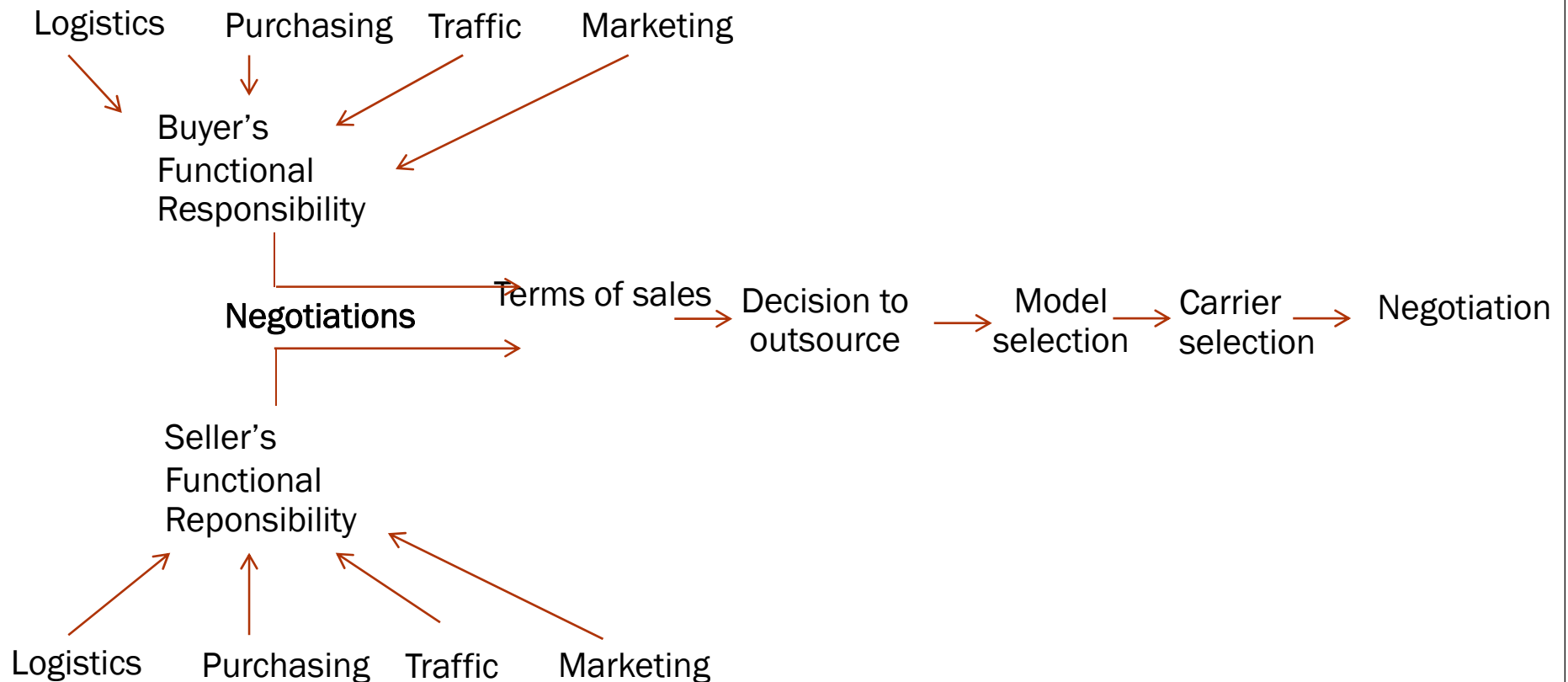
- Greater accessibility
- Overall cost efficiency can be achieved without sacrificed service quality or accessibility
- Intermodal transportation facilitates global trade

The freight services provided by intermodal transportation

- Containerized freight
 - is loaded into or onto storage equipment at the origin and delivered to the destination in or on that same piece of equipment with no additional handling
- Transload freight
 - Involves goods that are handled and transferred between transportation equipment multiple times

Transportation planning and strategy

Framework of transportation management planning activities



Transportation planning and strategy

- Functional control of transportation
- Terms of sale
- Decision to outsource transportation
- Modal selection
- Carrier selection
- Rate negotiation

Functional control of transportation

- The initial decision for any organization is straightforward but important- determining which departments will be responsible for each part of the transportation process
- Coordinate inbound and outbound transportation, develop common goals, leverage purchasing power, and procure quality service in support of supply chain excellence

Terms of sale

- Free-on-board (FOB)
 - When the ownership and title of the goods pass from a seller to a buyer in a domestic transaction
- FOB origin
 - Title (Ownership) to the goods changes hands at the origin- usually the shipping point or seller's distribution center loading dock
 - From that point on, the goods belong to the buyer, and any loss or damage is the responsibility of the buyer
- FOB destination
 - The title transfers at the destination-typically the buyer's unloading dock
 - The seller has total responsibility for the goods until they are delivered to the buyer

Key responsibilities under FOB and Freight Payment Terms

FOB Term and Freight Payment Responsibility	Who owns goods in transit?	Who handles freight claims?	Who selects and pays carrier?	Who ultimately bears freight costs?	Best used when ___ has greater influence with carrier
FOB Origin, Freight Collect	Buyer	Buyer	Buyer	Buyer	Buyer
FOB Origin, Freight Prepaid	Buyer	Buyer	Seller	Seller	Seller
FOB Origin, Freight Prepaid & Charged back	Buyer	Buyer	Seller	Buyer The seller adds freight costs to good invoice.	Seller
FOB destination, Freight Prepaid	Seller	Seller	Seller	Seller	Seller
FOB destination, Freight Collect	Seller	Seller	Buyer	Buyer	Buyer
FOB destination, Freight Collect & Allowed	Seller	Seller	Buyer	Seller The buyer deducts freight costs from goods payment.	Buyer

Source: Adapted from Bruce J. Riggs, "The Traffic Manager in Physical Distribution Management," Transportation and Distribution Management, June 1968, p. 45

- Incoterms (International Commercial Terms)
 - International transactions often present greater challenges, and parties to the transaction must understand how these terms of sale can impact transportation decision making
 - Incoterms facilitate efficient freight flows between countries
 - These term of sale decision help to clarify the following questions:
 - Who will be responsible for control and care of the goods while in transit?
 - Who will be responsible for carrier selection, transfers, and related product “flow” issues?
 - Who will bear various costs –freight, insurance, taxes, duties, and forwarding fees?
 - Who will handle documentation, problem resolution, and other related issues?

Decision to outsource transportation

- Firms must choose between transporting goods using a private fleet and using external service providers to move freight
- Private fleet
 - Operate at cost competitive with for hire carriers
 - Provide greater scheduling flexibility and control over transit time
 - E.g. PepsiCo, Dupont, and Walmart
- External fleet
 - Offer variable cost, simplified, headache-free alternative to private transportation

Modal selection

- Accessibility
- Transit time
- Reliability
- Product safety
- Cost

Accessibility

- Determines whether a particular mode can physically perform the transport service required
- Considers the mode's ability to reach origin and destination facilities and provide service over the specified route in question
- The geographic limits of a mode's infrastructure or network and the operating scope that governmental regulatory agencies authorize also affect

Transit time

- Total elapsed time that it takes to move goods from the point of origin to the destination
- Includes the time required for pickup activities, terminal handling, linehaul movement, and customer delivery
- Transit time is impacted by the speed of the mode and the ability of the mode to handle pickup and delivery responsibilities

Reliability

- The consistency of the transit time provided by a transportation mode
- Easy to forecast inventory needs, schedule production, and determine safety stock levels if it is known with some certainty when goods will arrive
- Is measured by the statistical variation in transit time

Product safety

- Is critical to the achievement of customer service, cost control, and supply chain effectiveness
- From a safety standpoint, goods must arrive at the destination in the same condition they were in when tendered for shipment at the origin

Cost

- Include the rate for moving freight from origin to destination plus any accessorial and terminal fees for additional services provided
- Example of these additional costs include inside delivery to a retailer located inside a mall, packing freight in crates for international delivery, or setting up a delivery of furniture in a residential location

Carrier selection

- A specialized purchasing decision that typically will be made by a logistics, transportation, or traffic manager who has expertise and experience in the purchase of transportation services
- Carrier selection is based on a variety of shipment criteria, and carrier capabilities: transit time average and reliability, equipment availability and capacity, geographic coverage, product protection, and freight rates
- Direct service – provides immediate point-to-point flows of goods
- Indirect service – requires interim stops or transfer of freight between equipment

Rate negotiations

- Focus on developing contracts with carriers for a tailored set of transportation services at a specific price
- Key negotiation issues for the buyer include equipment availability, delivery speed and consistency, freight protection and problem resolution, billing accuracy, and the cost of service
- Transportation companies focus on volume commitments, shipment frequencies, origin-destination combinations, freight characteristics, and related cost issues that impact their ability to serve the buyer profitably

Transport Execution and Control

Transport Execution and Control

- Shipment preparation
- Freight documentation
- Maintain in transit visibility
- Monitor service quality
- Transportation metrics

Shipment preparation

- When the need for transportation service is generated by a customer request, replenishment signal, or preschedule order, the delivery process is set in motion
- All of the prior work to identify the correct modes and carriers, secure capacity, and control transportation spending culminates in shipment preparation and handoff to a carrier for delivery

Freight documentation

- Bill of lading
 - Provides all the information the carrier needs to accomplish the move, stipulates the transportation contract terms including the scope of the carrier's liability for loss and damage, acts as a receipt for the goods the shipper tenders to the carrier
- A straight bill of lading
 - Nonnegotiable and the carrier must deliver the goods only to the specific receiving organization and destination in return for freight charge payment
- An order bill of lading
 - Negotiable and serves as a title to the goods listed on the document
 - The owner of the goods has the right to transfer title to the goods to another party and reroute the shipment to a location other than the one listed on the bill of lading

- The freight bill
 - The carrier's invoice for the fees the carrier charges to move a given shipment
- A freight claim form
 - A document that the transportation buyer files with the carrier to recoup monetary losses resulting from the carrier's failure to properly protect the freight
 - Freight claims are intended to compensate the transportation buyer an amount equal to the value of the goods had the carrier safely delivered them

Maintain in transit visibility

- To provide the location and status of the shipments regardless of the position in the supply chain, enabling transportation buyers to make decisions on the fly in the interest of better meeting customer needs
- Accurate and up-to-the minute shipment data make it possible for organizations to respond to problems as they are developing and to manage the supply chain as a single entity

Monitor service quality

- Information regarding the customer service demands and the service level that current carriers provide is needed to make a rational evaluation of performance
- Assign weight factors to the criteria, measures carrier performance, and multiplies the results by the weighting factor
- Performance criteria: on-time delivery, loss and damage rate, billing accuracy, equipment condition, and customer services

Transportation metrics

- Key performance indicators (KPIs)
- Measures of carrier or private fleet performance that are critical to the success of the organization
- Aspects of transportation performance : transportation spending efficiency, freight protection, delivery service, quality, and customer satisfaction

Transportation Management Systems (TMS)

- Information technologies used to plan, optimize, and execute transportation operations
 - Routing and scheduling
 - TMS software uses mathematical methods and optimization routines to evaluate possible combinations in which routes could be run and chooses the most economical one
 - Load planning
 - TMS load optimization programs help transportation managers build a database of package dimensions, loading requirements , and equipment capacity

Three of the key execution tools

- Load tendering
 - A TMS database determines which carriers are eligible to move the freight and then tenders the freight to the best carrier
- Status tracking
 - Provide timely information regarding potential delivery exceptions so that corrective actions can be taken
- Appointment scheduling
 - Provide the real-time visibility necessary to make appointment scheduling easier and more accurate

References

- Coyle J.J., Langley C.J. Jr., Novack R.A., Gibson, B.J. (2013). Managing Supply Chains A Logistics Approach. 9th edition. South-Western, Cengage Learning.