

8. Transportation and Global Supply Chains

International trade has been growing at a phenomenal rate ever since the end of World War II. Some of the institutions that were created at the end of the war were specifically designed to stimulate and grow trade between different nations of the world. The Bretton Woods Conference in July 1944 led to the creation of these entities:

- The International Monetary Fund (IMF), which managed the stability of exchange rates and established an international system of payment
- The World Bank, which has changed its focus from World War II reconstruction to poverty alleviation through trade and development
- The General Agreement on Tariffs and Trade (GATT), whose aim was to reduce tariffs and duties across the world to promote world trade, and to guarantee “Most Favored Nation (MFN)” status to all its members, thus preventing discrimination between locally owned firms and foreign firms
- The World Trade Organization (WTO), a successor organization to GATT created on January 1, 1995, whose goal is to “to help producers of goods and services, exporters, and importers conduct their business, while allowing governments to meet social and environmental objectives”¹

In addition, various countries have floated trade blocs to enhance trade within specific geographic areas. Some of the prominent trade blocs are the European Union (EU), Association of South East Asian Nations (ASEAN), Gulf Cooperation Council (GCC), Southern Common Market (MERCOSUR), North American Free Trade Agreement (NAFTA), and South African Customs Union.

International trade can be divided between merchandise trade and trade-in services. Merchandise trade involves export and import of physical goods. Service trade involves the export and import of intangible products such as people skills, finance, education, legal, transcription, entertainment, tourism, and communications. As far as the transportation industry and global supply chains are concerned, merchandise trade plays a more important role, compared to the trade in services. [Table 8-1](#) gives a global overview of world merchandise trade and the share of some of the bigger economies of the world in this trade.

	Value, mn \$	Share		Annual Percentage Change		
	2011	2005	2011	2005-2011	2010	2011
Total exports f.o.b.	17,816,372	100	100	10	22	20
Total imports c.i.f.	18,057,065	100	100	9	21	19
Leading Exporters						
European Union (27)	6,038,597	40	34	7	12	17
extra-EU (27) exports	2,132,888	13	12	8	17	19
China	1,898,381	7	11	16	31	20
United States	1,480,432	9	8	9	21	16
Japan	822,564	6	5	6	33	7
Korea, Republic of	555,214	3	3	12	28	19
Russian Federation	522,013	2	3	14	32	30
Hong Kong, China	455,650	—	—	8	22	14
domestic exports	16,832	0	0	-3	-12	14
re-exports	438,818	—	—	8	23	14
Canada	452,440	4	3	4	23	17
Singapore	409,503	2	2	10	30	16
domestic exports	223,688	1	1	10	33	23
re-exports	185,590	1	1	10	28	10
Leading Importers						
European Union (27)	6,255,558	40	35	7	13	17
extra-EU (27) imports	2,349,849	14	13	8	19	17
United States	2,265,894	16	13	5	23	15
China	1,743,484	6	10	18	39	25
Japan	854,998	5	5	9	26	23
Korea, Republic of	524,413	2	3	12	32	23
Hong Kong, China	510,855	—	—	9	25	16
retained imports	130,237	1	1	10	27	16
Canada	462,635	3	3	6	22	15
India	462,633	1	3	22	36	32
Singapore	365,770	2	2	11	26	18
retained imports	180,180	1	1	11	24	27
Mexico	361,068	2	2	8	28	16

Source: WTO, International Trade Statistics (ITS) 2012

(www.wto.org/english/res_e/statistics_e/its2012_e/its12_toc_e.htm).

Table 8-1 Total Merchandise Trade in Value and Percentages for the World and Select Economies.

Merchandise trade is dominated in both value and volume by the manufactured goods, followed by fuels and mining products, and finally by agricultural products. **Figures 8-1a** and **8-1b** track the rise of value of the merchandise exports by absolute value and volume, respectively. Apart from the global recessionary years (2008–2010), there has generally been an uptick in the absolute value and volume of all three kinds of merchandise exports, which has led to increasing demands on the various modes of transportation worldwide.

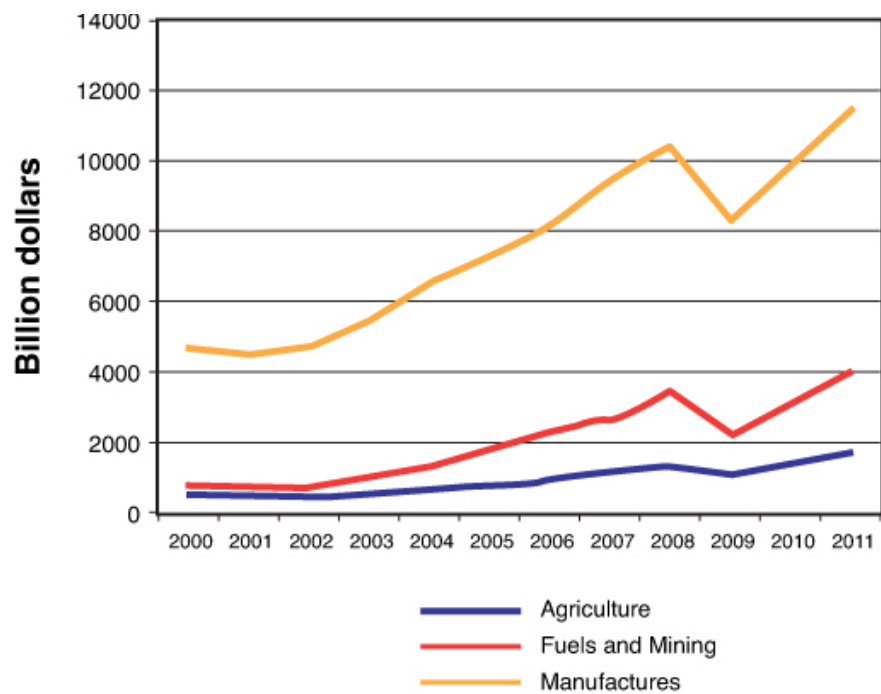


Figure 8-1a World merchandise exports by value (2000–2011)...

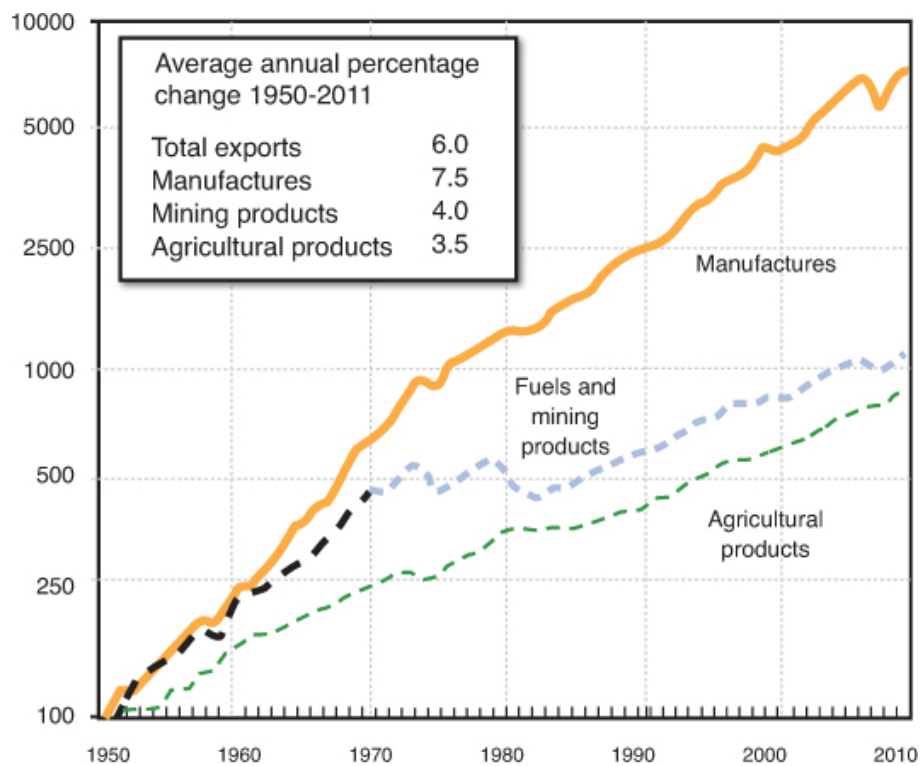
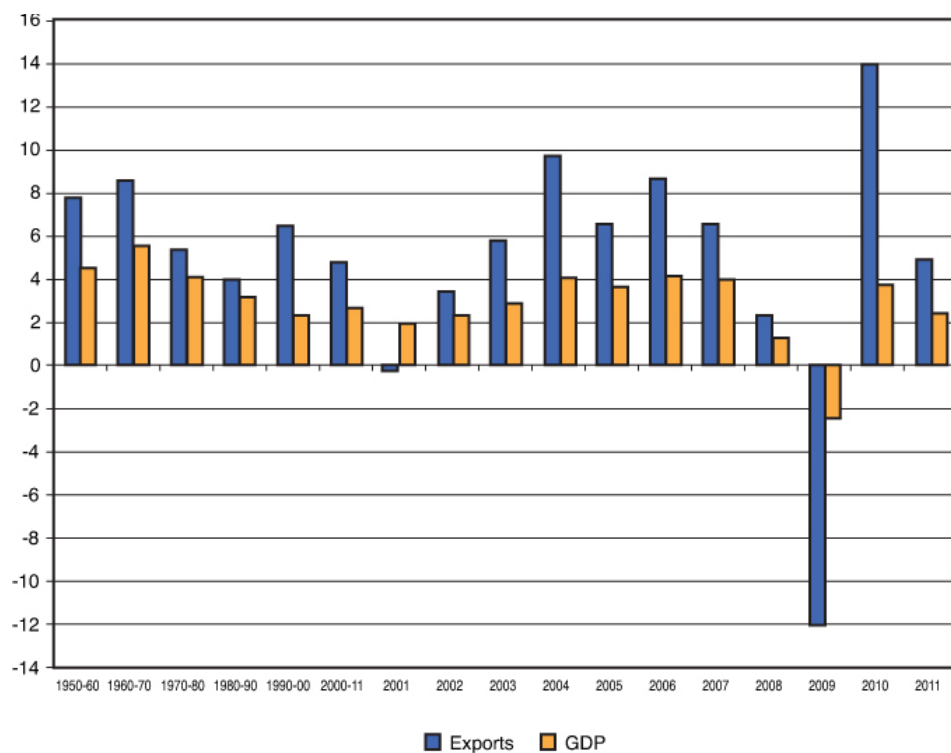


Figure 8-1b ...and merchandise trade by commodity volume (1950–2010).

Need for Global Supply Chains

International trade is often difficult and frustrating because of differences in culture, language, religious beliefs, traditions, morals, customs, legal framework, environmental concerns, political systems, and monetary systems. Since World War II, however, international trade has flourished and even outpaced growth in the gross domestic product (GDP) of the world (see [Figure 8-2](#)). Many economic theories and business models (including the Theory of Absolute Advantage, Theory of Comparative Advantage, Factor Endowment Theory, International Product Life Cycle Theory, Porter's Diamond Model, New Trade Theory, Ricardo-Sraffa Trade Theory, and the International Production Fragmentation Trade Theory) have tried to explain the growth in international trade that has led to the creation of global supply chains. The Ricardo-Sraffa Trade Theory and the International Production Fragmentation Trade Theory are extensions of Ricardo's Theory of Comparative Advantage and have been developed recently to overcome the limitations of the Theory of Absolute Advantage and Factor Endowment Theory. In essence, the growth in international trade is primarily attributed to comparative advantages that different nations have over one another and the ability of products to add value in different nations to keep the price of the final product as low as possible. This has enabled textile-trading firms such as Li & Fung to have different parts of the clothing supply chain in South Korea, Taiwan, Bangladesh, Thailand, and India, while catering to demand mainly in the United States and Western Europe. To enable complex global supply chains, firms such as Li & Fung rely extensively on efficient and effective modes of transportation.



Source: World Trade Organization
http://www.wto.org/english/res_e/statistics_e/its2012_e/its12_toc_e.htm

Figure 8-2 Growth of world merchandise exports and GDP (1950–2011).

International Modes of Transportation

When shipping globally, mode selection becomes critical because of high costliness, and there are many options transportation managers can choose from.

International Ocean Transportation

Of all the modes of transportation, the most important one as far as international trade is concerned is ocean transportation. Oceangoing vessels carry around 80 percent of world merchandise trade by volume and 70 percent by value. In 2011, the total volume of goods loaded worldwide was 8.7 billion tons. The world fleet of ships grew 37 percent from 2008 levels to 1.5 billion deadweight tons (dwt) in January 2012. Container traffic as measured by 20-foot equivalent units (TEUs) was 572.8 million TEUs in 2011.² In the United States, one in six jobs is related to marine transportation: The industry employs 2.3 million people. In addition, 95 percent of foreign trade is carried by ships, which accounts for 2 billion tons of imports and exports.³

Types of Service

Ocean transportation is organized around two types of service: liners and charterers (tramps). *Liners* are ships that operate on a regular schedule, traveling from one predetermined port to another. Liners are often organized as conferences, whose aim is to provide service on a specific route within a specified geographic region under uniform freight rates. They are a form of cartel whose aims are to “facilitate the orderly expansion of world sea-borne trade.”⁴ The bill of lading (B/L) issued by the master of the vessel is the evidence of contract of carriage. Liners often carry break-bulk/container cargo. Most B/Ls are drawn between the carrier and the shipper, and international treaties often govern the liabilities of damages. Several intermediaries, such as freight forwarders, custom house agents, and non-vessel operating common carriers (NVOCC), help facilitate the transaction between a carrier and shipper. Container ships are an example of liners.

Charterers are ships that operate under conditions of supply and demand. They do not have a fixed route, nor do they have a fixed port of call. These ships carry break-bulk and bulk cargo (dry and liquid) and often set freight rates with reference to the Baltic Exchange. Normally, a charter-party (contract) is drawn between the charterer and the ship owner as evidence of contract of transportation or affreightment. All terms and conditions and references to international treaties are mentioned in the charter-party. The B/L is issued by the charterer—examples are crude oil carriers, grain carriers, car carriers, and commodity carriers.

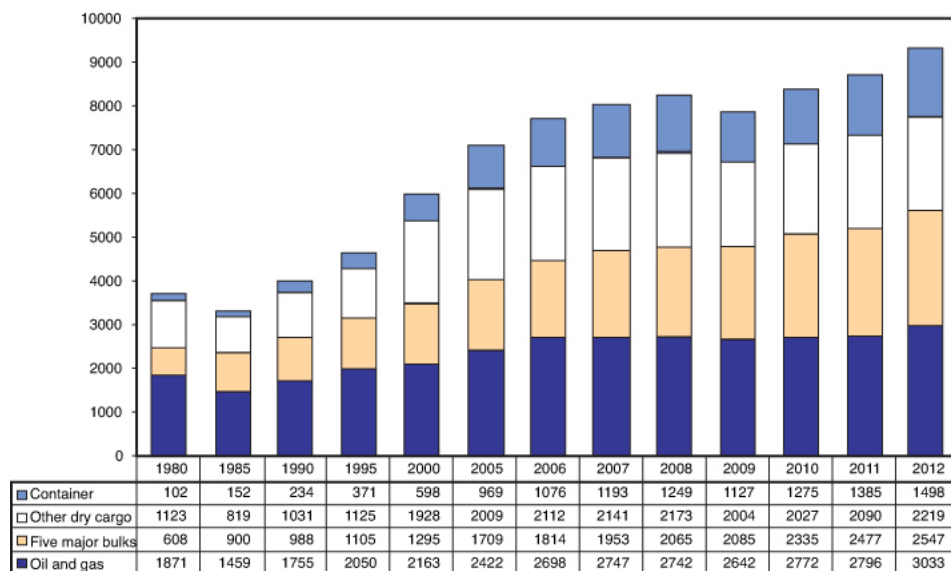
The most common types of charter-parties are the voyage charter, time charter, and bareboat charter/demise charter. As the name implies, a *voyage charter* refers to a contract based on chartering a ship from port of origin to port of destination. A gross form of voyage charter obliges the ship owner to take on the responsibility of paying for cargo loading, cargo discharging, and trimming (stability) of the ship. In a net form of voyage charter, the charterer pays the cargo loading, cargo unloading, and trimming charges. Some key clauses incorporated in a voyage charter are laytime (period of time to load and unload cargo from a ship without penalty) and demurrage (penalty imposed when the laytime is exceeded). Sometimes a *cesser clause* is inserted into a charter party when the charterer and the shipper on the B/L are different. The cesser clause ensures that the charterer is discharged of all the liabilities in case of any dues, and the cargo of the shipper of the B/L is held as collateral for the dues owed to the ship owner.

A *time charter* involves hiring the ship based on time and is independent of the voyage. The charterers take complete control of the ship and are responsible for all the liabilities and damages during the charter period. The ship owner normally takes an advance, to safeguard his or her interest in this specific charter-party.

A *bareboat charter*, or *demise charter*, occurs when the charter hires only the ship/vessel, without any fuel, provisions, cargo, or insurance. The charterer has complete control over the vessel and is required to pay for any incidental expenses, such as fuel, provisions, cargo, or insurance. A variation of a demise charter allows for hire-purchase in the shipping industry. This form of bareboat charter is initiated by the charterer for an extended period of time, with the intention of owning the vessel at the end of the charter time.

Types of Cargo

The types of cargo carried in oceangoing vessels are diverse and normally do not easily fit into a neat classification system. However, for the sake of simplicity, cargo is normally classified as bulk (wet or dry), break-bulk, and containerized cargo. **Figure 8-3** shows the growth in different types of cargo over the years.



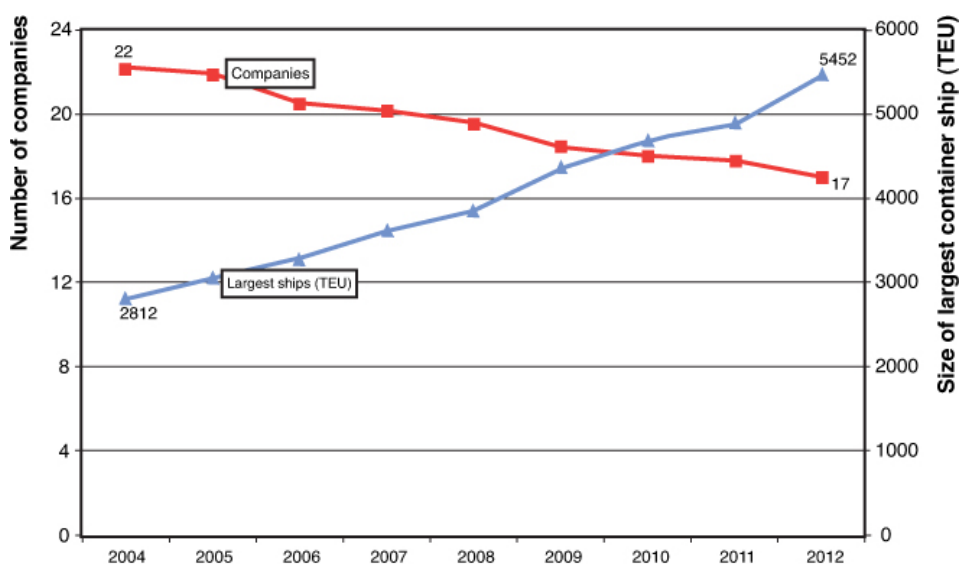
Source: United Nations Conference on Trade and Development (UNCTAD), Review of Maritime Transport 2012 (http://unctad.org/en/PublicationsLibrary/rmt2012_en.pdf).

Figure 8-3 International seaborne trade, by cargo type, selected years (millions of tons loaded).

Bulk cargo is usually transported unpackaged. It is normally poured or dropped into the hold of the ship. Sometimes palletized or boxed cargo

also is considered bulk cargo. *Break-bulk cargo* is normally noncontainerized, unitized cargo in which individual pieces are loaded on the ship.

Containerized cargos are normally of fixed lengths (TEUs or 40-foot equivalent units [FEUs]). Cargo is normally stuffed into these standard containers and then loaded into the ships. As an example, corn shipped in the holds of the ship or shipped as bags placed in holds of the ship is considered bulk cargo. The same corn packed in individual drums and shipped would be considered break-bulk cargo. If the corn were packed in TEU containers, it would be considered containerized cargo. The share of containerized cargo is increasing over the years, as [Figure 8-3](#) shows, and the share of break-bulk cargo has been decreasing over the years. Over the years, low container prices, coupled with the financial crisis, has prompted consolidation within the container shipping industry (see [Figure 8-4](#)). A smaller number of companies tend to deploy larger container ships. Three companies, Maersk, MSC, and CMA CGM, control 30 percent of the world container traffic.



Source: Calculations by the UNCTAD secretariat, on the basis of data supplied by *Lloyd's List Intelligence*.

Source: RMT 2012 (UNCTAD Review of Maritime Transport).

Figure 8-4 International seaborne industry profile.

Types of Vessels

Vessels are classified based on either the types of cargo they carry or their size. Note that some ships fit into more than one classification system, depending on their usage and the kind of cargo they carry.

Classification based on size follows:

■ **Handysize**—Ships that typically serve small and large ports, including coastal shipping. They represent the bulk of the number of ships in the world. Their capacity is between 15,000 and 35,000 dwt and can carry dry and wet cargo.

■ **Handymax**—The workhorses of dry bulk cargo, with a capacity of less than 60,000 dwt.

■ **Supramax**—Ships normally used in costal shipping and small ports. They often carry dry bulk cargo with a capacity of between 50,000 and 60,000 dwt.

■ **Panamax**—The largest ships to transverse the Panama Canal. The highest capacity is capped at 65,000 dwt by the Panama Canal Authority. The typical size of Panamax container ships is around 5,000 TEUs. Ship length is restricted to 275 meters, with a width of 32 meters and a draught of 12.04 meters. They mainly carry commodities.

■ **Aframax**—Ships named after the Average Freight Rate Assessment (AFRA) tanker rate system. They typically carry crude oil, with a capacity of between 75,000 and 115,000 dwt.

■ **Suezmax**—Ships designed to navigate the Suez Canal. They can easily dock at most ports in the world and are used for containerized dry and wet cargo. They have typical capacity ranges between 120,000 and 200,000 dwt.

■ **Capesize**—Ships that generally cannot go through either the Panama Canal or the Suez Canal—they must transit through either Cape Horn or the Cape of Good Hope. Capacity ranges from 80,000 to 175,000 dwt.

■ **New Panamax ships**—Bigger and more efficient ships, with larger dimensions, thanks to the building of the New Panama Canal. They have the capacity to carry 15,000 TEUs. The lengths of ships through the New Panama Canal can be a maximum of 427 meters, with a width of 55 meters and a draught of 18.30 meters.

■ **Post New Panamax**—Large container ships (Triple E Class) being built for Maersk, with capacities reaching 18,000 TEUs. Plans also include building container ships to hold 20,000 TEUs.

■ **Very large ore carrier (VLOC)/ultra large ore carrier (ULOC)**—Iron ore carriers that travel primarily from Brazil to Europe and Asia. VLOCs

are typically greater than 200,000 dwt; ULOCs are greater than 300,000 dwt. The largest ULOC ever built, the *Berge Stahl* in 1986, had a capacity of 365,000 dwt, a length of 343 meters, a width of 65 meters, and a draught of 25 meters.

■ **Very large crude carriers (VLCC)/ultra large crude carriers (ULCC)**—

VLCCs typically have a capacity of between 180,000 and 320,000 dwt. They serve the North Sea, Mediterranean, and West African Ports. ULCCs have a capacity greater than 320,000 dwt and carry crude from the Middle East to Europe, Asia, and North America. *Knock Nevis*, the largest ULCC ever built, had a capacity of 564,763 dwt, with a length of 458 meters, a width of 68.8 meters, and a draught of 29.8 meters.

Some ships are classified according to the unique geographical area they serve or the specialized cargo they carry:

■ **Malaccamax**—These ships navigate the Strait of Malacca. They can have a maximum length of 400 meters, a width of 59 meters, and a draught of 14.5 meters.

■ **Seawaymax**—Ships that can pass the locks of St. Lawrence Seaway can have a maximum length of 225.6 meters, a width of 23.80 meters, and a draught of 7.92 meters.

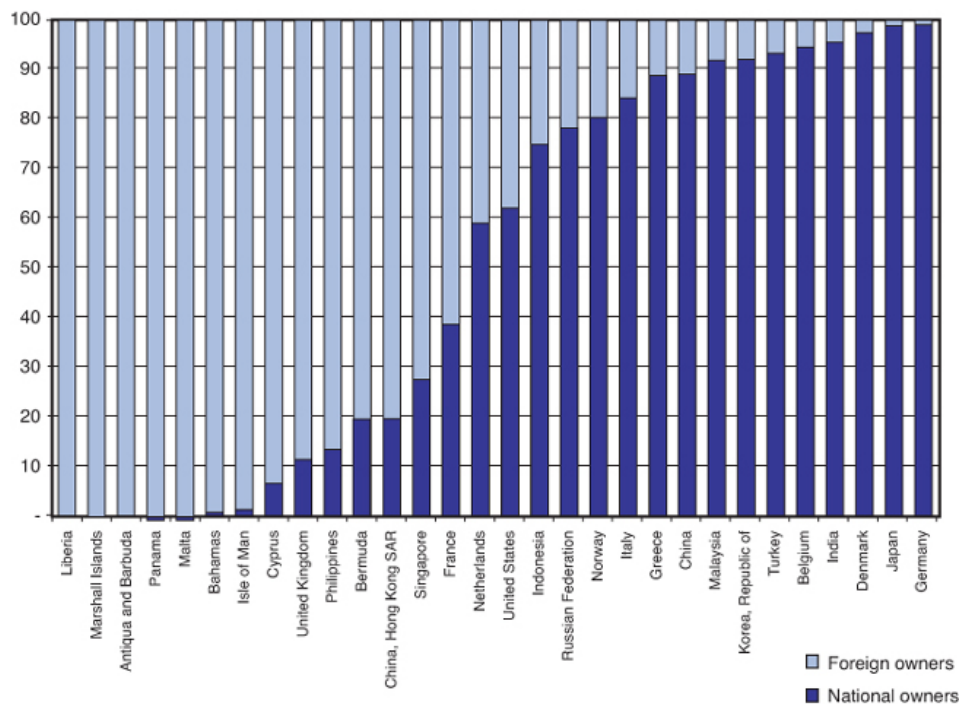
■ **Q-max**—These ships are named after Qatar and carry liquefied natural gas (LNG) from Qatar to the rest of the world.

■ **Roll-on/roll-off (RORO)**—Self-propelled vehicles, railroad cars, and livestock often are carried by specialized ships called RORO. The advantages are that the cargo does not need specialized cranes or gantries to load or unload, so labor is often cheaper. The big disadvantage is that, in most cases, the ships return to the port of origin empty because they are not capable of handling different kinds of cargo.

■ **Container ships**—Approximately 60 percent of world trade by value is containerized. Container ships come in different sizes—the most common can carry 5,000 to 6,000 TEUs. The newer container ships, called the Triple E Class ships, will have the capacity to carry 18,000 TEUs.

Flags

Per international law, every ship must be registered in a country and must fly the “flag” of that specific country. Ship owners are allowed to choose which country they want to register their ships in. This has led to “open registry,” with countries allowing any ship to be registered in that country. The concept of flying the flag of a country entitles the ship to be treated as an extension of the country. The naval force of the flagged country is responsible for the security of the merchant ships. In addition, the laws and regulations of the country in which the ship is registered apply on the ship. In return, the ship must pay all the taxes and dues in the country of registration. Not surprisingly, ship owners choose “flags of convenience,” based on the most relaxed regulations and lowest taxation rates. **Figure 8-5** gives the percentage of foreign and domestic ownership of ships registered in select countries.



Source: Compiled by the UNCTAD secretariat, based on data provided by IHS Fairplay.

Source: UNCTAD, Review of Maritime Transport 2012.

Figure 8-5 Foreign and national ownership of the top 30 fleets by flags of registration, 2012 (percentage share of fleet dwt).

Cabotage

Originally, the term *cabotage* (from the French word *caboter*, meaning “to sail along the coast”) was the exclusive right of a nation to navigate its inland waters. The country could decide which entities could ply the inland or coastal waterways. This term has now been expanded to cover all forms of transportation. Within the United States, the Jones Act authorizes the movement of cargo between two U.S. ports exclusively on U.S. flagged ships. Proponents of the Jones Act and cabotage point to the fact that 500,000 jobs and \$100 billion in annual economic output accrue directly to the United States. In case of war, the United States has the ability to requisition its domestic U.S. flagged fleet for the movement of troops, equipment, and provisions. The safety record of ships flagged in developed countries tends to be greater than the safety record of ships flying the flags of convenience. Opponents of the Jones Act point to increasing cost of operations and fewer choices to consumers for shipping their cargo.

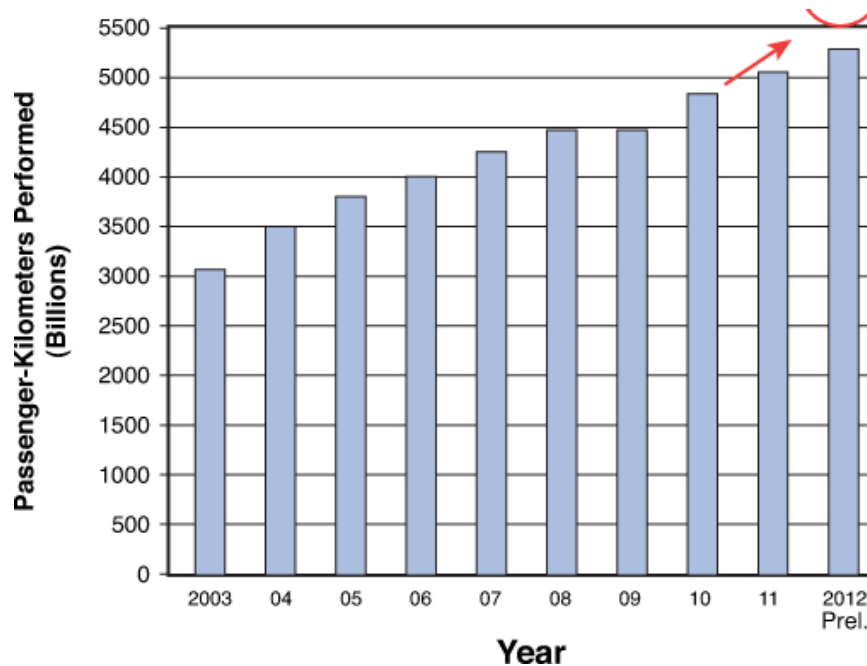
Liability

Supply chains have become more complex, and the number of multimodal shipments has increased over the years since the Carriage of Goods by Sea Act was passed in 1936. At the same time, technology and newer forms of communication have changed the way cargo and documentation are generated, arranged, and transported when compared to the previous century. The United Nations attempted to change with the times by proposing the Hague Rules, the Hague-Visby Rules, and the Hamburg Rules, but most countries never ratified these documents. The latest effort by the United Nations is to adopt the Convention on Contract for the International Carriage of Goods Wholly or Partly by Sea, popularly known as the Rotterdam Rules. The Rotterdam Rules are now being debated in the member countries and could be ratified in the coming years. The salient features of the Rotterdam Rules as applied to global supply chains follow:

- One contract of carriage for multimodal transportation
- Liability expressed clearly in terms of Special Drawing Rights (SDR)
- New rules that take into account e-commerce, enhanced navigational devices, and new ways of doing business
- A clear description of the rights and obligations of the shipper, the ship owner, and the receiver

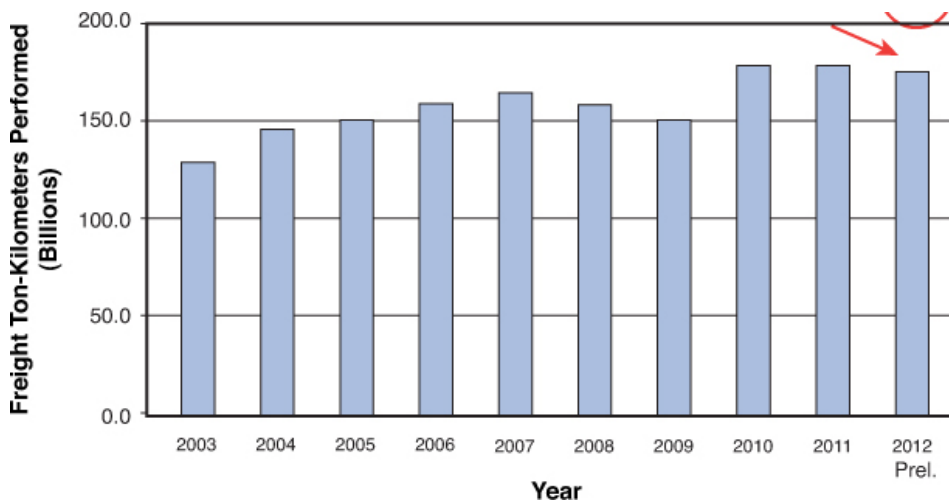
International Air Transportation

The global air network has been growing phenomenally during the last 50 years: The air network size has been basically doubling every 15 years since the 1970s. The number of passengers in 2011 rose to 3 billion, and 49.2 million tons of freight was carried in 2011. **Figures 8-6a** and **8-6b** give the growth rate of passengers (in terms of passenger-kilometers) and cargo (in terms of freight ton-kilometer) for select years.



Source: International Civil Aviation Organization (ICAO), Annual Report of the Council 2012.

Figure 8-6a Total scheduled traffic in passenger-kilometers performed (2003–2012).



Source: ICAO, Annual Report of the Council 2012.

Figure 8-6b Total scheduled freight traffic (2003–2012).

Service

The airline industry can be broadly divided as passenger services and cargo operations. Passenger services can be further divided as scheduled services and nonscheduled services. Scheduled services are normally run on a fixed time table, regardless of the demand in a short period of time. Nonscheduled operators cater mostly to the tourism industry and private business and leisure travel. Scheduled passenger services typically accounted for 93.7 percent of the total traffic, and this number has been growing as a percentage of total traffic. **Table 8-2** gives the 2012 ranking of the scheduled airlines, based on the passenger-kilometers flown. **Table 8-3** gives the top 25 airports in 2012, based on the total passengers.

Rank	Airline	Millions
1	United Airlines	288,282
2	Delta Airlines	271,567
3	American Airlines	203,336
4	Emirates	180,880
5	Lufthansa	142,512
6	Southwest Airlines	137,708
7	Air France	135,821
8	China Southern Airlines	135,021
9	British Airways	124,318
10	Qantas Airways	108,051

Source: International Air Transport Association (IATA), Scheduled Passengers – Kilometres Flown (www.iata.org/publications/Pages/wats-passenger-km.aspx).

Table 8-2 2012 Rankings of Airlines, Based on Passenger-Kilometers (International + Domestic) Flown

Rank No.	City	Airport	Passengers Embarked and Disembarked ^a			Aircraft Movements ^b		
			2012 (thousands)	2011 (thousands)	2012/2011 (%)	2012 (thousands)	2011 (thousands)	2012/2011 (%)
1	Atlanta, GA	Hartsfield-Jackson Atlanta International	95,487	92,389	3.4	930	924	0.7
2	Beijing	Beijing Capital International	81,929	78,675	4.1	557	533	4.5
3	London	Heathrow	69,983	69,391	0.9	471	476	-1.0
4	Tokyo	Haneda (Tokyo International)	66,795	62,585	6.7	391	380	3.0
5	Chicago, IL	O'Hare International	66,835	66,806	0.0	878	879	-0.1
6	Los Angeles, CA	Los Angeles International	63,688	61,862	3.0	605	604	0.3
7	Paris	Charles de Gaulle	61,612	60,971	1.1	498	514	-3.2
8	Dallas/Fort Worth, TX	Dallas-Fort Worth International	58,591	57,774	1.4	650	647	0.5
9	Jakarta	Jakarta Soekarno-Hatta International	57,773	51,533	12.1	380	346	10.1
10	Dubai	Dubai International	57,685	50,978	13.2	344	326	5.5
11	Frankfurt	Frankfurt	57,520	56,436	1.9	482	487	-1.0
12	Hong Kong	Hong Kong International	56,062	53,329	5.1	362	344	5.1

13	Denver, CO	Denver International	53,156	52,849	0.6	618	635	-2.6
14	Bangkok	Bangkok Suvarnabhumi International	53,002	47,911	10.6	317	305	3.8
15	Singapore	Changi	51,182	46,544	10.0	325	302	7.6
16	Amsterdam	Schiphol Amsterdam	51,036	49,755	2.6	438	437	0.2
17	New York, NY	John F. Kennedy International	50,819	49,198	3.3	402	409	-1.8
18	Guangzhou	Guangzhou Baiyun International	48,309	45,040	7.3	373	349	6.9
19	Madrid	Barajas	45,195	49,671	-9.0	373	429	-13.1
20	Istanbul	Ataturk International	44,999	37,395	20.3	349	302	15.6
21	Shanghai	Shanghai Pudong International	44,880	41,448	8.3	362	344	5.1
22	San Francisco, CA	San Francisco International	44,477	41,045	8.4	425	404	5.2
23	Charlotte, NC	Charlotte-Douglas International	41,228	39,044	5.6	552	540	2.3
24	Las Vegas, NV	McCarran International Las Vegas	41,668	41,480	0.5	528	532	-0.7
25	Phoenix, AZ	Sky Harbor International	40,422	40,592	-0.4	450	462	-2.6
Total			1,404,332	1,334,699	4.4	12,061	11,909	1.3

^a Revenue and nonrevenue air carrier passengers and passengers in direct transit; scheduled and nonscheduled services.

^b All aircraft movements (commercial and noncommercial).

Source: ICAO, Annual Report of the Council 2012.

Table 8-3 2012 Top 25 Airports, Based on Total Passengers

The cargo operations of airlines can generally be divided as scheduled air freight services and chartered air freight services. Examples of scheduled air freight services are FedEx and UPS Airlines, which operate on fixed routes on a fixed schedule. Examples of chartered air freight services are the Dreamlifter of Boeing and the Beluga of Airbus, which transport cargo when there is demand. Approximately \$6.4 trillion of cargo, representing 35 percent of the total world trade by value, is flown. [Table 8-4](#) gives the ranking of scheduled airlines, based on the freight-ton kilometers flown in 2012.

Rank	Airline	Millions
1	FedEx	16,108
2	UPS Airlines	10,416
3	Emirates	9,319
4	Cathay Pacific Airways	8,433
5	Korean Air Lines	8,144
6	Lufthansa	7,175
7	Singapore Airlines	6,694
8	British Airways	4,732
9	China Airlines	4,538
10	Eva Air	4,470

Source: IATA, Scheduled Freight Ton-Kilometers.

Table 8-4 2012 Rankings of Airlines, Based on Freight-Ton Kilometers (International + Domestic) Flown

Leases

Both passenger and cargo aircrafts can be bought outright by various operators. But in most cases, leasing companies buy the aircrafts and lease them to various operators. This helps the operators reduce capital expenditure and gives them the ability to adjust the capacity of the aircraft, depending on the demand, without much financial commitment. The only downside is in the form of higher lease fees. Leases can be of three different kinds:

- **Dry lease**—The lessor provides the lessee with only the aircraft.
- **Wet lease**—The lessor provides the lessee with the aircraft, crew, insurance, maintenance, and fuel.
- **ACMI lease**—The lessor provides the lessee with the aircraft, crew, maintenance, and insurance (ACMI).

Tariffs and Liabilities

The airline industry normally charges tariffs on the principle of charging what the market can bear. As with ocean transportation, the tariffs are normally charged on the basis of volume or weight, whichever is higher. About 240 airlines, or 84 percent of total air traffic, are represented by the International Air Traffic Association (IATA). One of the functions of IATA is to act as a clearinghouse for its member airlines and help ensure seamless travel for passengers across the world.

The liability of damages to cargo and loss of life or incapacitation to passengers has been restricted over time. Currently, the Montreal Protocol of 2009 is in force and limits liability in terms of special drawing rights (SDRs).

Open Skies

Cabotage and the rules under IATA and the International Civil Aviation Organization (ICAO) give nations the power to restrict the number of domestic and foreign airlines flying into their territory. Most international flights are negotiated between countries on a bilateral basis. However, in 1992 the United States and Norway implemented the open skies policy, to remove a restriction on the number of flights, routes, and capacity. All EU members put the same policy into effect in 2007. The only restriction now is the number of available landing slots at some of the key airports. This open skies policy has led to more airlines flying into the United States and Europe, and also has resulted in alliances being developed, such as between British Airways and American Airlines, and between Air France /KLM and Delta Airlines.

Intermodal Transportation

The primary modes of international shipment are oceangoing vessels and air. But land-based transportation such as trucking and rail are important modes of transportation in their own right. Trucking and rail often provide domestic transportation, but they also provide last-mile connectivity for international transportation. For land-locked countries, trucks and rails are the only means of connecting to global supply chains.

The critical issues for a shipper to consider before hiring trucks to move goods in any country include these:

- Weight restriction on the truck
- Weight restriction in the geographical area where it is operated
- Hours of operation governed by local laws
- Quality of infrastructure (roads, bridges, congestion, docks)
- Size of trucks and trailers that can be used

Issues that shippers normally consider before sending goods through rail include these:

- Ownership of railroads (private versus public, and the availability of subsidies to move goods)

- Infrastructure available (including the gauge of tracks, electrification of lines, maintenance of the system, availability of loading and unloading docks and platforms, connectivity to the road network, and speed at which trains can travel)
- Relationship between passenger traffic and merchandise traffic, and the priority of one over the other

Within the United States, the number of air carriers has been decreasing steadily since 1990 (see [Table 8-5](#)) because of bankruptcy, mergers and acquisitions (M&As), and reduced capacity in terms of seats offered and routes flown. The number of Class I railroads that carry the bulk of the traffic in terms of both volume and value has decreased due to M&As. An exception to the decreasing trend has been trucking (motor carriers), which has shown an increase in the number of carriers plying the nation's roadways. This could be because of the fragmented nature of the business—ownership of trucks continues to be fragmented, with a preference for owner-operators. The inland and coastal vessel operators have seen a steady decrease because of the shift in traffic away from waterways to trucks and rail. These vessel operators also are more prone to vagaries of nature, such as droughts and floods. The pipeline operators are more insulated from market forces because they specialize in moving goods such as oil, gas, and viscous chemicals in bulk at very low costs.

	1990	1995	2000	2005	2010
Air carriers^a	70	96	91	85	77
Major air carriers	14	11	15	17	21
Other air carriers	56	85	76	68	56
Railroads	530	541	560	560	565
Class I railroads	14	11	8	7	7
Other railroads	516	530	552	553	558
Interstate motor carriers^b	216,000	346,000	560,393	679,744	739,421
Marine vessel operators^c	U	1,381	1,114	733	603
Pipeline operators^d	2,198	2,367	2,157	(R) 2,329	(P) 2,219
Hazardous liquids	171	197	220	(R) 308	(P) 350
Natural gas transmission	866	975	844	975	(P) 981
Natural gas distribution	1,382	1,444	1,363	(R) 1,388	(P) 1,241

KEY: P = preliminary data; R = revised data; U = data unavailable.

Source: U.S. Department of Transportation (DOT), Research and Innovative Technology Administration (RITA).

Bureau of Transportation Statistics (BTS), Table 1-2: Number of Air Carriers, Railroads, Interstate Motor Carriers, Marine Vessel Operators, and Pipeline Operators (www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_02.html).

^a Carrier groups are categorized based on their annual operating revenues as major, national, large regional, and medium regional. The thresholds were last adjusted July 1, 1999, and the threshold for *Major air carriers* is currently \$1 billion. The *Other air carriers* category contains all national, large regional, and medium regional air carriers. Beginning in 2003, regional air carriers are not required to report financial data which may result in underreporting of *Other air carriers* in this table.

^b 1990-2005 figures are for the fiscal year, October through September. 2006-2009 figures are snapshots dated Dec. 22, 2006; Dec. 21, 2007; Dec. 19, 2008, and Dec. 18, 2009. 2010 figure is the U.S. DOT number of active interstate motor carriers as of the end of December 2010. The numbers of *Interstate motor carriers* are based on “active” U.S. DOT numbers. The Federal Motor Carrier Safety Administration deletes motor carriers from the Motor Carrier Management Information System (MCMIS) when they receive an official notice of a change in status. However, some companies may go out of business without de-activating their U.S. DOT number. As a result, inactive carriers may be included in the MCMIS.

^c The printed source materials do not contain totals for the number of operators, and data files from which the figures can be determined are not available prior to 1993.

^d There is some overlap among the operators for the pipeline modes. Therefore, the total number of *Pipeline operators* is lower than the sum for the three pipeline modes.

Table 8-5 Number of Carriers in Different Modes of Transportation for Select Years

Intermodal transportation involves shipment of the same merchandise through more than one mode of transportation with a single rate. The Rotterdam Rules specifically provide and enhance documentation, security, and liability terms for intermodal (multimodal) transportation. Some of the features of intermodal transportation follow:

- The cargo is not handled multiple times; the container/pallet gets handled multiple times.
- A single multimodal/intermodal B/L covers all modes of transport to provide “door-to-door” delivery.
- Technology such as electronic data interchange (EDI)/Internet enables coordination among transportation agencies and various arms of governments (such as Customs and port authorities).
- Containerization of cargo is in standard units of TEUs/FEUs, for compatibility across various modes of transportation across the world. This ensures the integrity of goods inside the container.
- Cargo from different shippers is consolidated in a container, to bring down overall shipping costs.
- The benefits of different modes of transportation, in terms of costs and service levels, are utilized to optimize shipping time.
- Economies of scale from speed and flexibility have reduced costs over bulk shipments by more than 20 times.

- Warehousing and security are enhanced because the shipping unit or container is opened only at the destination.

Table 8-6 summarizes the factors that have led to increased intermodal transportation.

Factor	Cause	Consequence
Technology	Containerization and IT	Modal and intermodal innovations; tracking shipments and managing fleets
Capital investments	Returns on investments	High costs and long amortization; improved utilization to lessen capital costs
Alliances and M&A	Deregulation	Easier contractual agreements; joint ownership
Commodity chains	Globalization	Coordination of transportation and production (integrated demand)
Networks	Consolidation and interconnection	Multiplying effect

Source: Jean-Paul Rodrigue, *Intermodal Transportation and Integrated Transport Systems: Spaces, Networks and Flows* (unpublished working paper, 2006), p. 10.

Table 8-6 Causes for Intermodal Transportation

Even within the United States, trucks and rail play a prominent role in international trade, along with other modes of transportation. Primarily, truck and rail are used in Canada extensively and, in a limited way, in Mexico. Trucks from both Mexico and the United States are allowed only to a certain point within the borders because of the limitations in the NAFTA agreement. Trucks and rail are free to move within the United States and Canada, as far as international trade is concerned. **Table 8-7** gives the volume and value breakup of the imported and exported merchandise goods.

Table 8-7 U.S. International Merchandise Trade by Transportation Mode, 2010 (Billions of U.S. Dollars)

Land Bridges

One consequence of the growth of intermodal transportation has been the exploration of new ways of shipping goods to lower overall costs and also decrease shipping time. One such innovation is the concept of *land bridges*. As an example, the continent of North America is an obstacle for oceangoing vessels between the ports on the east coast of Asia and the ports on the west coast of Europe. To overcome this obstacle, intermodal firms are now using the United States and Canada as land bridges, whereby goods in containers are brought from, say, Shanghai to Seattle by sea and then sent first from Seattle to New York by rail and then from New York to Rotterdam by sea. In this case, the United States acts as a land bridge between the Pacific Ocean and the Atlantic Ocean. A big issue cropping up in land bridges is the availability of surplus capacity of infrastructure and manpower to handle increased volume of shipments not bound for the domestic market.

Enablers and Key Players in Transporting Goods to Global Supply Chains

Freight forwarders: Sending merchandise across global supply chains is complex because of differences in customs, duties, tariff and nontariff barriers, regulations, documentation, and coordination between government and transportation agencies. Specialized agencies have evolved to deal with the complexities. Freight forwarders are intermediaries who specialize in booking space for the cargo, creating the necessary documentation, and calculating the total cost of shipment.

Custom brokers and custom house agents (CHAs): These agencies often specialize in clearing goods for export and import with the customs of the country. They are well versed with the documentation needs and the regulatory environment of the law of the land.

Non-vessel operating common carriers (NVOCC): The ship owners of the air freighters, liners, and charterers rarely interact with full-container-load (FCL)/less-than-container-load (LCL) shippers, unless the shippers ship substantial volume in the ship owners' fleet. The ship owners often sell space in bulk to entities called NVOCCs, who then resell the

space to individual customers. The NVOCCs in the United States are regulated by the Federal Maritime Commission. In most cases, the functions of freight forwarder, custom broker, and NVOCC might reside in the same organization, to provide seamless services to the shipper.

3PLs: A third-party logistics provider (3PL) supplies functional services, compared to 1PL (shippers) and 2PL (asset-based carriers). The functions a 3PL provides its clients could take the form of pick and pack, basic inventory management, warehousing, and distribution. The latest innovation of 3PL is to venture into the area of non-asset-based solutions such as consultation on packaging and transport, freight contract negotiations, auditing and tracking of freight, financial settlement with different parts of the supply chain, and dispute resolution with customers.

4PLs: The fourth-party logistics provider (4PL) role is still evolving, and its definition is still being contested. Some believe 4PL to be a totally non-asset-based software solutions company that provides a common software and hardware platform to all its clients, to enable the 4PLs to leverage savings from consolidation of loads, shipments, transportation, and supply chain efficiency from different shippers. Another school of thought defines 4PLs as firms that provide all the functions of a 3PL but that also have elements of non-asset-based solutions to promote commerce.

Incoterms

Incoterms are rules created by the International Chamber of Commerce, headquartered in Paris, France. The current version, called Incoterms 2010 (shown in **Figure 8-7a, b**), following the descriptions), came into effect January 1, 2011. Incoterms are terms of trade that are often incorporated in contracts (domestic and international) to clarify issues of risk, costs, and ownership of property. Contracts using Incoterms 2010 carry the same meaning for each three-letter abbreviation anywhere in the world. The current version has 11 Incoterms. A B/L, airway bill (AWB), or multimodal B/L is the transportation document that prominently features the Incoterm in addition to the contract itself.

Source: ICAO, Annual Report of the Council 2012.

Figure 8-7a Incoterms 2010.

Incoterm	Applicable Mode	Incoterm	Applicable Mode
EXW Ex Works		FCA Free Carrier	
FAS Free Alongside Ship		FOB Free On Board	
CPT Carriage Paid To		CFR Cost and Freight	
CIP Carriage and Insurance Paid To		CIF Cost Insurance and Freight	
DAT Delivered at Terminal		DAP Delivered at Place	
DDP Delivery Duty Paid		 Any mode of transportation	
		 Only Sea / Inland Waterways	

Source: ICAO, Annual Report of the Council 2012.

Figure 8-7b Incoterms 2010.

The 11 Incoterms and a brief description for each follow. *Carrier* mentioned in the Incoterms can be substituted for *first carrier*, in case of a multimodal transportation.

EXW: Ex-Works (EXW *place*)

The seller is responsible for making the goods available at the seller's premises.

Costs: The buyer bears all costs, from seller's premises to destination, including transportation.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are made available to the buyer. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Air, rail, road, multimodal, containerized, sea, inland waterway.

FCA: Free Carrier (FCA *place*)

The seller clears the goods for export and hands them over to the carrier and place named by the buyer.

Costs: The buyer bears all costs, from the time the goods are handed over to the carrier, at the place named by the buyer.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are handed over to the carrier at the place named by the buyer. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Air, rail, road, multimodal, containerized, sea, inland waterway.

FAS: Free Alongside Ship (FAS *loading port*)

The seller clears the goods for export and places them alongside the ship at the named port.

Costs: The buyer bears all costs from the time the goods are placed alongside the ship, including loading of the cargo.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are placed alongside the ship at the port named by the buyer. Ownership of

goods transfers from seller to buyer along with the risk.

Mode of transportation used: Sea, inland waterway.

FOB: Free On Board (FOB *loading port*)

The seller clears the goods for export and places them on board the ship at the named port.

Costs: The buyer bears all costs from the time the goods are placed on board the ship. The seller pays for loading of the cargo.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are placed on board the ship at the port named by the buyer. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Sea, inland waterway.

CFR: Cost and Freight (CFR *destination port*)

The seller clears the goods for export and pays all charges, including freight, up to the destination port mentioned by the buyer.

Costs: The buyer bears all costs from the time the goods reach the destination port. The seller pays for loading and freight of the cargo up to the destination port.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are placed on board the ship at the port of origin. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Sea, inland waterway.

CIF: Cost, Insurance, and Freight (CIF *destination port*)

The seller clears the goods for export and pays all charges, including freight, up to the destination port mentioned by the buyer. The seller buys insurance on behalf of the buyer.

Costs: The buyer bears all costs from the time the goods reach the destination port. The seller pays for loading, freight, and insurance of the cargo up to the destination port.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are placed on board the ship at the port of origin. Ownership of goods trans-

fers from seller to buyer along with the risk.

Mode of transportation used: Sea, inland waterway.

CPT: Carriage Paid To (CPT *place of destination*)

The seller clears the goods for export and pays all charges, including freight, up to the place of destination mentioned by the buyer.

Costs: The buyer bears all costs from the time the goods reach the place of destination. The seller pays for loading and freight of the cargo up to the place of destination.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are handed over to the carrier at the place of origin. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Air, rail, road, multimodal, containerized, sea, inland waterway.

CIP: Carriage and Insurance Paid to (CIP *place of destination*)

The seller clears the goods for export and pays all charges, including freight, up to the place of destination mentioned by the buyer. The seller buys insurance on behalf of the buyer.

Costs: The buyer bears all costs from the time the goods reach the place of destination. The seller pays for loading, freight, and insurance of the cargo up to the place of destination.

Risk and ownership of goods: Risk passes to the buyer as soon as goods are handed over to the carrier at the place of origin. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Air, rail, road, multimodal, containerized, sea, inland waterway.

DAP: Delivery at Place (DAP *place of destination*)

The seller is discharged of all responsibilities when the goods are placed at the disposal of the buyer on the mode of transportation on which it has arrived and is ready for unloading at the place of destination.

Costs: The seller bears all costs until the goods are ready to be unloaded at the place of destination from a mode of transportation (including insurance, if applicable). The buyer pays for unloading goods and every other charge subsequent to unloading.

Risk and ownership of goods: The seller bears all risks up to the place of destination and the point of unloading. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Air, rail, road, multimodal, containerized, sea, inland waterway.

DAT: Delivered at Terminal (DAT *place of destination*)

The seller is discharged of all responsibilities when the goods are placed at the disposal of the buyer at the buyer's terminal of choice after unloading from the mode of transportation. "Terminal" includes a place, whether covered or not, such as a quay, warehouse, container yard, or road, rail, or air cargo terminal.

Costs: The seller bears all costs up to the unloading of goods at the buyer's terminal of choice. The buyer pays for all costs subsequent to unloading the goods.

Risk and ownership of goods: The seller bears all risks up to the place of destination and including the unloading of goods. Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Air, rail, road, multimodal, containerized, sea, inland waterway.

DDP: Delivery Duty Paid (DDP *place of destination*)

The seller is discharged of all responsibilities when the goods are placed at the disposal of the buyer at the place of destination requested by the buyer. All export and import Customs clearance are the responsibility of the seller.

Costs: The seller bears all costs until the goods are placed at the disposal of the buyer. Costs include loading, unloading, tariffs, Customs duties, and any other incidental charges required to be paid to deliver the goods to the place of destination of the buyer.

Risk and ownership of goods: The seller bears all risks up to the place of destination of the buyer until the buyer takes charge of the goods.

Ownership of goods transfers from seller to buyer along with the risk.

Mode of transportation used: Air, rail, road, multimodal, containerized, sea, inland waterway. Source: ICAO, Annual Report of the Council 2012.

Key Documents Used in Enabling Transportation for Global Supply Chains

In the current environment, more countries are adopting EDI/Internet to transmit key documents among various government agencies and entities such as buyers, sellers, vendors, banks, port authorities, freight brokers, and ship owners, to name a few. However, such countries are in the minority. Most of the documentation is still done physically, and the need for accuracy and paperwork is relatively high when compared to domestic trade. This section lists some of the key documents and their functions that enable global supply chains to exist. It is by no means an exhaustive list; each country might have its own set of documents before goods are allowed to be imported or exported.

■ **Pro-forma invoice**—This invoice contains the initial quote that the buyer and seller agreed to. Several Customs authorities around the world require the pro-forma invoice to be part of the mandatory documentation. The contents, prices, and terms of trade listed on the pro-forma invoice need to be reflected accurately in the actual commercial invoice and packing list.

■ **Commercial invoice**—A commercial invoice (or its copy) is the actual document that accompanies the shipment. The original commercial invoice can be sent with the shipment itself or through banking channels, as when a letter of credit is used as a method of payment. A commercial invoice must state the nature of the goods, its harmonized system number, the dimensions, the weight, the Incoterms used for the shipment, the currency to be used in the trade, the shipping information, and the names and addresses of the buyer and seller.

■ **Packing list**—A packing list breaks down the shipment in unit sizes (drums, pallets, boxes, bags). It disaggregates the description in the commercial invoice and lists the units of goods that are physically packed together. This document is helpful in case damages occur because specific shipments can quickly be identified and isolated. It also helps customs in

identifying unique shipments based on identifiers such as batch numbers or lot numbers.

■ **Bill of lading (B/L)/airway bill (AWB)**—A B/L or AWB is the primary transportation document. It lists the names and addresses of the buyer and seller, Incoterms used for the terms of trade, the terms of contract for transportation, the name of the carrier, and identifying marks of the shipment. The B/L has three main functions: a) a contract of affreightment between the shipper and carrier, b) a receipt by the carrier that the goods have been received from the shipper, and c) a certificate of the title of the goods. Normally, limited “negotiable” B/L and AWB are made of every shipment as the goods are released to the bearer of the “negotiable” B/L. A B/L is considered a “clean B/L” if the master of the vessel does not notice visible damages while loading the goods onto the ship. The B/L is considered a “soiled B/L” if defects are noted on it, which can delay payment to the seller of the goods.

■ **Certificate of analysis**—Most times, the buyer wants to be reassured that the products conform to certain standards. The seller normally issues a certificate of analysis itself (or through an inspection agency) to satisfy the buyer.

■ **Export/import licenses**—Certain countries prohibit or limit the import or export of certain kinds of goods. In such cases, the countries issue export/import licenses to be furnished at the time of clearance of goods at Customs. Importers and exporters need to check in advance whether the goods they want to trade are not on a “negative” or “restricted” list by any of the countries concerned and obtain any necessary export/import licenses in advance.

■ **Certificate of origin**—Certain countries give least developed/underdeveloped countries preferential access to their markets at concessional import tariffs. In other cases, countries might want to trade in certain commodities with limited nations. In all such cases, the importer must furnish a certificate of origin from the exporter to prove that the goods were actually made in the country of the exporter. In most cases, the chamber of commerce in the exporter’s country issues this document.

■ **Certificate of inspection**—This is similar to the certificate of analysis. The importer requests that an independent agency inspect the goods either at the place of origin or at the place of destination (or both) to certify that it fits the description of the goods and adheres to the terms of the

contract in weight, description, number of units, and quality of the goods. The independent inspection agency then issues a certificate of inspection with or without any defects noted on it.

■ **Certificate of insurance**—When the goods are shipped on a CIF or CIP basis, the importer normally requires the exporter to furnish a certificate of insurance from an insurance agency to cover the risks of the shipment in case of unforeseen circumstances. Insurance is normally given to goods or services that have pure risk (that is, the probability of a loss only), as opposed to speculative risk (the probability of a loss or gain). Losses can be due to undesirable movement of cargo during its transportation, theft and pilferage, exposure to weather, acts of God, piracy, and *force majeure* clause. As far as shippers go, the higher the risks that are covered, the greater is the premium paid for the insurance. Types of insurance follow:

■ **Institute Marine Cargo Clauses (A)**—The highest insurance that a shipper can get is Coverage A, which is similar to “All Risks Coverage” and covers losses or damages to the shipment under consideration.

■ **Institute Marine Cargo Clauses (B)**—Coverage B is normally called the “named peril” policy because it specifically states the perils (such as fire, collision, water damage, sinking, jettison, and piracy) that are covered for a shipment.

■ **Institute Marine Cargo Clauses (C)**—Coverage C provides the minimum coverage required under the CIF/CIP Incoterms. It normally covers fire, stranding, sinking, collision, and jettisoning.

Many other types of insurance coverage exist, and insurance companies can negotiate with exporters and importers to tailor coverage to specific clients’ requirements.

Summary

This chapter focused on how transportation enables the functioning of global supply chains. We covered the basic modes of transportation and their importance to the functioning of international trade. We looked at key players who participate in the transportation process. We detailed Incoterms that have standardized the terms of trade throughout the world. Finally, we examined some of the key documents that form the basis of every shipment.

Key takeaways from this chapter include:

- Understand the various modes of transportation to enable global supply chains
- Distinguish between the various kinds of sea and air services, based on type of service and size.
- Know and apply all the 11 Incoterms appropriately.
- The role of the key enablers in transporting goods in international trade.
- The use and importance of the key documents on which transportation is based, specifically the role of bill of lading (B/L).

Endnotes

1. World Trade Organization (WTO), “Understanding the WTO: Who we are,” www.wto.org/english/thewto_e/whatis_e/who_we_are_e.htm.

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4. Admiralty and Maritime Law Guide, International Conventions, “Convention on a Code of Conduct for Liner Conferences,” Geneva, 6 April 1974, www.admiraltylawguide.com/conven/liner1974.html.