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REVIEW OF MARITIME TRANSPORT

2017

UNITED NATIONS

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UNCTAD

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2017

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NOTE

The *Review of Maritime Transport* is a recurrent publication prepared by the UNCTAD secretariat since 1968 with the aim of fostering the transparency of maritime markets and analysing relevant developments. Any factual or editorial corrections that may prove necessary, based on comments made by Governments, will be reflected in a corrigendum to be issued subsequently.

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ABBREVIATIONS

AIS	automatic identification system
dwt	dead-weight ton
e-commerce	electronic commerce
FEU	40-foot equivalent unit
GDP	gross domestic product
IGF Code	International Code of Safety for Ships using Gases or Other Low-flashpoint Fuels
IMO	International Maritime Organization
ISO	International Organization for Standardization
NO_x	nitrogen oxides
OECD	Organization for Economic Cooperation and Development
SO_x	sulphur oxides
TEU	20-foot equivalent unit

EXPLANATORY NOTES

The *Review of Maritime Transport 2017* covers data and events from January 2016 until June 2017. Where possible, every effort has been made to reflect more recent developments.

The terms “countries” and “economies” refer to countries, territories or areas.

All references to dollars ($) are to United States dollars, unless otherwise stated.

The terms “ton” and “mile” refer to metric ton (1,000 kg) and nautical mile, respectively, unless otherwise specified.

In tables and figures:

- Because of rounding, totals of percentages presented may not add up to 100
- - (hyphen) stands for “not applicable”

Since 2014, the *Review of Maritime Transport* has not included printed statistical annexes. Instead, UNCTAD has expanded the coverage of statistical data online via the following links:

Overview: http://stats.unctad.org/maritime

Seaborne trade: http://stats.unctad.org/seabornetrade

Merchant fleet by flag of registration: http://stats.unctad.org/fleet

Merchant fleet by country of ownership: http://stats.unctad.org/fleetownership

National maritime country profiles: http://unctadstat.unctad.org/CountryProfile/en-GB/index.html

Ship building by country in which built: http://stats.unctad.org/shipbuilding

Ship scrapping by country of demolition: http://stats.unctad.org/shipscrapping

Liner shipping connectivity index: http://stats.unctad.org/lsci

Bilateral liner shipping connectivity index: http://stats.unctad.org/lsbci

Containerized port traffic: http://stats.unctad.org/teu

Vessel groupings used in the *Review of Maritime Transport*

Grouping	Constituent ship types
Oil tankers	Oil tankers
Bulk carriers	Bulk carriers, combination carriers
General cargo ships	Multi-purpose and project vessels, roll-on/roll-off cargo, general cargo
Container ships	Fully cellular container ships
Other ships	Liquefied petroleum gas carriers, liquefied natural gas carriers, parcel (chemical) tankers, specialized tankers, reefers, offshore supply, tugs, dredgers, cruise, ferries, other non-cargo
Total all ships	Includes all vessel types mentioned above

Approximate vessel size groups referred to in the *Review of Maritime Transport,* according to generally used shipping terminology

Crude oil tankers	
Very large crude carrier	200,000 dwt and above
Suezmax crude tanker	120,000–200,000 dwt
Aframax crude tanker	80,000–119,999 dwt
Panamax crude tanker	60,000–79,999 dwt
Dry bulk and ore carriers	
Capesize bulk carrier	100,000 dwt and above
Panamax bulk carrier	65,000–99,999 dwt
Handymax bulk carrier	40,000–64,999 dwt
Handysize bulk carrier	10,000–39,999 dwt
Container ships	
Neo-Panamax	Ships able to transit the expanded locks of the Panama Canal, with up to a maximum 49 m beam and 366 m in length overall
Panamax	Ships above 3,000 20-foot equivalent units with a beam below 33.2 m, i.e. the largest size of vessel able to transit the former locks of the Panama Canal

Source: Clarksons Research.

Note: Unless otherwise specified, the ships covered in the *Review of Maritime Transport* include all propelled seagoing merchant vessels of 100 gross tons and above, excluding inland waterway vessels, fishing vessels, military vessels, yachts and offshore fixed and mobile platforms and barges, with the exception of floating production storage and offloading units and drillships.

EXECUTIVE SUMMARY

With over 80 per cent of global trade by volume and more than 70 per cent of its value being carried on board ships and handled by seaports worldwide, the importance of maritime transport for trade and development cannot be overemphasized. Recognizing the sector's strategic function, the global policy framework under the Addis Ababa Action Agenda and the 2030 Agenda for Sustainable Development underscores the role of trade – and by extension, seaborne trade – as an engine for inclusive and sustainable growth and development.

The *Review of Maritime Transport 2017* presents key developments in the world economy and international trade and related impacts on shipping demand and supply, and freight and charter markets in 2016 and early 2017, as well as seaports and the regulatory and legal framework. In addition, this year's *Review* features a special chapter on maritime transport connectivity, reflecting the prominence of physical and electronic connectivity as a priority area in the trade and development policy agenda.

Sustaining seaborne trade flows

In 2016, demand for shipping services improved, albeit only moderately. World seaborne trade volumes expanded by 2.6 per cent, up from 1.8 per cent in 2015, but below the historical average of 3 per cent recorded over the past four decades. Total volumes reached 10.3 billion tons, reflecting the addition of over 260 million tons of cargo, about half of which was attributed to tanker trade.

UNCTAD forecasts world seaborne trade to increase by 2.8 per cent in 2017, with total volumes reaching 10.6 billion tons. Projections for the medium term also point to continued expansion, with volumes growing at an estimated compound annual growth rate of 3.2 per cent between 2017 and 2022. Cargo flows are set to expand across all segments, with containerized and major dry bulk commodities trades recording the fastest growth.

Uncertainty and various positive and negative risk factors are shaping the world economic and merchandise trade outlook. A positive development is the Economic Partnership Agreement concluded between the European Union and Japan in July 2017. The Agreement could support trade flows and the European Union–Canada Comprehensive Economic and Trade Agreement, which is likely to come into force in 2017–2021. In the longer term, growing cross-border electronic commerce (e-commerce) could also support demand for container shipping. Negative risk factors include the continued rebalancing of the Chinese economy towards domestic demand, the emerging trade policy direction of the United States of America, as well as uncertainties associated with the decision of the United Kingdom of Great Britain and Northern Ireland to leave the European Union. These uncertainties require strong commitment and measures at all levels, including coherent and coordinated multilateral policies, to ensure sustained recovery in world shipping demand.

Opportunities in maritime businesses

The world shipping fleet provides not only transport connectivity to global trade but also livelihoods to those working in maritime businesses. In 2016, world fleet capacity increased by an estimated 3.2 per cent, down from 3.5 per cent in 2015. Dead-weight capacity of the world commercial fleet was 1.86 billion dead-weight tons (dwt) in early 2017, worth $829 billion.

Industry consolidation – different countries specializing in different maritime subsectors – continues. Different countries, including in developing regions, benefit from building, owning, registering, operating and scrapping ships. Specialization in maritime business requires that policymakers carefully identify possible market niches for their respective countries and decide between seemingly conflicting policy choices. For example, they may have to choose between protecting national shipping businesses from foreign competition or increasing trade competitiveness by improving connectivity and reducing trade costs. In the latter case, there may be a need to liberalize domestic shipping and port markets.

The shipping business – both offshore and onshore – is traditionally a male-dominated sector. At sea, 1 per cent of seafarers are women. Onshore, women hold 55 per cent of global maritime junior-level positions, compared with 9 per cent of executive-level positions. By promoting the employment of women, maritime businesses may not only help overcome shortages in labour supply, but may also contribute to achieving key Sustainable Development Goals.

Achieving environmental sustainability, including in maritime transport, is an imperative of the 2030 Agenda for Sustainable Development. In this respect, the growing importance of liquefied natural gas is relevant. Growing trade in this area has promoted investment in carriers of liquefied natural gas and has led to about a 10 per cent increase in dead-weight tonnage in the 12 months leading to January 2017. In parallel, the use of liquefied natural gas as a fuel is on the rise. The share of gross tonnage from liquefied natural gas-capable ships on the order book for delivery in 2018 and beyond currently stands at 13.5 per cent. This is more than twice the value of 2017 and more than three times that of 2015. By promoting liquefied natural gas-powered ships, the industry can reduce costs and use a cleaner

source of energy, in line with energy and climate-related targets under Sustainable Development Goals 7 (on energy) and 13 (on climate change).

Balancing demand and supply

For the fifth year in a row, world fleet growth has been decelerating. Nevertheless, the supply of ship-carrying capacity increased faster than demand, leading to a continued situation of global overcapacity and downward pressure on freight rates and earnings. The current low demand–high overcapacity environment has constrained freight rates and dampened profitability in most shipping market segments. The collective operating loss reported by the container-shipping market in 2016 amounted to $3.5 billion.

In 2017, projected growth in world shipping demand and continued management of ship supply capacity are likely to support improved market fundamentals and therefore support freight rates. However, for this to materialize, it will be necessary to reduce ship supply overcapacity by building less ships and increase scrapping and capacity sharing, for example, through alliances.

The recent mergers and mega alliances among container carriers can support better handling of supply and fleet utilization, which in turn can help improve the container-shipping sector's financial situation. However, there is a danger that the growing market concentration may lead to oligopolistic structures. Regulators will need to monitor developments in container-shipping mergers and alliances to ensure competition in the market. It may also be necessary to revisit the rules governing consortiums and alliances to determine whether these would require revised regulation. This will make it possible to balance the interests of shippers, ports and carriers to prevent potential market power abuse.

In 2016, UNCTAD estimates that countries spent on average about 15 per cent of the value of their imports on international transport and insurance. Smaller and structurally vulnerable economies pay significantly more, reaching an average of 22 per cent for small island developing States and 19 per cent for landlocked developing countries, and 21 per cent for the least developed countries. Lower efficiency in ports, inadequate infrastructure, limited economies of scale, and less competitive transport markets are behind the persistent transport cost burden in many developing countries. Owing to growing vessel size and further consolidation, there is a risk that the situation will deteriorate further in the case of small and structurally weak economies.

Seaports: The nodes supporting maritime and hinterland connectivity

Growth rates in 2015, 2016 and 2017 were among the lowest recorded by the industry over the 2000–2016 period, with the exception of 2009. At the same time, world container ports must cope with the continued deployment of ever-larger ships, cascading of vessels from main trade routes to secondary routes, growing concentration in liner shipping, increased consolidation activity, a reshuffling of liner shipping alliances and growing cybersecurity threats.

Because of the heightened competitive pressure on ports, it is essential to improve performance levels that extend beyond the optimization of operations, cost reduction, time efficiency and trade promotion objectives. Ports are increasingly expected to meet other performance criteria by ensuring the highest service reliability and standards relating to quality, security, safety, financial sustainability, resource conservation, environmental protection and social inclusion, many of which are linked to key Sustainable Development Goals.

Ports should formulate policies and devise plans on how best to adapt to the requirements of the changing liner shipping market environment. Greater cooperation among ports and their stakeholders are required to help mitigate the negative impact on growing cost pressures. Competing in maritime operations for trans-shipment traffic may not always be sustainable in the context of the new operating landscape. Ports will need to reconsider their offering by considering other services to customers, which would increase their revenue streams. The adoption of relevant technologies and solutions in ports, including for customs automation and port community systems, should be promoted; the assessment of port performance to inform transport planning, port management, policy and regulatory processes should be promoted as well. In this respect, port performance measurements should be supported by investments in data collection capabilities and supporting information and communications technology platforms that lower data collection and analysis costs.

The growing need to provide modern ports and sophisticated cargo-handling facilities with terminal management and security systems has substantially increased capital and technical requirements of ports in recent years. Consequently, greater collaboration between the private and public sector has become necessary. Between, 2000 and 2016 some $68.8 billion of private investment was committed across 292 port projects including port infrastructure, superstructures, terminals, channels for container, dry bulk, liquid bulk and multipurpose terminals. Governments can build on various public–private partnership models and make them a viable and effective tool for the development of sustainable ports. Important prerequisites for a successful public–private partnership are a well-designed contract to ensure clear distribution of roles and activities, appropriate risk sharing and flexibility, a clear policy framework, a legal and regulatory system that ensures contracts are effective and enforceable, and an institutional framework to properly manage the process. The partnership should ensure not only that improved port performance is achieved, but also that

improvements are passed on to shippers through better services and lower charges.

Not all port investment may be worthwhile, however. Pressure from shipping lines to expand and dredge so as to accommodate ever larger ships, especially for trans-shipment operations, may not be worth the extra cost. Without additional volumes, increasing ship size alone will reduce the effective capacity of seaports as they would require larger yards and additional equipment to handle the same total volume.

Legal and regulatory developments

Two important international conventions affecting the maritime industry entered into force in 2017. The International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, entered into force on 8 September, and the International Labour Organization Work in Fishing Convention, 2007 (No. 188), on 16 November. Also worth noting is the decision of the International Maritime Organization (IMO) to implement a global cap of 0.5 per cent on sulphur content in fuel oil used on board ships from 1 January 2020, an important development with respect to human health and the environment.

Progress is being made in ongoing negotiations at the United Nations on an international legally binding instrument under the United Nations Convention on the Law of the Sea, 1982 on the conservation and sustainable use of the marine biological diversity of areas beyond national jurisdiction. In this context, and in particular with regard to questions on the sharing of benefits from marine genetic resources, capacity-building and the transfer of marine technology, it is important for the special requirements of developing countries, in particular the least developed countries, landlocked developing countries, geographically disadvantaged States, small island developing States and coastal African States, to be taken into account when drafting the instrument.

New technologies are transforming the maritime transport industry and providing opportunities to improve economic efficiency, optimize logistics management systems and operations, and expand connectivity, including digital connectivity. At the same time, such technologies are raising new concerns such as increased cybersecurity threats and risks. To ensure that ships navigate safely and that important information offshore and onshore remains secure, public and private stakeholders should work together to better understand, assess, manage and implement relevant emerging technologies.

In addition, despite the new possibilities that emerging technology, such as blockchain technology, might offer for identity generation and management, there are concerns regarding its use in applications that involve identity authentication or the protection of privacy or financial data. Therefore, developments regarding this technology, as well as related legal, cost, infrastructure and other implications should be monitored.

Cybersecurity concerns should be reflected in the regulatory frameworks governing the maritime sector, and regulatory compliance encouraged and supported. The enforcement of existing cybersecurity regulations is important, as is the development of additional standards and policies. In addition, best practices, guidance and standards adopted to date should be considered, along with the five functional elements contained in the IMO guidelines on maritime cybersecurity risk management (2017), namely identify, protect, detect, respond and recover.

Liner shipping connectivity: Understanding and strengthening container shipping networks

Low transport connectivity continues to undermine the access of smaller and weaker economies to global markets. Many landlocked developing countries, small island developing States and least developed countries are among those most affected, given their access to fewer, less frequent, less reliable and more costly transport connections. UNCTAD data and research show that planning and forecasts can be significantly improved if data on maritime transport networks are included in relevant policy processes such as negotiating trade deals and formulating transport infrastructure development plans.

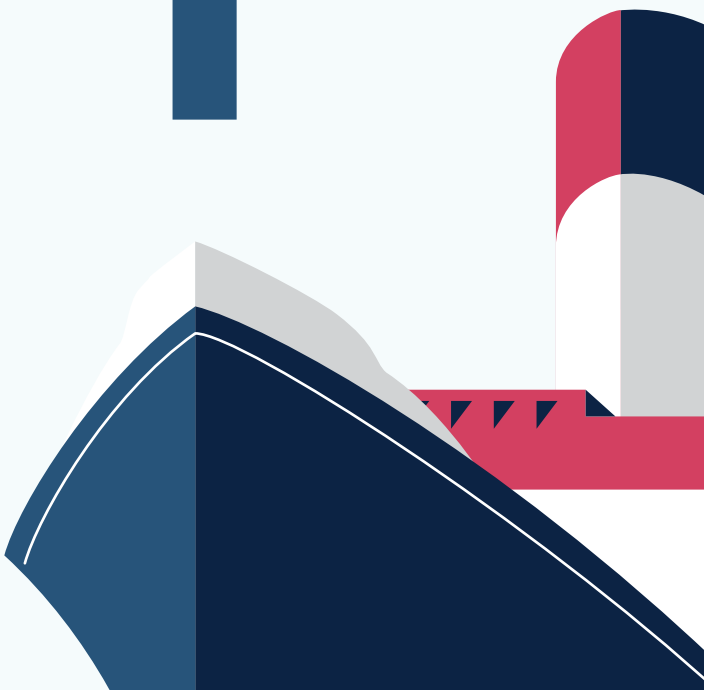
National, regional and intercontinental liner shipping services should be interconnected to the extent possible. In many countries today, domestic shipping services for cabotage transport are protected from foreign competition. Such market restrictions can lead to unnecessary inefficiencies and loss of maritime connectivity. Well-designed policies that allow – under clearly defined conditions – international shipping lines to also carry domestic trade and cargo from feeder vessels can enhance both the competitiveness of a nation's seaports and the access of importers and exporters to international shipping services.

Fostering competition among ports is important to ensure that port operators maximize efficiency, and pass on efficiency gains to their clients. Inter-port competition should not be limited to national seaports, but also to ports of neighbouring countries. Improved maritime connectivity thus also depends on effective port hinterland access through inland and multimodal transport connections. Efficient trucking regional markets, inland waterways, rail and road infrastructure, as well as transit regimes are all important instruments to enhance inter-port competition. Transit can be facilitated in line with international standards and recommendations, including those of the United Nations, the World Customs Organization and the World Trade Organization.

Customs and other border agencies need to continuously modernize and facilitate trade and its transport. The long-standing technical cooperation work of UNCTAD on the automation of customs procedures and the integration of trade and other processes of government agencies through the Automated System for Customs Data shows that these efforts can reduce transaction costs, shorten cargo dwell time and increase transparency – and thus the accountability of all stakeholders. Under the Agreement on Trade Facilitation of the World Trade Organization and IMO Convention on Facilitation of International Maritime Traffic, members should establish committees or other collaborative platforms in which stakeholders coordinate and cooperate in the implementation of trade and transport facilitation reforms. Such collaborative platforms should go beyond compliance issues alone and aim to achieve all necessary reforms to facilitate international trade and transport connectivity.

Ocean shipping will remain the most important mode of transport for international merchandise trade. Ministries of transport and planning, and maritime and port authorities need to understand the determinants of maritime transport connectivity, as well as the associated opportunities and risks, to ensure informed policy and decision-making processes and adequate investment plans in shipping, ports and their hinterland connections.

1



DEVELOPMENTS IN INTERNATIONAL SEABORNE TRADE

In 2016, the maritime transport sector continued to face the prolonged effects of the economic downturn of 2009. Seaborne trade remained under pressure owing to continued weak global demand and heightened uncertainty stemming from factors such as trade policy and low commodity and oil prices. Moreover, several trends with relevant implications for maritime transport continued to gradually unfold and raise attention, in particular digitalization, the rapid expansion of electronic commerce (e-commerce) and growing concentration in the liner shipping market.

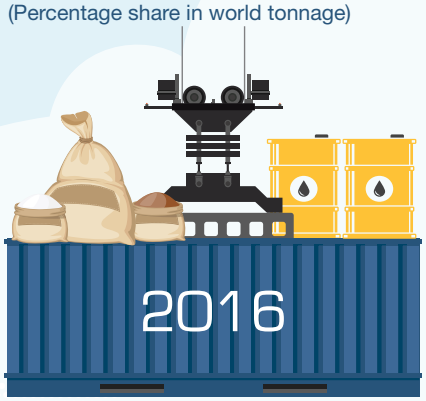
Reflecting the state of the world economy, demand for shipping services increased moderately in 2016. World seaborne trade volumes expanded by 2.6 per cent, up from 1.8 per cent in 2015, which was below the historical average of 3 per cent recorded over the past four decades. Total volumes reached 10.3 billion tons, reflecting the addition of over 260 million tons of cargo, about half of which was attributed to tanker trade.

In 2017, the outlook for the world economy and merchandise trade is expected to improve somewhat. However, uncertainty and other factors, both positive and negative, continue to shape this outlook. In this context, UNCTAD estimates that seaborne trade will increase by 2.8 per cent, with total volumes reaching 10.6 billion tons. Its projections for the medium-term point to continued expansion, with volumes growing at an estimated compound annual growth rate of 3.2 per cent between 2017 and 2022. Volumes are set to expand across all segments, with containerized trade and major dry bulk commodities trade recording the fastest growth.

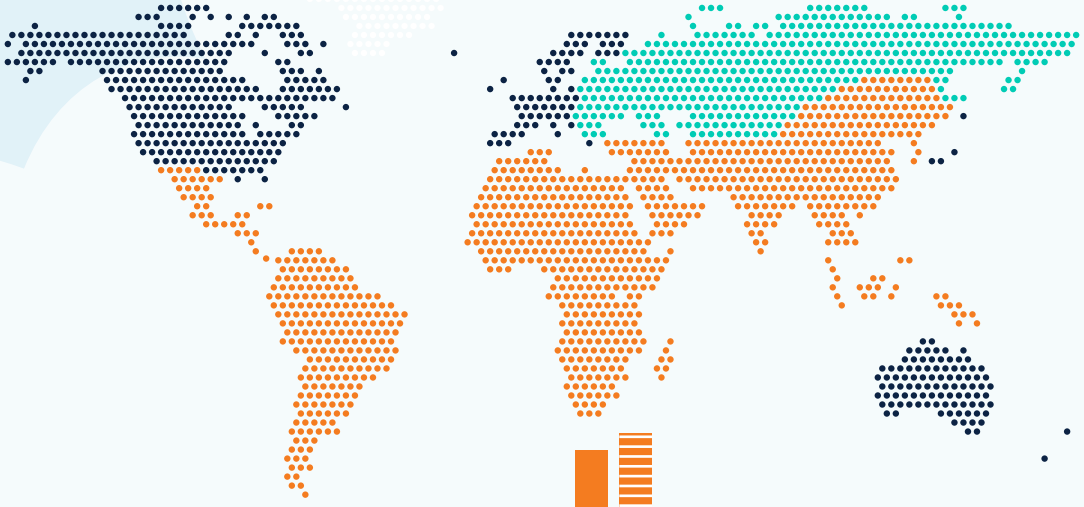
WORLD SEABORNE TRADE

(Percentage share in world tonnage)

10.3 billion tons
Total volumes reached
reflecting the addition of over 260 million tons of cargo



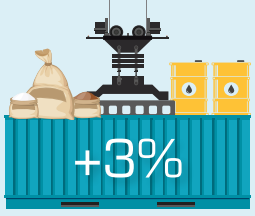
+2.6% in 2016
up from 1.8% in 2015



	Developed economies	Developing economies	Transition economies
Loaded (outbound/exports)	35%	59%	6%
Unloaded (inbound/imports)	35%	64%	1%

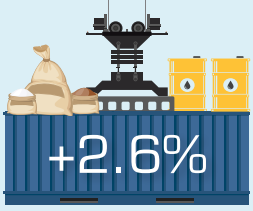
EVOLUTION OF WORLD SEABORNE TRADE VOLUMES

1974–2014



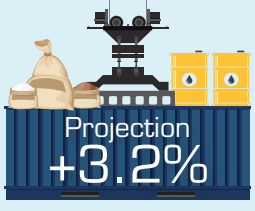
2015

2016



UNCTAD projects world seaborne trade volumes to expand at a compound annual growth rate of 3.2% between 2017 and 2022

2017–2022



A. WORLD ECONOMIC SITUATION

1. World economic growth

World seaborne trade continues to be largely determined by developments in the world economy and trade. Although the relationship between economic output and merchandise trade seems to be shifting, with an observed decline in the growth ratio of trade to gross domestic product (GDP) over recent years,[1] demand for maritime transport services remains heavily dependent on the performance of the world economy.

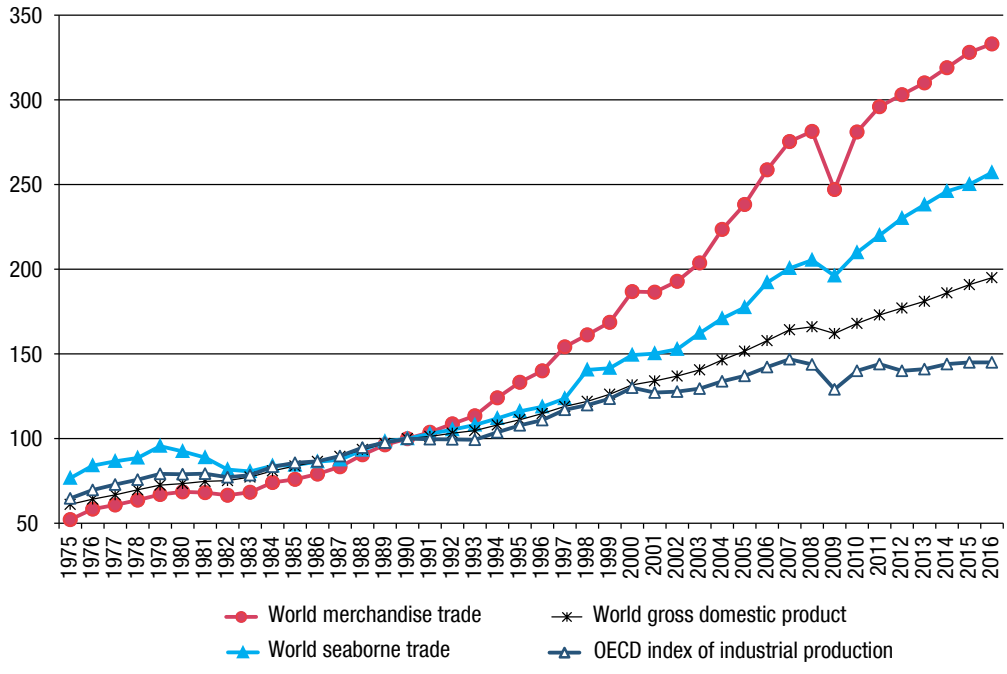
While industrial activity, economic output, merchandise trade and seaborne trade shipments may be growing at different speeds, these variables remain, nevertheless, positively correlated, as shown in figure 1.1 on factors relating to the index of industrial production of the Organization for Economic Cooperation and Development (OECD) and world indices.

World economic growth decelerated in 2016 with GDP expanding by 2.2 per cent, down from 2.6 per cent in 2015 and below the 2001–2008 average annual growth rate of 3.2 per cent (table 1.1). Explanatory factors include a weak global investment environment, limited growth in world merchandise trade, increased trade policy uncertainty and the continued negative impact of low commodity price levels both on investment and the export earnings of commodity-exporting countries.

Economic output in developed economies also dropped from 2.2 per cent in 2015 to 1.7 per cent in 2016, reflecting slower growth in the European Union (1.9 per cent), the United States (1.6 per cent) and Japan (1.0 per cent). In the developing economies, GDP growth fell to 3.6 per cent, down from 3.8 per cent in 2015. Despite a firm GDP growth of 6.7 per cent – supported by government stimulus measures introduced during the year – China continued its gradual transition towards a consumption-driven economy powered by its own internal growth. In India, strong GDP growth (7 per cent) continued but at a slightly slower pace than in 2015.

Limited activity in oil-exporting countries of Africa, Latin America and the Caribbean, Western Asia and the transition economies, together with the recession in Brazil and the Russian Federation, continued to hold back growth in the developing economies, as well as in the transition economies. In the least developed countries, GDP growth expanded by 3.7 per cent in 2016, a rate well below the growth target of at least 7 per cent set under the Sustainable Development Goals, in particular Goal 8 to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Figure 1.1. Organization for Economic Cooperation and Development index of industrial production and world indices: Gross domestic product, merchandise trade and seaborne shipments, 1975–2016 (1990 = 100)



Sources: UNCTAD secretariat calculations, based on data from OECD, 2017; United Nations, 2017; *UNCTAD Review of Maritime Transport*, various issues; World Trade Organization, 2012.
Note: Index calculations are based on GDP and merchandise trade in dollars, and seaborne trade in metric tons.

Table 1.1. World economic growth, 2015–2017 (Annual percentage change)

Region or economic grouping	2001–2008	2015	2016	2017
World	3.2	2.6	2.2	2.6
Developed economies	**2.2**	**2.2**	**1.7**	**1.9**
of which:				
United States	2.5	2.6	1.6	2.1
European Union 28	2.2	2.3	1.9	1.9
Japan	1.2	1.2	1.0	1.2
Developing economies	**6.2**	**3.8**	**3.6**	**4.2**
of which:				
Africa	5.7	3.0	1.5	2.7
Asia	7.3	5.2	5.1	5.2
China	10.9	6.9	6.7	6.7
India	7.6	7.2	7.0	6.7
Western Asia	5.8	3.7	2.2	2.7
Latin American and the Caribbean	**3.9**	**-0.3**	**-0.8**	**1.2**
Brazil	3.7	-3.8	-3.6	0.1
Least developed countries	**7.2**	**3.6**	**3.7**	**4.4**
Transition economies	**7.1**	**-2.2**	**0.4**	**1.8**
Russian Federation	6.8	–2.8	–0.2	1.5

Source: UNCTAD, 2017a.
Note: Data for 2017 are projected figures.

2. World merchandise trade

World merchandise trade underperformed in 2016 with volumes (that is, trade in value terms but adjusted to account for inflation and exchange rate movements), expanding by a modest 1.9 per cent (average growth rate of imports and exports), up from 1.7 per cent in 2015 (table 1.2). Weaker trade is both a cause and an effect of a slowdown in global economic activity in view of the strong linkages between investment, growth and trade. World export volumes and import demand both accelerated in 2016, compared with 2015. Exports expanded at the faster rate of 1.7 per cent up from 1.4 per cent in 2015, while the import demand increased by 2.1 per cent, up from 1.9 per cent in 2015.

Weakness in trade flows affected developed and developing economies alike; yet, some differences in regional performance were observed. Developed economies' exports increased at a slower rate (1 per cent) in 2016, compared with 2015 (2.1 per cent). Their import demand decelerated to 2.7 per cent, down from 3.3 per cent in 2015.

Trade growth in developing regions underperformed in 2016. While exports increased by 2.8 per cent, up from 0.6 per cent in 2015, this rate remains below the 4.4 per cent growth recorded in 2013. Reflecting in particular the reduced purchasing power of many commodity-exporting countries that faced an erosion of terms of trade because of lower commodity prices (for example, Africa, and Latin America and the Caribbean)

Table 1.2. Growth in volume of merchandise trade, 2013–2016 (Annual percentage change)

Exports				Economies or regions	Imports			
2013	2014	2015	2016		2013	2014	2015	2016
3.1	2.0	1.4	1.7	**World**	**2.3**	**2.5**	**1.9**	**2.1**
2.1	1.7	2.1	1.0	**Developed economies**	**0.0**	**2.8**	**3.3**	**2.7**
2.6	3.3	–1.1	–0.2	United States	**0.8**	**4.7**	**3.7**	**3.6**
1.9	1.6	3.3	1.1	European Union	**–1.0**	**3.2**	**4.1**	**2.8**
–1.5	0.6	–1.0	0.3	Japan	**0.3**	**0.6**	**–2.8**	**–0.3**
4.4	**2.5**	**0.6**	**2.8**	**Developing economies**	5.5	2.7	1.1	1.1
2.4	2.3	3.2	2.3	Latin America and the Caribbean	**3.8**	**0.0**	**–2.0**	**–4.2**
–1.6	–2.0	0.6	2.9	Africa	**6.8**	**3.6**	**0.7**	**–4.6**
6.7	4.9	–0.6	0.6	Eastern Asia	**7.0**	**3.4**	**–1.1**	**2.2**
8.5	5.6	–0.9	0.0	China	**9.1**	**2.9**	**–1.8**	**3.1**
0.0	1.1	–1.4	18.1	Southern Asia	**–0.4**	**4.7**	**7.4**	**8.9**
8.5	3.5	–2.1	6.7	India	**–0.3**	**3.2**	**10.1**	**7.3**
5.0	3.7	3.7	3.9	South-East Asia	**4.2**	**2.4**	**5.7**	**4.4**
3.7	–3.2	–0.6	3.5	Western Asia	**6.7**	**2.2**	**3.1**	**–2.4**
2.0	**0.5**	**1.0**	**–1.6**	**Transition economies**	–0.4	–7.9	–19.9	7.3

Source: UNCTAD, 2017a.
Note: Trade volumes are derived from international merchandise trade values deflated by UNCTAD unit value indices.

the import demand of developing economies expanded at the modest rate of 1.1 per cent in 2016. Much of the contraction in the import demand of Latin America and the Caribbean was also driven by the recession in Brazil.

In 2016, export volumes in the transition economies declined, reflecting in particular the negative impact of the recession in the Russian Federation. In contrast, the import demand of these economies recovered from the deep contraction recorded in 2015 due to the erosion of their terms of trade resulting from lower commodity and oil prices. The relative improvement in oil price levels in 2016 and the ability of transition economies to absorb the shock affecting their terms of trade helped support their demand for imports.

Overall merchandise trade growth was also weak in relation to world GDP growth, a trend that has increased since 2008. In addition to cyclical factors such as the weakness in global demand and the slowdown in economic activity, the apparent shift in the traditional relationship between GDP and trade also reflects structural factors such as the slowdown in the pace of globalization and supply chain fragmentation (UNCTAD, 2016; Bems et al, 2013). For example, the share of Chinese imports of parts and components in merchandise exports decreased from 60 per cent in 2000 to less than 35 per cent in recent years (United Nations, 2017). These developments may have contributed to reducing trade–GDP elasticity. The latter was estimated at 1.3 in 1970–1985, 2.2 in 1986–2000, 1.3 in the 2000s and 0.7 in 2008–2013.[2]

A shift in the composition of global demand seems to have also contributed to moderating the GDP and trade link. Investment – the most trade-intensive component of global demand – has weakened in recent years. Also, slower progress in trade liberalization under the World Trade Organization, uncertainty about the future of regional trade agreements, notably the Trans-Pacific Partnership Agreement, and growing protectionist trends, including as measured by the proliferation of trade restrictions, constitute additional constraining factors. In addition to the uncertainty arising from the trade policy stance of the new Administration in the United States, the rise in the overall stock of trade-restrictive measures since the 2008/2009 downturn is also a concern. Of the 1,671 trade-restrictive measures recorded in Group of 20 economies since 2008, only 408 had been removed by mid-October 2016. Today, the total number of restrictive measures still in place is estimated to exceed 1,250 (World Trade Organization, OECD and UNCTAD, 2016).

B. WORLD SEABORNE TRADE

1. Overview

In line with developments in the world economy, demand for shipping services improved in 2016, albeit only moderately. World seaborne trade expanded by 2.6 per cent, up from 1.8 per cent in 2015, which is below the historical average of 3 per cent recorded over the past four decades. Total volumes reached 10.3 billion tons, reflecting the addition of over 260 million tons of cargo, about half of which was attributed to tanker trade (tables 1.3 and 1.4; figure 1.2). Strong import demand in China in 2016 continued to support world maritime seaborne trade, although overall growth was offset by limited expansion in the import demand of other developing regions.

Table 1.3. Growth in international seaborne trade, selected years (Millions of tons loaded)

Year	Oil and gas	Main bulks[a]	Dry cargo other than main bulks	Total (all cargoes)
1970	1 440	448	717	2 605
1980	1 871	608	1 225	3 704
1990	1 755	988	1 265	4 008
2000	2 163	1 295	2 526	5 984
2005	2 422	1 709	2 978	7 109
2006	2 698	1 814	3 188	7 700
2007	2 747	1 953	3 334	8 034
2008	2 742	2 065	3 422	8 229
2009	2 642	2 085	3 131	7 858
2010	2 772	2 335	3 302	8 409
2011	2 794	2 486	3 505	8 785
2012	2 841	2 742	3 614	9 197
2013	2 829	2 923	3 762	9 514
2014	2 825	2 985	4 033	9 843
2015	2 932	3 121	3 971	10 023
2016	3 055	3 172	4 059	10 287

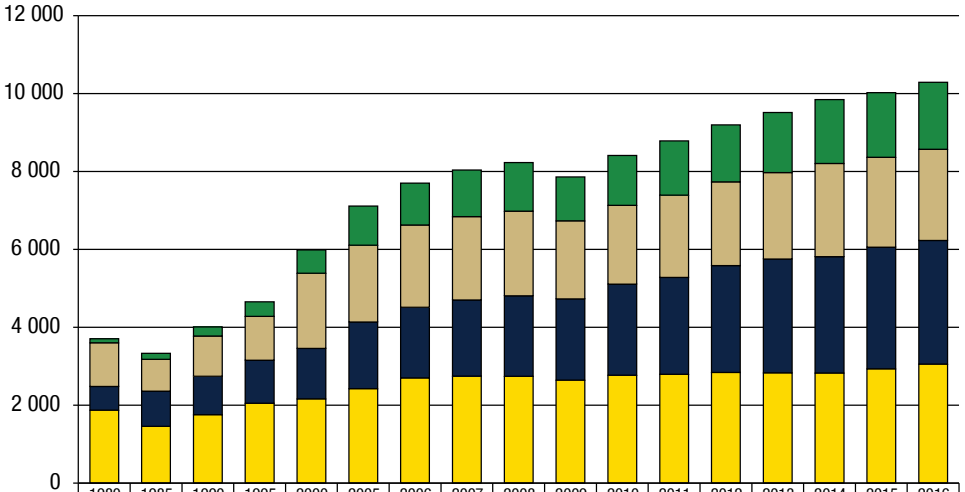
Source: Compiled by the UNCTAD secretariat, based on data supplied by reporting countries and as published on government and port industry websites, and by specialist sources. Data for 2006 onwards have been revised and updated to reflect improved reporting, including more recent figures and better information regarding the breakdown by cargo type. Figures for 2016 are estimates, based on preliminary data or on the last year for which data were available.

[a] Iron ore, grain, coal, bauxite, alumina and phosphate rock.

Seaborne dry cargo shipments totalled 7.23 billion tons in 2016, reflecting an increase of 2 per cent over the previous year (table 1.4). As shown in figure 1.2 and table 1.3, the share of the major bulk commodities (coal, iron ore, grain and bauxite/alumina/phosphate rock) amounted to about 43.9 per cent of total dry cargo volumes, followed by containerized trade (23.8 per cent) and minor bulks (23.7 per cent). Remaining volumes were accounted for by "other" dry cargo,[3] namely breakbulk shipments.

In 2016, the major bulk commodities increased by 1.6 per cent, while other dry cargo expanded by 2.2 per cent.

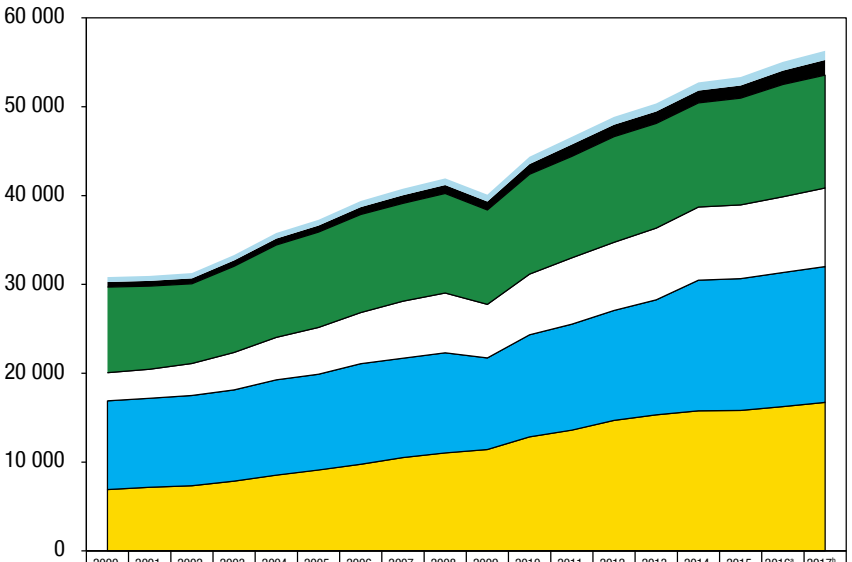
Figure 1.2. International seaborne trade, selected years (Millions of tons loaded)



	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Container	102	152	234	371	598	1 001	1 076	1 193	1 249	1 127	1 280	1 393	1 464	1 544	1 640	1 661	1 720
Other dry cargo	1 123	819	1 031	1 125	1 928	1 975	2 112	2 141	2 173	2 004	2 022	2 112	2 150	2 218	2 393	2 310	2 339
Five major bulks	608	900	988	1 105	1 295	1 711	1 814	1 953	2 065	2 085	2 335	2 486	2 742	2 923	2 985	3 121	3 172
Oil and gas	1 871	1 459	1 755	2 050	2 163	2 422	2 698	2 747	2 742	2 642	2 772	2 794	2 841	2 829	2 825	2 932	3 055

Sources: Review of Maritime Transport, various issues. For 2006–2016, the breakdown by cargo type is based on data from Clarksons Research, Shipping Review and Outlook and Seaborne Trade Monitor, various issues.

Figure 1.3. World seaborne trade in cargo ton-miles by type of cargo, 2000–2017 (Billions of ton-miles)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016[a]	2017[b]
Chemicals	552	562	593	606	625	651	689	724	736	765	824	864	889	908	914	953	991	1 039
Gas	576	591	611	662	719	736	833	913	956	958	1 147	1 344	1 346	1 347	1 392	1 422	1 563	1 706
Oil	9 631	9 352	8 971	9 698	10 393	10 729	11 036	11 011	11 200	10 621	11 237	11 417	11 890	11 779	11 717	12 013	12 638	12 701
Container	3 170	3 271	3 601	4 216	4 785	5 269	5 757	6 422	6 734	6 030	6 833	7 469	7 673	8 076	8 237	8 302	8 529	8 845
Other (minor bulks and other dry cargo)	9 998	10 023	10 167	10 275	10 729	10 782	11 330	11 186	11 272	10 325	11 504	11 927	12 375	12 952	14 707	14 836	15 097	15 298
Five main dry bulks	6 896	7 158	7 331	7 852	8 527	9 107	9 745	10 503	11 028	11 400	12 824	13 596	14 691	15 312	15 768	15 813	16 239	16 710

Source: UNCTAD secretariat calculations, based on data from Clarksons Research, 2017a.
[a] Estimated.
[b] Projected figures.

Table 1.4. World seaborne trade by economic grouping, region and type of cargo, 2015 and 2016 (Tonnage and percentage share)

Economic grouping	Year	Goods loaded				Goods unloaded			
		Total	Crude	Petroleum products and gas	Dry cargo	Total	Crude	Petroleum products and gas	Dry cargo
		Millions of tons							
World	2015	10 023.5	1 761.0	1 170.9	7 091.6	10 016.4	1 910.2	1 187.2	6 919.0
	2016	10 286.9	1 837.6	1 217.9	7 231.4	10 281.6	1 990.0	1 233.3	7 058.3
Developed economies	2015	3 417.4	129.6	467.2	2 820.6	3 733.7	994.3	530.9	2 208.5
	2016	3 594.7	143.5	505.0	2 946.3	3 633.0	990.8	533.5	2 108.7
Transition economies	2015	632.3	164.4	43.1	424.7	58.6	0.3	4.3	54.0
	2016	646.5	176.3	48.2	421.9	61.5	0.3	4.5	56.7
Developing economies	2015	5 973.8	1 466.9	660.6	3 846.3	6 224.0	915.6	651.9	4 656.5
	2016	6 045.7	1 517.7	664.7	3 863.2	6 587.1	998.9	695.4	4 892.8
Africa	2015	755.1	293.7	58.6	402.8	485.6	39.4	72.1	374.2
	2016	745.3	290.1	50.2	405.0	506.2	40.1	78.7	387.4
America	2015	1 327.6	223.5	83.8	1 020.3	589.6	65.8	102.1	421.7
	2016	1 369.0	270.7	69.7	1 028.6	594.3	58.2	123.1	413.1
Asia	2015	3 882.9	948.0	517.3	2 417.7	5 136.3	809.6	473.6	3 853.1
	2016	3 923.0	955.1	543.9	2 424.0	5 473.9	899.7	489.4	4 084.8
Oceania	2015	8.2	1.7	0.9	5.5	12.5	0.9	4.1	7.5
	2016	8.4	1.8	1.0	5.6	12.7	0.9	4.3	7.5
Economic grouping	**Year**	**Goods loaded**				**Goods unloaded**			
		Total	**Crude**	**Petroleum products and gas**	**Dry cargo**	**Total**	**Crude**	**Petroleum products and gas**	**Dry cargo**
		Percentage share							
World	2015	100.0	17.6	11.7	70.7	100.0	19.1	11.9	69.1
	2016	100.0	17.9	11.8	70.3	100.0	19.4	12.0	68.6
Developed economies	2014	34.1	7.4	39.9	39.8	37.3	52.1	44.7	31.9
	2015	34.9	7.8	41.5	40.7	35.3	49.8	43.3	29.9
Transition economies	2015	6.3	9.3	3.7	6.0	0.6	0.0	0.4	0.8
	2016	6.3	9.6	4.0	5.8	0.6	0.0	0.4	0.8
Developing economies	2015	59.6	83.3	56.4	54.2	62.1	47.9	54.9	67.3
	2016	58.8	82.6	54.6	53.4	64.1	50.2	56.4	69.3
Africa	2015	7.5	16.7	5.0	5.7	4.8	2.1	6.1	5.4
	2016	7.2	15.8	4.1	5.6	4.9	2.0	6.4	5.5
America	2015	13.2	12.7	7.2	14.4	5.9	3.4	8.6	6.1
	2016	13.3	14.7	5.7	14.2	5.8	2.9	10.0	5.9
Asia	2015	38.7	53.8	44.2	34.1	51.3	42.4	39.9	55.7
	2016	38.1	52.0	44.7	33.5	53.2	45.2	39.7	57.9
Oceania	2015	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.1
	2016	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.1

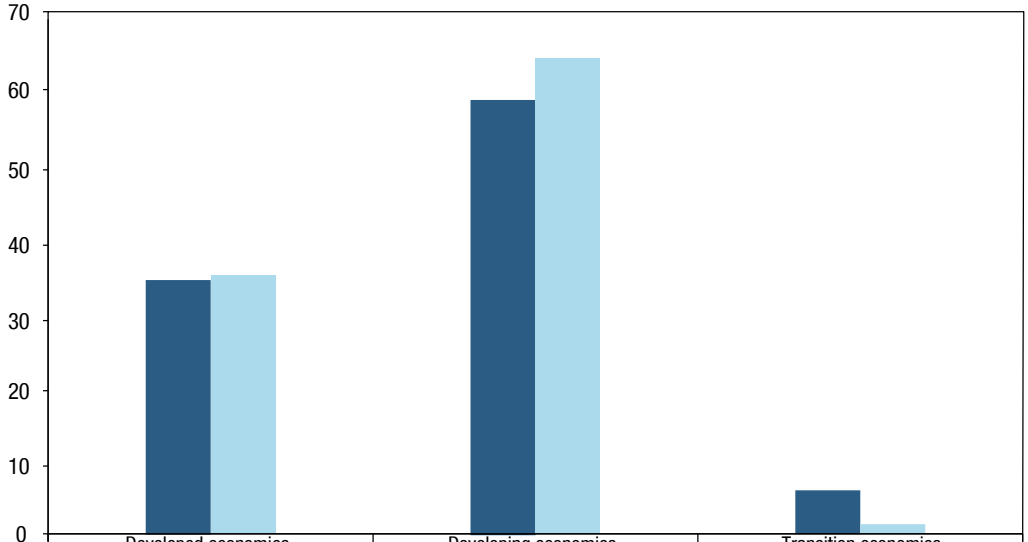
Sources: Compiled by the UNCTAD secretariat, based on data supplied by reporting countries and data obtained from government, port industry and other specialist websites and sources. Data for 2006 onwards have been revised and updated to reflect improved reporting, including more recent figures and better information regarding the breakdown by cargo type. Figures for 2016 are estimates based on preliminary data or on the last year for which data were available.

Note: For longer time series and data prior to 2015, see UNCTAD, 2017b.

In 2016, distance-adjusted seaborne trade continued to grow but at a slightly faster pace than seaborne trade in tons. Global shipping ton-miles reached 55,057 estimated billions, up by 3.2 per cent over the previous year, when ton–miles increased by 1.1 per cent (figure 1.3).

Despite the particularly weak import demand and limited exports in many economies, developing economies as a group continued, nevertheless, to account for most of world seaborne cargo shipments in 2016. As shown in figure 1.4 (a), developing economies accounted for 59 per cent of world goods loaded (outbound/exports)

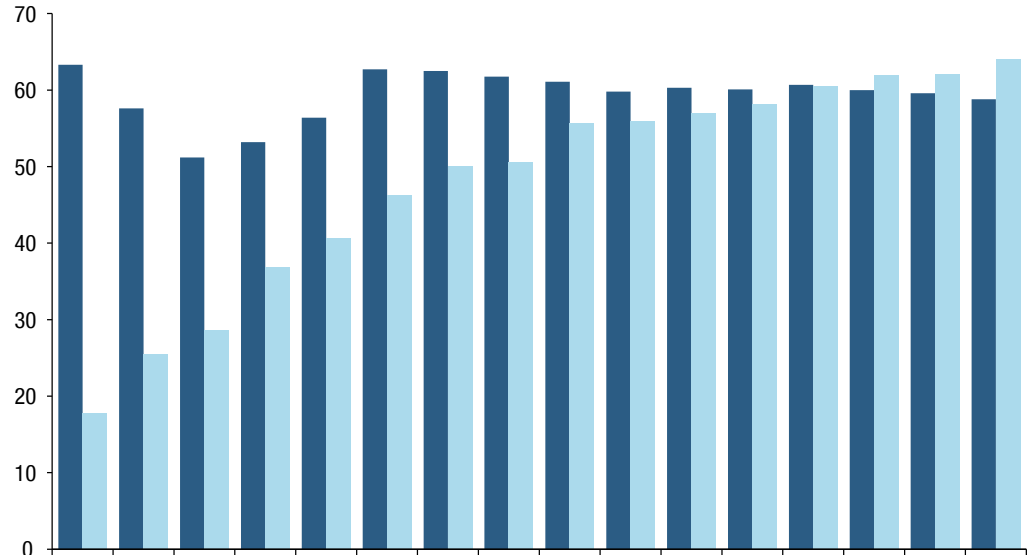
Figure 1.4 (a). World seaborne trade, by type of economy, 2016 (Percentage share in world tonnage)



	Developed economies	Developing economies	Transition economies
Loaded	35	59	6
Unloaded	35	64	1

Sources: Compiled by the UNCTAD secretariat, based on data supplied by reporting countries and as published on government and port industry websites, and by specialist sources.
Note: Estimates are based on preliminary data or on the last year for which data were available.

Figure 1.4 (b). Participation of developing economies in world seaborne trade, selected years (Percentage share in world tonnage)



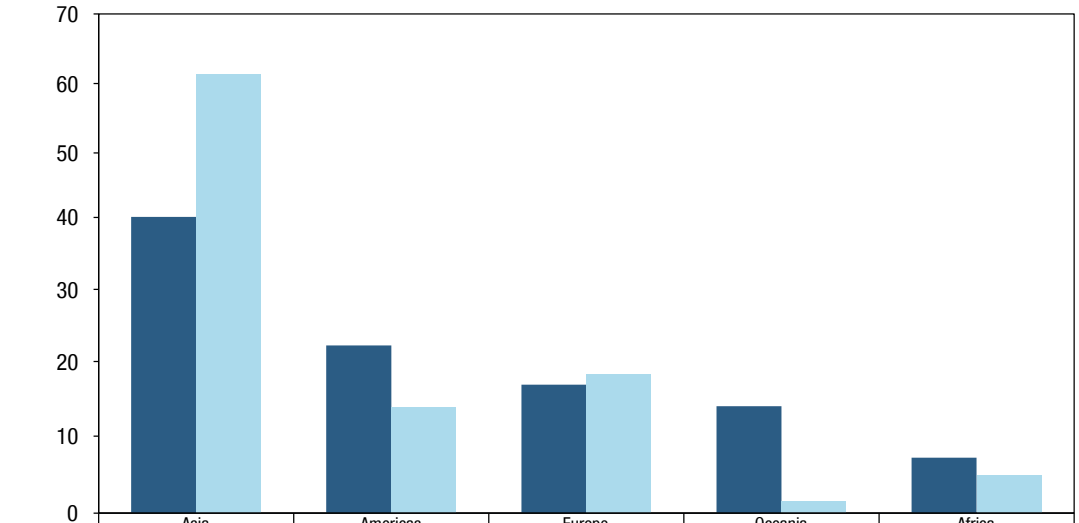
	1970	1980	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Loaded	63	58	51	53	56	63	62	62	61	60	60	60	61	60	60	59
Unloaded	18	26	29	37	41	46	50	51	56	56	57	58	60	62	62	64

Source: Review of Maritime Transport, various issues.

and nearly two thirds of goods unloaded (inbound/imports), respectively.

Figure 1.4 (b) highlights the contribution of developing economies in terms of goods loaded and unloaded globally. Since the 1970s, participation of developing economies in world seaborne trade has shifted, reflecting their rise as major importers and exporters. For over four decades, developing economies' share of goods unloaded has increased significantly, while their share of goods loaded has also increased, albeit at a slower rate, before stabilizing at about 60 per cent since 2010.

Figure 1.4 (c). World seaborne trade, by region, 2016 (Percentage share in world tonnage)



	Asia	Americas	Europe	Oceania	Africa
Loaded	40	22	17	14	7
Unloaded	61	14	18	2	5

Sources: Compiled by the UNCTAD secretariat, based on data supplied by reporting countries and as published on the relevant government and port industry websites, and by specialist sources. Estimates are based on preliminary data or on the last year for which data were available.

Developing economies are no longer only a source of supply for raw materials and fossil fuel energy, but are also key players in globalized manufacturing processes and a growing source of consumption import demand, including of raw materials, such as oil (figure 1.4 (b)). In terms of geographical influence, Asia remained the main global cargo loading and unloading area in 2016 (figure 1.4 (c)).

2. Seaborne trade by cargo type

Tanker trade

In 2016, world seaborne tanker trade – crude oil, refined petroleum products and gas – continued to grow amid a surplus in oil market supply and low oil prices. Total volumes reached 3.1 billion tons, reflecting an increase of 4.2 per cent over the previous year. Oil imports for inventory building continued unabated for crude oil and refined oil products, and resulted in record high storage levels. These positive trends were underpinned by strong demand for crude oil imports in China, India and the United States and a high level of exported petroleum products from China and India. An overview of global players in oil and gas production, consumption and volumes shipped in 2016, is presented in tables 1.5 and 1.6.

Table 1.5. Major producers and consumers of oil and natural gas, 2016 (World market share in percentage)

World oil production		World oil consumption	
Western Asia	35	Asia Pacific	35
North America	18	North America	23
Transition economies	15	Europe	14
Developing America	11	Western Asia	11
Africa	9	Developing America	9
Asia Pacific	9	Transition economies	4
Europe	4	Africa	4
Oil refinery capacities		**Oil refinery throughput**	
Asia Pacific	34	Asia Pacific	34
North America	21	North America	22
Europe	15	Europe	15
Western Asia	10	Western Asia	11
Transition economies	9	Transition economies	9
Developing America	7	Developing America	7
Africa	4	Africa	2
World natural gas production		**World natural gas consumption**	
North America	26	North America	25
Transition economies	22	Asia Pacific	20
Western Asia	18	Transition economies	16
Asia Pacific	16	Western Asia	15
Europe	6	Europe	12
Developing America	6	Developing America	8
Africa	6	Africa	4

Source: UNCTAD secretariat calculations, based on data from British Petroleum, 2017.

Notes: Totals may not add up to 100 per cent due to rounding. Oil includes crude oil, shale oil, oil sands and natural gas liquids. The term excludes liquid fuels from other sources such as biomass and coal derivatives.

Supported by firm import demand in China, India and the United States and for the second consecutive year, crude oil shipments expanded by 4.3 per cent in 2016, reaching an estimated total volume of 1.8 billion tons. Imports into North America increased, reflecting reduced domestic production, while growing imports into China reflected additions to refinery capacity.

Exports from Western Asia rose steadily, owing to growing shipments from the Islamic Republic of Iran following the end of economic sanctions. In the United States, shipments of crude oil increased as the 40-year ban on oil exports was lifted. In Nigeria, exports dropped sharply, owing to disruptions in production.

Table 1.6. Oil and gas trade, 2015 and 2016 (Million tons and annual percentage change)

	2015	2016	Percentage change 2015–2016
Crude oil	1 761	1 838	4.3
Petroleum products and gas	1 171	1 218	4.0
Of which			
Liquefied natural gas	250	268	7.2
Liquefied petroleum gas	79	87	10.1
Total tanker trade	2 932	3 055	4.2

Source: UNCTAD secretariat calculations, derived from table 1.4 above. Figures relating to liquefied natural gas and liquefied petroleum gas are derived from Clarksons Research, 2017a.
Note: Discrepancies with data in table 1.4 are due to rounding.

Together, refined oil products and gas trade volumes expanded by 4 per cent, taking total shipments to 1.2 billion tons in 2016. Demand for refined oil products was generally supported by a low oil price environment, with growth driven by increased exports from Western Asia, China and India, as well as by a recovery in Europe's import demand. While demand for refined oil products grew in China, India and the United States, weak economic growth in Japan and developing America, has nevertheless, constrained global imports of refined oil products. Volumes were supported by stronger gasoline demand, while diesel demand declined as a result of weak global industrial activity. Only India, the Republic of Korea and Europe recorded strong increases in diesel oil demand, mostly for transportation use.

With regard to gas trade, liquefied natural gas shipments were estimated to have expanded by 7.2 per cent in 2016, with shipments reaching 268 million tons (Clarksons Research, 2017b). Expansion was led by increased exports from Australia and the United States, which saw new liquefaction terminals come online. Volumes of imports into China, India and other Asian developing economies, notably in Western Asia, grew steadily. These positive developments helped offset declines in the import volumes of the Republic of Korea and Japan.

Liquefied petroleum gas trade rose by 10.1 per cent, with volumes reaching 87 million tons in 2016 (Clarksons Research, 2017b). Volumes were supported by the continued strong expansion in exports from the United States and Western Asia and robust import demand in China and India. The growing needs of the petrochemical industry and the household sector were the primary source of demand in both countries. For the liquefied petroleum gas sector, the opening in June 2016 of the expanded Panama Canal allowed for the passage of gas carriers, thus shortening the distance travelled on the United States–China route as compared with the Cape of Good Hope.

Dry cargo trades

Dry bulk shipments: Major and minor dry bulks

Overall, weak global investment and industrial activity have weighed down on the dry bulk trade segment,[4] which continues to be heavily dependent on developments in China. In 2016, world demand for dry bulk commodities grew at a modest rate of 1.3 per cent, taking total shipments to 4.9 billion tons. China remained the primary source of growth, owing to the positive impact of the stimulus measures introduced during the year. Policy-driven support measures helped increase infrastructure and housing market investment and in turn, the demand for commodities and steel. However, these trends were offset by declines in import volumes in Latin America and the Caribbean, North America and India. An overview of global players in the dry bulk sector, including producers, consumers and volumes shipped in 2016, is presented in tables 1.7 and 1.8.

Within the dry bulk segment, trade in the major bulk commodities increased by 1.6 per cent. Iron ore trade showed the strongest growth with volumes expanding by 3.4 per cent, reaching 1.4 billion tons in 2016. Imports into China increased by over 7 per cent, reflecting the country's steel output growth, falling domestic iron ore production, growing stockpiling activity and access to affordable, high-quality iron ore from Australia and Brazil. In contrast, iron ore imports into Europe and other Asian countries declined, in the wake of low steel prices.

Coal trade diminished in 2016, owing to flat demand for coal. Total volumes were estimated at 1.14 billion tons, with both coking coal and thermal coal volumes stagnating at 249 million tons and 890 million tons, respectively. A marginal increase in coking coal volumes reflected higher import demand in China and Japan. These were offset by declining import volumes in India, the Republic of Korea and Europe.

Declining imports of thermal coal into India, Japan, the Republic of Korea and Europe were offset by a 4 per cent increase in other Asian countries imports, notably China, where import volumes surged by over 28 per cent.

Table 1.7. Major dry bulks and steel: Market shares of producers, users, exporters and importers, 2016 (Percentage)

Steel producers		Steel users	
China	50	China	45
Japan	6	United States	6
India	6	India	6
United States	5	Japan	4
Russian Federation	4	Republic of Korea	4
Republic of Korea	4	Germany	3
Germany	3	Russian Federation	3
Turkey	2	Turkey	2
Brazil	2	Mexico	2
Other	18	Other	25
Iron ore exporters		**Iron ore importers**	
Australia	57	China	71
Brazil	26	Japan	9
South Africa	5	Europe	7
Canada	3	Republic of Korea	5
Sweden	2	Other	8
Other	7		
Coal exporters		**Coal importers**	
Australia	33	China	18
Indonesia	32	India	17
Russian Federation	9	Japan	16
Colombia	8	Europe	12
South Africa	6	Republic of Korea	11
United States	4	Taiwan Province of China	5
Canada	2	Malaysia	3
Other	6	Other	18
Grain exporters		**Grain importers**	
United States	22	Eastern and Southern Asia	34
Russian Federation	19	Africa	22
European Union	14	Developing America	19
Ukraine	11	Western Asia	16
Argentina	9	Europe	6
Canada	8	Transition economies	3
Others	17		

Sources: UNCTAD secretariat calculations, based on data from the World Steel Association, 2017a and 2017b; Clarksons Research, 2017d.

Grain trade grew by an estimated 3.7 per cent in 2016 as imports into the European Union rose sharply, owing to poor harvests in some producing member countries. In China, grain imports fell as the Government decided to promote the use of local grain stocks to support local farmers. Import demand in the United States declined due to strong domestic production, while Brazil increased its exports of corn and soybeans.

Given limited growth in the minor bulks trade, volumes remained static at an estimated 1.7 billion tons. The drag on volumes reflects the decline in steel products trade, as well as the reduction in bauxite and nickel ore shipments resulting from a bauxite-mining ban in Malaysia and nickel ore mine closures in the Philippines. However, trade in some other minor bulk commodities such as cement, petroleum coke and sugar was positive and helped offset slightly the decline in nickel ore and bauxite shipments.

Table 1.8. Dry bulk trade, 2015 and 2016 (Million tons and annual percentage change)

	2015	2016	Percentage change 2015–2016
Five major bulks	3 121	3 172	1.6
of which:			
Iron ore	1 364	1 410	3.4
Coal	1 142	1 140	-0.2
Grain	459	476	3.7
Bauxite/alumina	126	116	-7.9
Phosphate rock	30	30	1.0
Minor bulks	1 706	1 716	0.6
of which:			
Steel products	406	404	-0.5
Forest products	346	354	2.3
Total dry bulks	4 827	4 888	1.3

Source: UNCTAD secretariat calculations, based on data from Clarksons Research, 2017d.

Other dry cargo

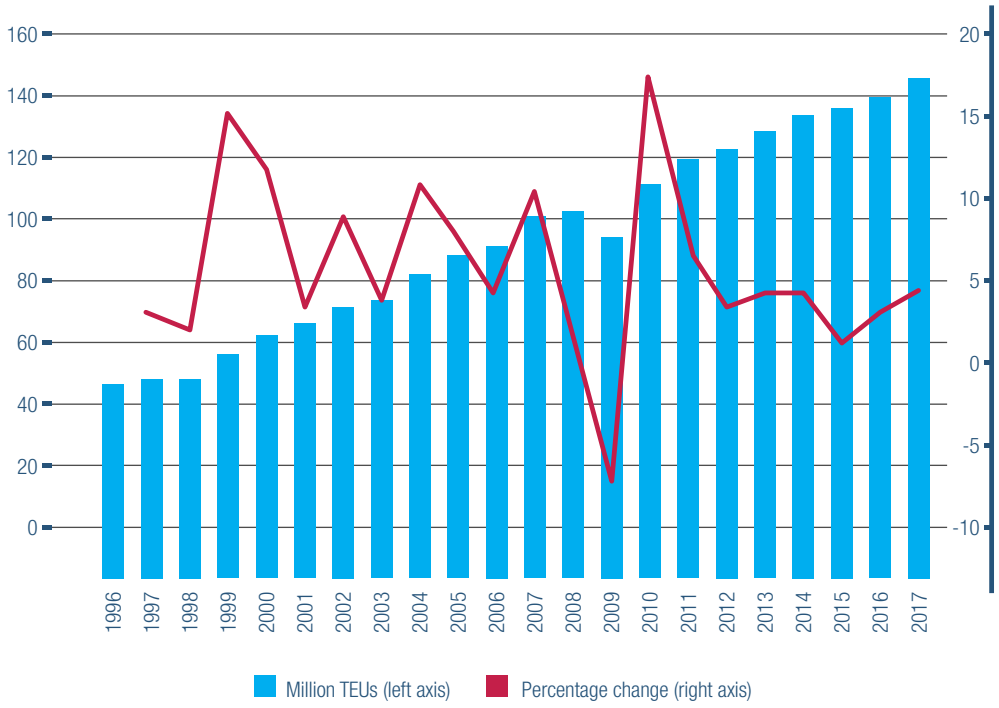
Containerized trade

As shown in figure 1.5, following a modest expansion of 1.2 per cent in 2015, global containerized trade expanded at a faster rate of 3.1 per cent in 2016, with volumes attaining an estimated 140 million 20-foot equivalent units (TEUs) (MDS Transmodal, 2017).

Recovery was driven by volume growth in the peak leg of the Asia–Europe trade, where volumes contracted in 2015. Other contributing factors were accelerated growth in intra-Asian cargo flows and positive trends in the trans-Pacific. Together, these developments contributed to raising overall containerized trade volumes. In contrast, limited growth on North–South trade routes caused by reduced import demand of key fuel and non-fuel commodity exporters hindered overall growth.

Table 1.9 and figure 1.6 summarize developments in contain trade flows on the main East–West trade routes. Cargo flows on the route increased by 4.4 per cent in 2016, up from 1.2 per cent in 2015. The trans-Pacific containerized trade route dominated the East–West containerized trade lane in 2016, with volumes exceeding 25 million TEUs. Volumes on the Asia–Europe route increased by 3.1 per cent, reflecting some recovery in volumes following the 2015 contraction. Volumes on the transatlantic trade route increased by 2.9 per cent, with volumes reaching 7 million TEUs in 2016.

Figure 1.5. Global containerized trade, 1996–2017 (Million 20-foot equivalent units and annual percentage change)



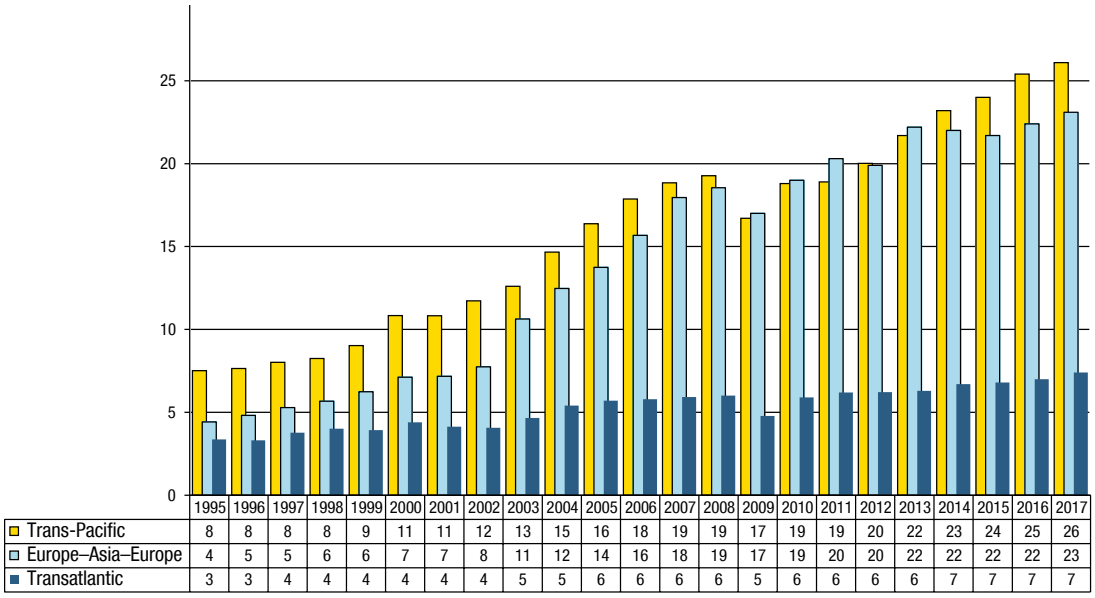
Source: UNCTAD secretariat calculations, based on data from MDS Transmodal, 2017.
Note: Data for 2017 are projected figures.

Table 1.9. Containerized trade on major East–West trade routes, 2014–2017 (Million 20-foot equivalent units and annual percentage change)

Year	Trans-Pacific Eastbound	Westbound	Asia–Europe Eastbound	Westbound	Trans-Atlantic Eastbound	Westbound
	Eastern Asia–North America	North America–Eastern Asia	Northern Europe and Mediterranean to Eastern Asia	Eastern Asia to Northern Europe and Mediterranean	North America to Northern Europe and Mediterra-nean	Northern Europe and Mediterra-nean to North America
2014	15.8	7.4	6.8	15.2	2.8	3.9
2015	16.8	7.2	6.8	14.9	2.7	4.1
2016	17.7	7.7	7.1	15.3	2.7	4.3
2017	17.9	8.2	7.6	15.5	2.9	4.5
Annual percentage change						
2014–2015	6.6	-2.9	0.0	-2.4	-2.4	5.6
2015–2016	5.2	7.3	4.0	2.8	0.5	3.3
2016–2017	1.0	6.4	7.3	1.8	6.7	4.5

Source: UNCTAD secretariat calculations, based on data from MDS Transmodal, 2017.
Note: Data for 2017 are projected figures.

Figure 1.6. Estimated containerized cargo flows on major East–West trade routes, 1995–2017 (Million 20-foot equivalent units)



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Trans-Pacific	8	8	8	8	9	11	11	12	13	15	16	18	19	19	17	19	19	20	22	23	24	25	26
Europe–Asia–Europe	4	5	5	6	6	7	7	8	11	12	14	16	18	19	17	19	20	20	22	22	22	22	23
Transatlantic	3	3	4	4	4	4	4	4	5	5	6	6	6	6	5	6	6	6	6	7	7	7	7

Sources: UNCTAD secretariat calculations, based on data from United Nations Economic Commission for Latin America and the Caribbean, 2010 (Global Insight database). Figures from 2009 onward are derived from data provided by MDS Transmodal, 2017 and Clarksons Research.

Note: Data for 2017 are estimated forecasts.

Table 1.10. Containerized trade on non-mainlane routes, 2015–2017 (Million 20-foot equivalent units and annual percentage change)

	Intraregional	South–South	Non-mainlane East–West	North–South
	Annual percentage change			
2015	3.2	-3.1	5.1	0.3
2016	5.1	-2.9	2.6	0.7
2017	6.1	-1.7	4.3	2.0

Source: UNCTAD secretariat calculations, based on data from Clarksons Research, 2017e.

Notes: Data for 2017 are projected figures.

Non-mainlane East–West: Trade from the Middle East and Indian subcontinent with Europe, the Far East and North America. North–South: Trade between regions of the southern hemisphere (Latin America, Oceania and sub-Saharan Africa) and those of the northern hemisphere (Europe, the Far East and North America). Intraregional: Mainly intra-Asian (trade between Asian countries, not including the Indian subcontinent). South–South: Trade between regions of the southern hemisphere.

As shown in table 1.10, intraregional trade continued to growth steadily (5.1 per cent) in 2016. To a large extent, intraregional trade has been gaining market share due to the rapid expansion in intra-Asian containerized trade, driven by the movement of intermediate goods and the value chains involving China and its neighbouring Asian countries. South–South trade contracted by 3.1 per cent and 2.9 per cent in 2015 and 2016, respectively. In this respect, the impact of lower commodity prices on developing economies' purchasing power may play a part in this development. However, given the small volumes associated with South–South containerized trade, the impact on overall trade appears to be marginal.

Falling commodity prices continued to undermine North–South trade and hinder flows on secondary East–West trade routes. There were fewer imports into Western Asia, owing to the negative impact of lower oil prices on the purchasing power of the region. Offsetting this trend, however, was the strong import demand in Southern Asia.

The troubles experienced by the liner shipping industry since 2008/2009 highlight the difficulties for the sector to adapt to the seemingly "new normal", where merchandise trade flows are growing at a slower pace than GDP. In an oversupplied market characterized by mega containerships (over 18,000 TEUs) and overall weak growth in global demand, the shipping industry has turned to consolidation and rationalization to optimize capacity utilization and reduce costs. In 2016 and first half of 2017, the container shipping industry intensified its consolidation efforts, both in the form of mergers and acquisitions, as well as through shake-ups in liner shipping alliances and the exit from the market of a major container shipping company after it filed for bankruptcy protection (Hanjin effect). The advent of megaships, intensified consolidation activity and formation of new and larger shipping alliances is

altering overall liner shipping dynamics and forces. It remains unclear whether this is a temporary cyclical development or a permanent structural shift.

These trends could potentially alter the bargaining powers between large carriers and cargo owners and entail some negative implications for prices and costs to shippers, as well as trade competitiveness through reduced market access, with lines and alliances deploying strategies that may change the configuration of their networks and market areas serviced by their port calls.

Ship upsizing and cascading of capacity continue to affect containerized trade, while the opening of the expanded Panama Canal locks is creating a shift in ship deployment patterns, which could affect seaborne trade. In the second quarter of 2017, some 40 "old Panamax" ships were deployed on the Asia–United States East Coast route via the Panama Canal. In comparison, there were over 150 "old Panamax" ships in early June 2016. These have been replaced by capacity ranging from 8,000–12,000 TEUs (Clarksons Research, 2017c). Ship cascading onto secondary trade routes is affecting the usual balance between transhipment and direct call patterns, a trend that can be expected to continue as carriers aim to limit the number of calls made by their megaships (Lloyd's List, 2017).

The standard box or container is considered to be a landmark technological development that revolutionized shipping and seaborne trade when it was first introduced over 60 years ago. Today other technological developments are unfolding and could redefine not only the containerized trade landscape but the entire maritime transport sector. These span digitalization, e-commerce, cloud computing, big data, the Internet of Things, three-dimensional printing (also known as additive manufacturing), to name but a few (UNCTAD, forthcoming). Some observers have estimated that as much as 37 per cent of container shipping operations and related freight flows are threatened by three-dimensional printing (PricewaterhouseCoopers, 2015). Others, however, question this estimate. They consider that three-dimensional printing is destined for only a niche role in logistics, for example, prototyping, aftermarket or service logistics where spare parts are required to be available on a timely basis, for locations that are not accessible and where supply chains are uncertain, especially in remote developing regions. Furthermore, the technology will not result in a huge disruptive effect (Lloyd's Loading List, 2016). How trends will evolve and whether they will materialize and at what speed still remains to be seen.

The rapid expansion of e-commerce is to a large extent enabled by digitalization and the use of electronic platforms. The market for e-commerce expanded significantly over the past decade and continues to grow. While global e-commerce is still dominated by the developed economies, the highest growth can be observed in developing regions, especially in Asia. UNCTAD estimates the 2015 business-to-consumer sales and business-to-business sales reached $25.3 trillion in 2015, $9 trillion above the 2013 value. The business-to-business segment represents the largest share of e-commerce, while the business-to-consumer segment appears to be expanding faster. The world's largest business-to-consumer e-commerce market, China, accounted for $617 billion, followed by the United States, with $612 billion. However, the United States led in business-to-business sales (UNCTAD, 2017c).

Experts participating in the third UNCTAD E-commerce Week held in April 2017, emphasized the magnitude of opportunities and challenges that e-commerce entails for transport and trade, noting that there was "more than enough capacity in the shipping and air transport channels to deal with the anticipated and projected increase in the number of shipments due to e-commerce trade" (UNCTAD, 2017d). Data from the Universal Postal Union on the volume of international postal traffic offer insights into the recent growth of cross-border e-commerce of goods. Between 2011 and 2016, global deliveries of small packets, parcels and packages more than doubled, most likely in great part due to e-commerce transactions (OECD and World Trade Organization, 2017).

These trends have implications for shipping and container shipping. For industry players such as liner shipping companies, logistics service providers and air carriers, e-commerce will likely have a transformational effect on transport and supply chains (Business Insider, 2016). While this impact continues to unfold, one basic pattern is emerging and is pointing to the importance of ocean shipping for e-commerce. There is a growth in the strategic distribution support centres for both cross-border and domestic e-commerce transactions and a rise in business models that favour the emergence of shipping as the main mode of transport (JOC.com, 2016). Products that are highly time sensitive and could rapidly lose value between production and delivery will continue to favour air transport. However, for goods that are less time sensitive and that rely on forward inventory systems close to markets – seemingly the preferred e-commerce supply chain model – maritime shipping will remain the favoured mode of delivery (JOC.com, 2016). This e-commerce supply chain model is more cost-effective and allows for e-commerce-specific services that are well integrated with logistics.

C. OUTLOOK AND POLICY CONSIDERATIONS

1. Economic situation

According to UNCTAD projections, world GDP will expand by 2.6 per cent in 2017, up from 2.2 per cent in 2016. This growth is not expected to reflect a sustained recovery in global demand, but rather factors such as the end of the destocking cycle in the United

States; improved commodity price levels; the impact of support measures such as stimulus packages, for example in China; and gradual economic recovery in Brazil and the Russian Federation. Expansion in Eastern and Southern Asia is expected to accelerate, with developments in China remaining a key determinant of the outlook. Projected growth in the least developed countries (4.4 per cent) remains below the Sustainable Development Goal target. In line with GDP growth, world merchandise trade volumes are also expected to expand: the World Trade Organization forecasts an increase of 2.4 per cent in 2017, up from 1.9 per cent in 2016. Projected growth is, however, placed within a range of 1.8 per cent to 3.6 per cent.

The conclusion of the Economic Partnership Agreement between the European Union and Japan in July 2017 was a positive development that could support trade flows. The Agreement is expected to abolish most of the duties paid by companies in the European Union, which are estimated at €1 billion annually (*Financial Times*, 2017). It is also expected to open the Japanese market to key agricultural exports, end tariffs on automobiles and automotive parts, and further open services trade (European Commission, 2017). The European Union–Canada Comprehensive Economic and Trade Agreement is also likely to come into force in 2017–2021 (Economist Intelligence Unit, 2017).

In addition, policies that tackle persistent transport infrastructure gaps in the developing countries and enable adequate capacity in maritime transport could also help boost trade. Sustainable Development Goal 9 ("build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation") and more specifically, Goal 9.1 relating to resilient infrastructure, provides a framework for channelling relevant efforts. The Inter-agency and Expert Group on Sustainable Development Goal Indicators has proposed that freight volumes, including by mode of transport, be used to measure progress in achieving Goal 9.1.

Yet, the expected gradual recovery in the world economy and trade continues to be overshadowed by uncertainty and risks. These include the continued rebalancing of the Chinese economy, the new policy framework in the United States and the outcome of the negotiations between the United Kingdom and the rest of the European Union and their future economic and trade relations after the United Kingdom leaves the Union. One study estimates that both a "hard" exit of the United Kingdom resulting in a loss of preferential access to the European single market, and the imposition of various trade barriers in the United States would reduce the value of world merchandise exports to a level close to 3 per cent below baseline in 2030. In terms of value, the loss would be equivalent to $1.2 trillion (*Shipping and Finance*, 2017).

Various factors play against a strong revival in merchandise trade growth: concerns over the potential rise of trade protectionism, moving production closer to home, shortening supply chains, a growing aversion to trade liberalization and the failure of regional trade agreements such as the Transatlantic Trade and Investment Partnership and the Trans-Pacific Partnership Agreement to fully materialize.

2. Seaborne trade development forecasts

Bearing in mind projected growth in world GDP and merchandise trade and the downside risks to the global economy and trade policy, various estimates of future seaborne trade growth have been put forward and all appear to converge on continued growth in world seaborne trade in 2017. As shown in table 1.11, UNCTAD forecasts an increase in world seaborne trade volumes between 2017 and 2022. Projected growth estimates are based on the income elasticity of seaborne trade, including by cargo segment derived by using regression analysis over 2000–2016. Combining the estimated elasticities with the latest International Monetary Fund GDP growth projections for 2017–2022, world seaborne trade volumes are expected to expand across all segments, with containerized trade and major dry bulk commodities trade recording the fastest growth.

In 2017, UNCTAD forecasts indicate that world seaborne trade volumes will reach 10.6 billion tons, reflecting an increase of 2.8 per cent, up from 2.6 per cent in 2016. Improved prospects reflect a firming up in demand in the dry bulk trade sector, with the major bulk commodities projected to expand by 5.4 per cent in 2017. Containerized trade is projected to grow by 4.5 per cent, owing mainly to growing intra-Asian trade volumes and improved flows on the East–West mainlanes. Growth in tanker trade is expected to diminish, reflecting the impact of oil output cuts by major producers since the start of 2017, as well as some recovery in oil price levels. Crude oil trade is projected to grow by less than 1 per cent while, together, refined petroleum products and gas are projected to grow by 2 per cent.

As shown in table 1.11, the medium-term outlook is also positive. UNCTAD projects world seaborne trade volumes to expand at a compound annual growth rate of 3.2 per cent between 2017 and 2022. This is in line with some existing projections, including by Clarksons Research and is consistent with the historical average annual growth rate of 3 per cent estimated by UNCTAD in 1970–2016.

Between 2017 and 2022, trade in the major commodities and containerized trade is forecast to growth by 5.6 per cent and 5 per cent, respectively. Volumes are likely to be further supported by infrastructure development projects such as the One Belt, One Road initiative (China), the International North–South Transport Corridor (India, the Russian Federation and Central Asia) and

the Quality for Infrastructure Partnership (Japan). With around 900 projects either under negotiation or under way, the One Belt, One Road initiative, for example, may boost demand for raw materials and support Chinese exports of machinery and manufactured goods by sea. These would help support dry bulk shipments, port development and the container network (Gordon, 2017). The financing of the initiative remains, however, an important consideration. China has provided initial funding but more resources are required. The project will involve mobilizing financing through various channels (United Nations Economic and Social Commission for Asia and the Pacific, 2017). Prospects relating to coal remain, nevertheless uncertain, given the global green and climate agenda and the incremental phasing out of coal in favour of renewable energies.

Projected growth in tanker trade volumes is expected to remain relatively modest between 2017 and 2022. Crude oil volumes and refined petroleum products and gas are projected to increase by 1.2 per cent and 1.7 per cent, respectively. Future developments in oil trade remain uncertain due to trends relating to shale oil production and crude oil imports in the United States. Prospects for gas trade seem to be more positive.

3. Policy considerations

Seaborne trade is of strategic economic importance, as it accounts for over 80 per cent of world merchandise trade by volume and more than 70 per cent of its value. Projected growth in world seaborne trade remains subject to uncertainty and several downside risks. It is imperative to tackle these risks and uncertainty. Preparing for the projected growth in world seaborne trade volumes will be required; this means that implications for ship carrying capacity, maritime transport connectivity, port performance and capacity requirements be identified and clearly understood. In this context and considering the emerging trends currently shaping the outlook for seaborne cargo flows, some important issues are arising and span areas such

Table 1.11. Projected seaborne trade developments, 2017–2030

	Growth rates	Years	Seaborne trade flows	Source
Lloyd's List Intelligence	3.1	2017–2026	Seaborne trade volume	*Lloyd's List Intelligence research, 2017*
	4.6	2017–2026	Containerized trade volume	
	3.6	2017–2026	Dry bulk	
	2.5	2017–2026	Liquid bulk	
Clarksons Research Services	3.1	2017	Seaborne trade volume	*Seaborne Trade Monitor, June 2017*
	4.8	2017	Containerized trade volume	*Container Intelligence Monthly, June 2017*
	5.1	2018	Containerized trade volume	*Container Intelligence Monthly, June 2017*
	3.4	2017	Dry bulk	*Dry Bulk Trade Outlook, June 2017*
	2.1	2017	Liquid bulk	*Seaborne Trade Monitor, June 2017*
Drewry Maritime Research	1.9	2017	Containerized trade volume	*Container Forecaster, Quarter 1, 2017*
Maritime Strategies International	3.7	2017	Containerized trade volume	*Dynamar B.V, Dynaliners Monthly, May 2017*
	4.5	2018	Containerized trade volume	
	4.5	2019	Containerized trade volume	
McKinsey	3.0	2017	Containerized trade volume	*Dynamar B.V, Dynaliners Monthly, May 2017*
IHS Markit	By a factor of 2.7	2016–2030	Seaborne trade value	*IHS Markit research, 2016*
UNCTAD	2.8	2017	Seaborne trade volume	*Review of Maritime Transport 2017*
	4.5	2017	Containerized trade volume	
	5.4	2017	Five major bulks	
	0.9	2017	Crude oil	
	2.0	2017	Refined petroleum products and gas	
UNCTAD	3.2	2017–2022	Seaborne trade volume	*Review of Maritime Transport 2017*
	5.0	2017–2022	Containerized trade volume	
	5.6	2017–2022	Five major bulks	
	1.2	2017–2022	Crude oil	
	1.7	2017–2022	Refined petroleum products and gas	

Sources: UNCTAD secretariat calculations, based on own calculations and forecasts published by the indicated institutions and data providers (column 5 of table).
Note: Figures by Lloyd's List Intelligence and UNCTAD are compound annual growth rates. Figures for the other sources are annual percentage changes.

as trade policy, infrastructure development as well as technology and e-commerce.

At the trade policy level and bearing in mind the overall policy framework under the Addis Ababa Action Agenda and the 2030 Agenda for Sustainable Development, efforts should aim to limit trade-restrictive measures. Developments relating to regional trade agreements and their potential implications for trade and shipping should be monitored and assessed. An example is the trade that could derive from the newly adopted European Union–Japan free trade agreement, given the associated significant ton-miles and capacity utilization (Baltic and International Maritime Council, 2017). Furthermore, effective implementation of the World Trade Organization Agreement on Trade Facilitation, which came into force in February 2017, can help support trade flows by unlocking capacity and reducing transaction costs, especially in developing economies.

In parallel, policies that tackle the persistent transport infrastructure gaps in developing economies and enable adequate capacity in maritime transport to effectively service and boost trade should also be promoted. Furthermore, policy measures that have an important transport infrastructure development component (for example, the One Belt, One Road initiative) could also stimulate trade and boost demand for maritime transportation.

Cross-border e-commerce patterns that favour shipping as the main mode of transport could also be promoted. Intervention measures may include helping relevant e-commerce stakeholders embrace technology, implementing trade facilitation solutions and customs reforms and developing common standards and practices. Clarifying the scale of digitalization and its implications for industrial production processes, supply chains, shipping and seaborne trade will also be necessary to ensure the formulation of adequate response measures.

Monitoring developments in the liner shipping markets, including the impact of liner shipping market consolidation and concentration on shipping rates and prices will be required to ensure that trade is not undermined by increasing shipping costs in the longer term, as will be discussed in the following chapters.

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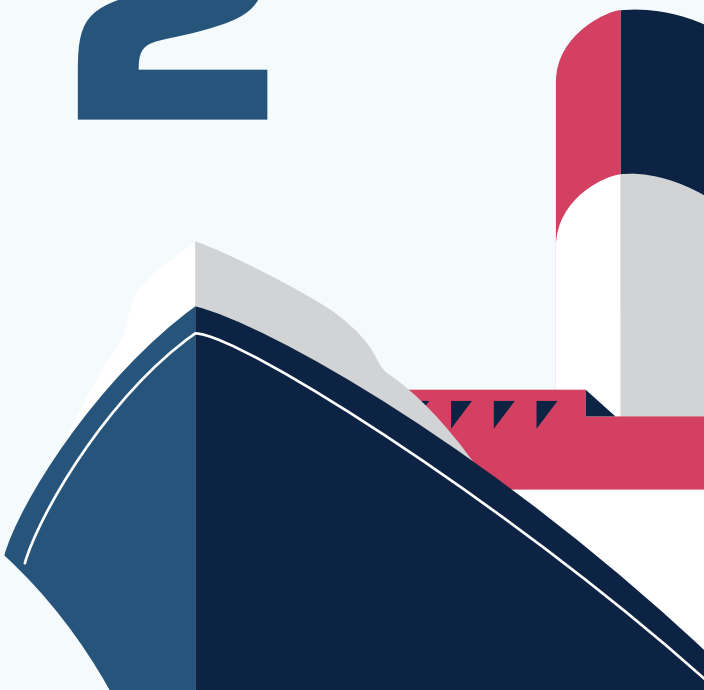
ENDNOTES

1. See *Review of Maritime Transport 2015* for a discussion of structural and cyclical factors underpinning this trend.
2. See *Review of Maritime Transport 2016* for a more detailed discussion.
3. Other dry cargo refers to all dry cargo except major and minor bulks.
4. Detailed figures on dry bulk commodities are derived from Clarksons Research, 2017d.

2



STRUCTURE, OWNERSHIP AND REGISTRATION OF THE WORLD FLEET

The world shipping fleet provides not only transport connectivity to global trade but also livelihoods to the people working in maritime businesses in developed and developing countries. At the beginning of 2017, the world fleet's commercial value amounted to $829 billion, with different countries benefiting from the building, owning, flagging, operation and scrapping of ships.

The top five shipowners in terms of cargo carrying capacity (dwt) are Greece, Japan, China, Germany and Singapore; together, these five countries have a market share of 49.5 per cent of dwt. Only one country from Latin America – Brazil – is among the top 35 shipowning countries; none are from Africa. The five largest flag registries are Panama, Liberia, the Marshall Islands, Hong Kong (China) and Singapore; together they have a market share of 57.8 per cent. Three countries – the Republic of Korea, China and Japan – constructed 91.8 per cent of world gross tonnage in 2016; among these, the Republic of Korea had the largest share, with 38.1 per cent. Four countries – India, Bangladesh, Pakistan and China – together accounted for 94.9 per cent of ship scrapping in 2016. UNCTAD data confirms a continued trend of industry consolidation, where different countries specialize in different maritime subsectors. It also confirms the growing participation of developing countries in many maritime sectors.

For the fifth year in a row, world fleet growth has been decelerating. The commercial shipping fleet grew by 3.15 per cent in 2016, compared with 3.5 per cent in 2015. Despite this further decline, the supply still increased faster than demand, leading to a continued situation of global overcapacity and downward pressure on freight rates.

The structure of the world fleet in terms of vessel types, tonnage, value and age are described in section A. Fleet ownership and registration are discussed in sections B and C, respectively, and data on shipbuilding, scrapping and the order book, in section D. Three issues considered relevant for the future development of the industry are explored in section E: cabotage traffic, gender aspects and developments in marine fuels. The overall outlook of the industry and policy implications are presented in section F.

WORLD CONTAINER CARRYING SHIP FLEET

Germany China Greece

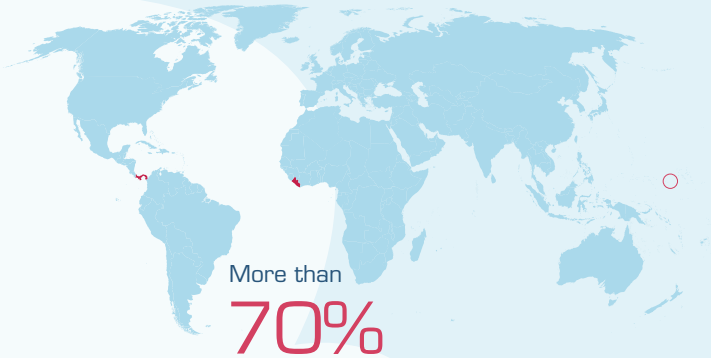
Germany, China and Greece own

39%

of the world container-carrying ship fleet

TOP THREE FLAGS BY TONNAGE

Panama Liberia Marshall Islands



More than

70%

of the commercial fleet is registered under a flag which is different from the country of ownership

LEADERS IN SHIP BUILDING

China Republic of Korea Japan

China, the Republic of Korea and Japan were leaders in ship building, accounting for

92%

of global deliveries in 2016

SHIP-SCRAPPING COUNTRIES

Bangladesh India Pakistan China

Bangladesh, India, Pakistan and China accounted for

94%

of ship scrapping in 2016

GENDER SPLIT IN ON SHORE MARITIME POSITIONS

2016

While more women than men work in administrative and junior positions, the maritime industry has yet to succeed in tapping the leadership potential of its female co-workers

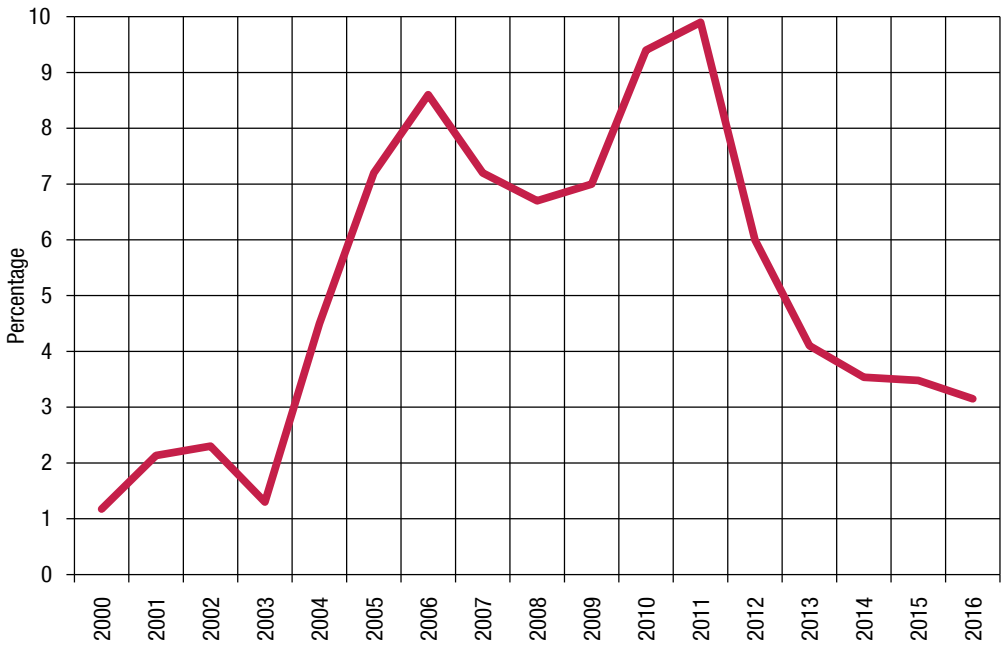
A. WORLD FLEET STRUCTURE

1. World fleet growth and principal types of vessel

Growing supply

For the fifth year in a row, world fleet growth[1] has been decelerating. The commercial shipping fleet grew by 3.15 per cent in the past 12 months to 1 January 2017 (figure 2.1). Despite this further decline in the annual growth rate, the supply increased faster than demand, at 2.6 per cent, leading to a continued situation of global overcapacity and downward pressure on freight rates. In terms of vessel numbers, the growth rate was 2.47 per cent – lower than tonnage – reflecting a further increase in average vessel sizes. In total, the world commercial fleet on 1 January 2017 consisted of 93,161 vessels, with a combined tonnage of 1.86 billion dwt.

Figure 2.1. Annual growth of world fleet, 2000–2016 (Percentage annual change)



Source: UNCTAD, *Review of Maritime Transport*, various issues.

Vessel types

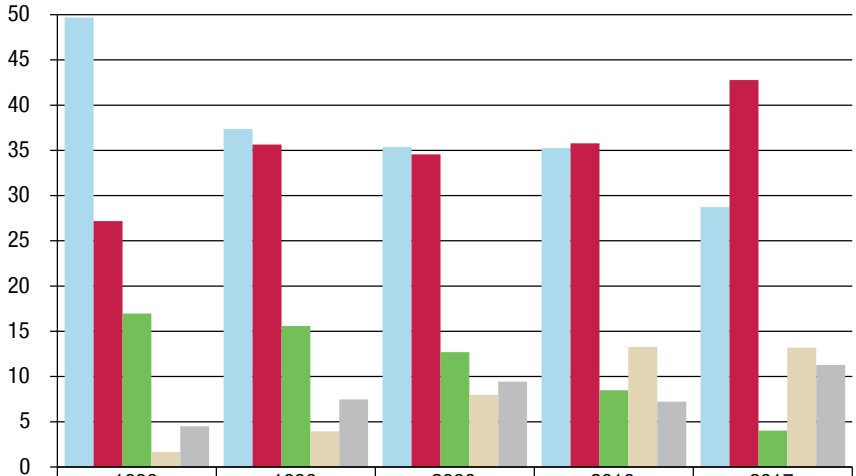
Carriers of liquefied natural gas and other gas recorded continued high growth (+9.7 per cent); growth was also recorded in the oil tanker (5.8 per cent) and chemical tanker (4.7 per cent) segments (table 2.1). In contrast, a long-term decline continued in the general cargo ship segment, which experienced negative growth (-0.2 per cent); its share of world's tonnage is currently 4 per cent, down from 17 per cent in 1980 (figure 2.2).

The further specialization of the world fleet poses challenges for smaller and weaker economies, as it is often more difficult for them to generate sufficient cargo volumes to fill specialized ships, and it is costly to provide the necessary specialized port facilities. While general cargo ships with their own gear have the advantage of flexibility and can call at small ports with no ship-to-shore cargo handling equipment, the ever-larger container ships require container cranes on the quays. Chemical tankers and offshore vessels for the oil and gas exploration industry also require higher investments in terminals and storage facilities.

Given the low growth in demand and low and volatile freight rates, seaports are reluctant to invest in new terminals. Current trends in vessel types and sizes, however, suggest that the pressure from the shipping industry will remain, and port and maritime authorities must carefully plan if and how to accommodate larger and specialized vessels.

Another trend that affects many developing countries, especially exporters of fruit, fish and meat, is the continued replacement of reefer ship capacity by reefer capacity on container ships. The reason behind this trend is not as much cost savings achieved on the maritime leg, but rather the improved door-to-door transport, reliability and intermodal connectivity of containers, as compared with bulk reefer ships (Arduino et al., 2015).

Figure 2.2. World fleet by principal vessel type, 1980–2017 (Percentage share of dead-weight tonnage)



	1980	1990	2000	2010	2017
Oil tankers	49.7	37.4	35.4	35.3	28.7
Dry bulk carriers	27.2	35.6	34.6	35.8	42.8
General cargo ships	17.0	15.6	12.7	8.5	4.0
Container ships	1.6	3.9	8.0	13.3	13.2
Other	4.5	7.5	9.4	7.2	11.3

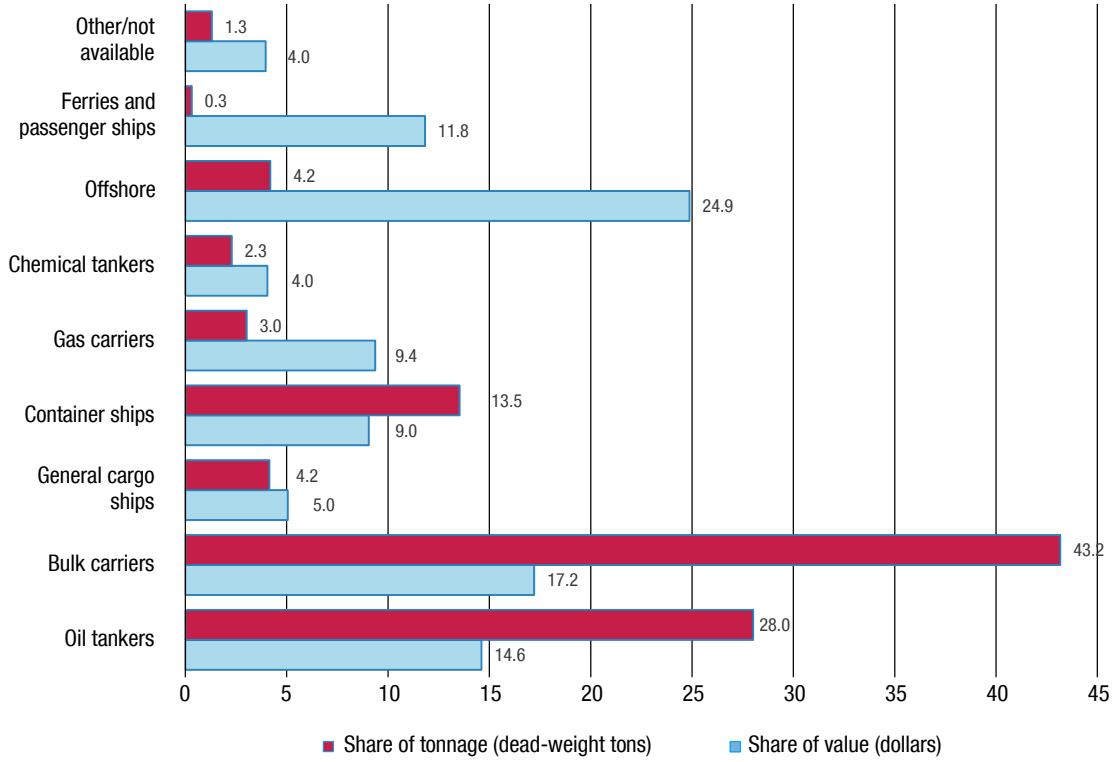
Sources: UNCTAD secretariat calculations, based on data from Clarksons Research and the *Review of Maritime Transport*, various issues.
Note: All propelled seagoing merchant vessels of 100 gross tons and above, not including inland waterway vessels, fishing vessels, military vessels, yachts and offshore fixed and mobile platforms and barges (with the exception of floating production, storage and offloading units, and drillships); beginning-of-year figures.

Table 2.1. World fleet by principal vessel type, 2016 and 2017 (Thousands of dead-weight tons and percentage share)

Principal types	2016	2017	Percentage change, 2016–2017
Oil tankers	505 736	534 855	5.76
	28.0	*28.7*	
Bulk carriers	779 289	796 581	2.22
	43.2	*42.8*	
General cargo ships	74 992	74 823	-0.23
	4.2	*4.0*	
Container ships	244 339	245 609	0.52
	13.5	*13.2*	
Other	200 923	209 984	4.55
	11.1	*11.3*	
Gas carriers	54 530	59 819	9.70
	3.0	*3.2*	
Chemical tankers	41 295	43 225	4.68
	2.3	*2.3*	
Offshore	75 696	77 490	2.48
	4.2	*4.2*	
Ferries and passenger ships	5 757	5 896	2.43
	0.3	*0.3*	
Other/not available	23 645	23 554	-0.08
	1.3	1.3	
World total	1 805 279	1 861 852	3.15

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Notes: Propelled seagoing merchant vessels of 100 gross tons and above; beginning-of-year figures; percentage share in italics.

Figure 2.3. World fleet by principal vessel type, 2017
(Percentage of dead-weight tonnage and of dollar value)



Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Notes: Dwt share is calculated for all ships of 100 gross tons and above. The share of market value is estimated for all commercial ships of 1,000 gross tons and above.

Tonnage and value[2]

An analysis of the commercial value of the world fleet provides another perspective to the traditional market share in terms of cargo-carrying capacity (dwt). In general, dwt is considered the relevant indicator for shipping, because it represents the relevance of maritime transport for international trade volumes. In terms of dwt, the world fleet is dominated by dry bulk carriers, oil tankers and container ships transporting iron ore or coal.

If, however, the commercial value of the fleet is considered, offshore vessels, ferries and gas carriers gain in importance (figure 2.3.) These ships are costlier to build and the cargo they transport is often of higher unit value than the oil or iron ore transported by liquid and dry bulk carriers.

Container shipping

After years of overinvestment in container shipping, recent deliveries (figure 2.4) and the order book (figure 2.7) suggest that some improvements can be expected. In 2016, 127 new container ships were delivered, representing a reduction of 70 per cent from the 2008 peak of 436 ships. The combined TEU capacity amounted to less than 904 thousand TEUs, a reduction by almost half, compared with deliveries in 2015. The trend towards gearless ships continued: Only 4.1 per cent of delivered TEU capacity was on ships capable of calling in ports that did not have their own ship-to-shore container-handling equipment.

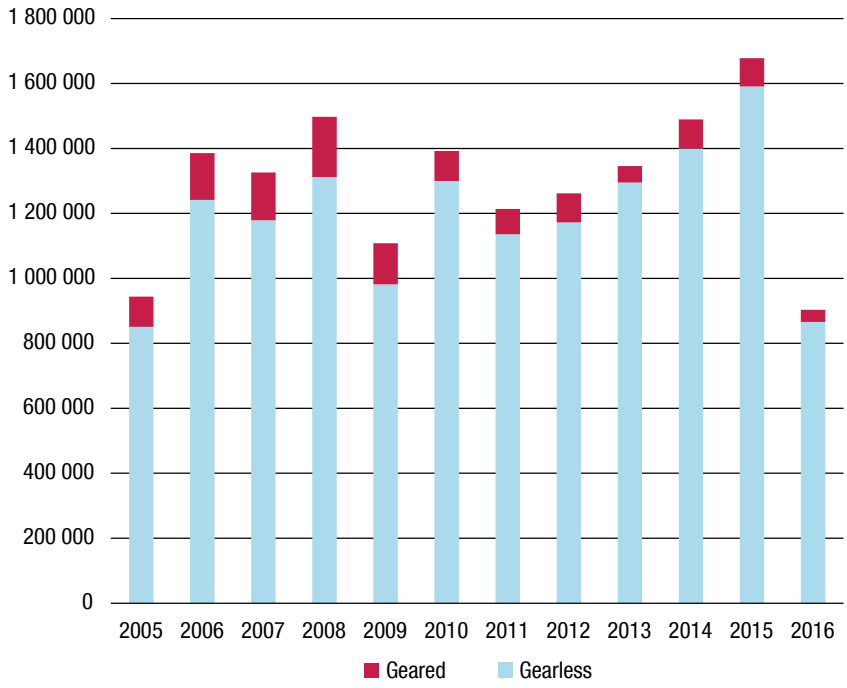
In 2016, there was some improvement regarding the average vessel size of newbuildings: TEU capacity per ship delivered was slightly below that of 2015. Yet the new ships are larger than the existing fleet, and there is continued pressure on ports to accommodate ever-larger vessels. This applies not only to the world's main hub ports in Eastern Asia and Europe, but just as much, if not more, to smaller ports in all regions, owing to the cascading effect.

Figure 2.5 depicts the difference in vessel sizes for geared and gearless ships. While the average container-carrying capacity of new gearless ships has doubled since 2005, the average capacity of geared newbuildings has remained practically unchanged.

2. World merchant fleet age distribution

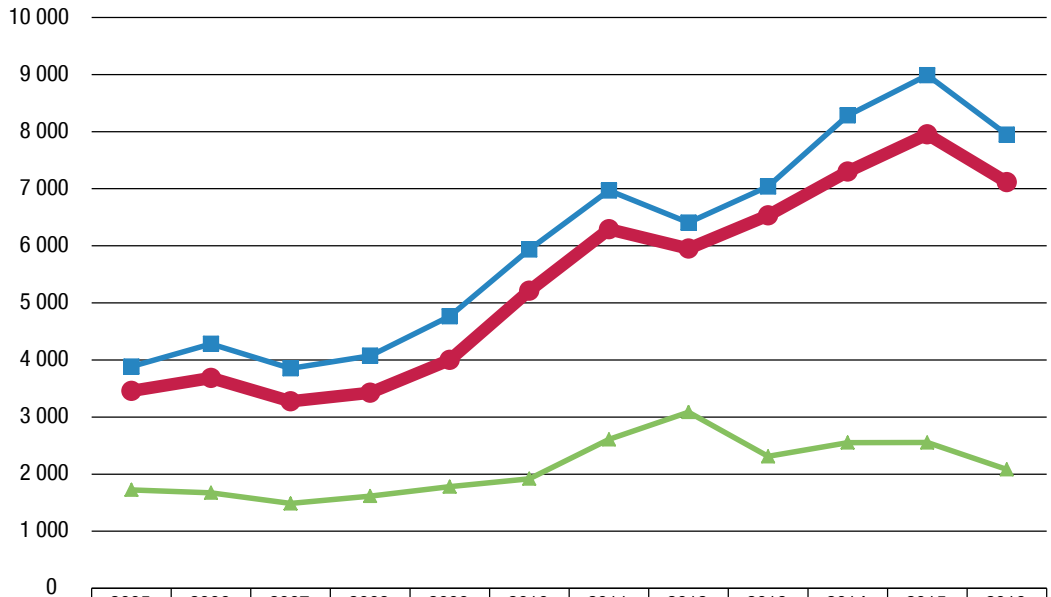
At the beginning of 2017, the average age of the commercial fleet was 20.6 years, representing a slight increase over the previous year (table 2.2). Fewer newbuildings than at the beginning of the decade, combined with similar scrapping levels, have led to an aging fleet. Compared with historical averages, however, the world fleet is still relatively young, especially in the bulker and container segments.

Figure 2.4. Container ship deliveries, 2005–2016 (Twenty-foot equivalent units)



Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Note: Propelled seagoing vessels of 100 gross tons and above.

Figure 2.5. Average vessel size of container ship deliveries, 2005–2016 (Twenty-foot equivalent units)



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Gearless	3 885	4 282	3 853	4 074	4 766	5 937	6 969	6 406	7 040	8 284	8 989	7 947
All	3 457	3 686	3 275	3 427	4 001	5 214	6 291	5 952	6 534	7 301	7 952	7 115
Geared	1 725	1 673	1 486	1 616	1 781	1 919	2 609	3 087	2 311	2 553	2 554	2 082

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Note: Propelled seagoing merchant container vessels of 100 gross tons and above.

Table 2.2. Age distribution of world merchant fleet, by vessel type, 2017

Economic grouping and vessel type		Years					Average age		Percentage change
		0–4	5–9	10–14	15–19	20+	2017	2016	2016–2017
World									
Bulk carriers	Percentage of total ships	35.77	33.80	12.05	9.33	9.05	8.80	8.80	0.00
	Percentage of dead weight tonnage	38.66	34.88	11.91	7.55	7.01	7.95	7.94	0.01
	Average vessel size (dwt)	79 099	75 525	72 283	59 244	56 673			
Container ships	Percentage of total ships	18.63	30.50	22.72	15.66	12.50	11.55	11.10	0.45
	Percentage of dead weight tonnage	31.51	32.57	20.82	10.17	4.92	8.72	8.39	0.33
	Average vessel size (dwt)	80 624	50 891	43 679	30 961	18 751			
General cargo	Percentage of total ships	7.68	16.50	10.20	7.54	58.08	25.21	24.44	0.76
	Percentage of dead weight tonnage	14.98	24.70	12.23	10.24	37.85	18.29	17.83	0.46
	Average vessel size (dwt)	8 118	6 081	5 086	5 630	2 561			
Oil tankers	Percentage of total ships	16.03	22.51	15.46	7.74	38.26	18.76	18.36	0.40
	Percentage of dead weight tonnage	22.07	34.74	24.44	12.67	6.09	9.90	9.54	0.36
	Average vessel size (dwt)	73 274	82 242	84 610	89 498	8 777			
Other	Percentage of total ships	14.37	18.65	10.60	8.43	47.96	22.73	22.25	0.48
	Percentage of dead weight tonnage	19.40	26.43	14.21	10.29	29.67	15.58	15.65	-0.07
	Average vessel size (dwt)	7 777	7 907	8 004	7 144	3 954			
All ships	Percentage of total ships	11.75	17.97	10.13	7.00	53.15	20.57	19.92	0.65
	Percentage of dead weight tonnage	29.80	33.16	16.95	9.78	10.31	9.90	9.55	0.34
	Average vessel size (dwt)	42 207	34 948	32 847	25 991	5 917			
Developing economies – all ships									
	Percentage of total ships	16.92	21.01	11.29	7.92	42.86	29.03	28.33	0.70
	Percentage of dead weight tonnage	31.40	30.60	12.74	9.75	15.50	16.72	15.91	0.81
	Average vessel size (dwt)	34 624	27 025	22 137	23 195	6 733			
Developed economies – all ships									
	Percentage of total ships	16.15	23.86	14.08	10.76	35.15	19.05	18.51	0.54
	Percentage of dead weight tonnage	29.25	35.13	19.73	9.76	6.12	9.15	9.04	0.11
	Average vessel size (dwt)	53 396	43 538	42 708	28 695	6 589			
Countries with economies in transition – all ships									
	Percentage of total ships	6.32	8.82	6.02	3.19	75.66	29.39	28.93	0.46
	Percentage of dead weight tonnage	12.58	28.76	21.23	11.20	26.22	15.59	16.03	-0.43
	Average vessel size (dwt)	14 835	24 533	26 714	25 028	2 447			

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Notes: Propelled seagoing vessels of 100 gross tons and above; beginning-of-year figures.

Ships flagged in the developing economies are on average 10 years older than those flagged in developed economies, and among the different vessel types, general cargo ships are the oldest (more than 25 years), and dry bulk carriers are the youngest (less than nine years).

The fleet's age structure also reflects growth in vessel size. In particular, container ships have increased their carrying capacity in recent decades. Container ships built 15 to 19 years ago were significantly smaller than dry- and liquid bulk carriers built at that time; today, container ships are the largest average size of vessel (dwt, delivered over the last four years).

If the past growth and levelling off of ship sizes in the dry bulk and tanker sectors is an indicator for the container segment, it can be assumed that container ship sizes have probably reached a peak and will not grow much further. Container ships have now reached similar dwt capacities as the largest dry and liquid bulk ships. Access channels and shipyards would need to expand capacity significantly if they are to accommodate ships beyond 20,000–22,000 TEUs. This conclusion is in line with the diseconomies of scale reached in seaports, which is discussed in chapter 4.

B. WORLD FLEET OWNERSHIP AND OPERATION

1. Shipowning countries

Greece continues to be the largest shipowning country in terms of cargo-carrying capacity (309 million dwt), followed by Japan, China, Germany and Singapore. Together, these five countries control almost half of the world's tonnage (table 2.3). Only one country from Latin America (Brazil) is among the top 35 shipowning countries; none are from Africa. In terms of vessel numbers, China is the leading shipowning country (5,206 ships of 1,000 gross tons and above), including many smaller ships deployed in coastal shipping.

The share of shipowning by the traditional maritime nations in Europe and North America has continued to decrease, while that of middle-income developing countries, especially from Asia, has increased. Shipowning is not a high-technology industry that would require the latest, most sophisticated technologies and thus provides opportunities for emerging economies. At the same time, shipowning is not a labour-intensive business, where low-wage countries could benefit from any cost advantage – as is the case for ship scrapping. It is for this reason that middle-income countries in particular have increased their market share over the last decades, while the least developed countries are not among the world's major shipowners.

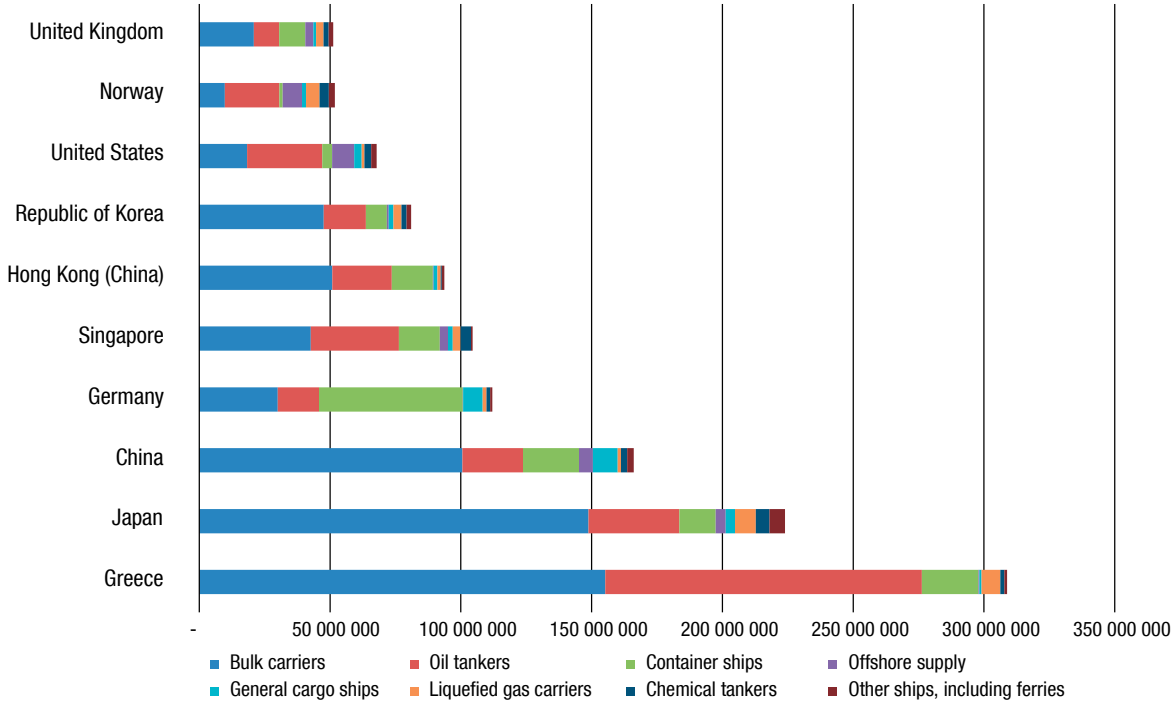
Table 2.3. Ownership of world fleet, 2017

Rank (dead-weight tonnage)	Country or territory	Number of vessels	Dead-weight tonnage	Foreign flag as a percentage of total (dwt)	Rank (dollars)	Total value (million dollars)	Average value per ship (million dollars)	Average value per dead-weight ton (dollars)
1	Greece	4 199	308 836 933	78.76	3	72 538	17.3	235
2	Japan	3 901	223 855 788	85.89	2	77 898	20.0	348
3	China	5 206	165 429 859	53.97	4	65 044	12.5	393
4	Germany	3 090	112 028 306	90.77	8	38 412	12.4	343
5	Singapore	2 599	104 414 424	39.02	7	39 193	15.1	375
6	Hong Kong (China)	1 532	93 629 750	23.98	9	25 769	16.8	275
7	Republic of Korea	1 656	80 976 874	81.98	11	20 928	12.6	258
8	United States	2 104	67 100 538	85.73	1	96 182	45.7	1 433
9	Norway	1 842	51 824 489	64.62	5	58 445	31.7	1 128
10	United Kingdom	1 360	51 150 767	80.55	6	40 671	29.9	795
11	Bermuda	440	48 059 392	98.93	13	19 691	44.8	410
12	Taiwan Province of China	926	46 864 949	90.62	17	10 857	11.7	232
13	Denmark	920	36 355 509	56.00	15	18 694	20.3	514
14	Monaco	338	31 629 834	100.00	23	7 903	23.4	250
15	Turkey	1 563	27 732 948	71.57	20	9 055	5.8	327
16	Switzerland	405	23 688 303	92.58	22	8 458	20.9	357
17	Belgium	263	23 550 024	67.81	27	6 505	24.7	276
18	India	986	22 665 452	27.35	25	6 938	7.0	306
19	Russian Federation	1 707	22 050 283	67.38	19	9 081	5.3	412
20	Italy	768	20 609 725	29.36	10	23 184	30.2	1 125
21	Islamic Republic of Iran	238	18 838 747	68.80	32	2 799	11.8	149
22	Indonesia	1 840	18 793 019	7.96	26	6 613	3.6	352
23	Malaysia	644	18 351 283	51.07	16	14 641	22.7	798
24	Netherlands	1 256	18 033 334	64.72	12	19 970	15.9	1 107
25	United Arab Emirates	883	17 876 272	97.30	24	7 406	8.4	414
26	Saudi Arabia	283	15 659 518	77.97	30	4 101	14.5	262
27	Brazil	394	14 189 164	72.25	14	19 676	49.9	1 387
28	France	452	11 931 397	69.93	18	10 616	23.5	890
29	Canada	376	10 235 954	75.48	28	5 231	13.9	511
30	Kuwait	86	10 208 147	49.92	31	3 749	43.6	367
31	Cyprus	277	9 257 094	63.95	33	2 711	9.8	293
32	Viet Nam	943	8 801 765	17.84	29	4 161	4.4	473
33	Oman	49	7 490 956	99.92	34	2 215	45.2	296
34	Thailand	393	7 022 484	27.84	35	1 949	5.0	278
35	Qatar	117	6 640 467	87.56	21	8 827	75.4	1 329
Subtotal, top 35 shipowners		**44 036**	**1 755 783 748**	**70.30**		**770 109**	**17.5**	**439**
Rest of world and unknown		*6 119*	*91 847 146*	*64.30*		*58 509*	*9.6*	*637*
World total		**50 155**	**1 847 630 894**	**70.01**		**828 618**	**16.5**	**448**

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.

Notes: Propelled seagoing vessels of 1,000 gross tons and above, as at 1 January. For a complete listing of nationally owned fleets, see http://stats.unctad.org/fleetownership (accessed 9 September 2017).

Figure 2.6. Top 10 nationally owned fleets by principal vessel type, 2017 (Dead-weight tons)



Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Notes: Propelled seagoing merchant vessels of 1,000 gross tons and above; beginning-of-year figures.

A somewhat different picture emerges if the estimated commercial value of the fleet is considered. Here, the United States fleet leads with $96 billion, followed by Japan, Greece, China and Norway (table 2.3). The average value per ship of owners from Qatar is $75 million, reflecting its fleet of expensive liquefied natural gas tankers and other specialized tankers. In comparison, Indonesia, Thailand and Viet Nam own fleets with low unit values. Indonesian-owned fleets have an average commercial value of $3.6 million per vessel, reflecting the large number of smaller and older general cargo ships and ferries that are employed in interisland transport.

Figure 2.6 depicts the composition of the fleets of the top 10 shipowning countries (dwt). Greece has the largest share of oil tankers, while China has the largest share of general cargo ships, and Germany, container vessels. The United States and Norway have relatively large shares in offshore tonnage, which tends to be of high commercial value. This also explains the high unit values of ships owned by these two countries (table 2.3).

2. Container ship ownership and liner services

Container ships are the work horses of the global liner shipping network that connects and supports global value chains and trade in manufactured goods. Table 2.4 depicts the container ship fleet ownership in TEUs. Germany continues to be the largest owner, with a market share of 21.46 per cent, followed by China and Greece.

The largest container ships of 17,000 TEUs and above are owned by carriers from China, Hong Kong (China), Denmark, France and Kuwait. German and Greek shipowners, most of which are not liner shipping companies, do not own any container ships of this size. They are primarily charter-owners, namely companies that charter their ships out to liner companies that provide a particular shipping service.

Table 2.5 provides a ranking of the top 50 liner shipping companies. As of May 2017, Maersk (Denmark) continues to be the largest liner shipping company in terms of operated container ship capacity (3.2 million TEUs), followed by MSC (Switzerland) and CMA CGM (France). Most liner shipping companies own about half the ships they deploy on their services, while the other half is chartered in. This practice explains why the leading liner companies (table 2.5) are not necessarily from the same countries as the leading container shipowners (table 2.4).

The years 2016 and 2017 are characterized by a new wave of mergers among liner shipping companies, as well as significant changes in the composition of alliances among them. These developments will be discussed in the context of freight markets in chapter 3. Trends in the service patterns and vessel deployment will be analysed in detail in chapter 6 on maritime connectivity.

Table 2.4. Ownership of container-carrying world fleet, 2017 (Twenty-foot equivalent units)

	20-foot equivalent units	Market share (percentage)	Number of ships	Size of largest ship (20-foot equivalent units)	Average size per ship (20-foot equivalent units)
Germany	4 795 085	21.46	2 106	14 036	2 277
China	2 098 655	9.39	871	19 224	2 409
Greece	1 815 265	8.13	563	14 354	3 224
Denmark	1 548 865	6.93	300	18 270	5 163
Hong Kong (China)	1 383 720	6.19	288	17 859	4 805
Singapore	1 368 888	6.13	448	15 908	3 056
Japan	1 240 871	5.55	410	14 026	3 027
Switzerland	1 225 932	5.49	236	14 000	5 195
Taiwan Province of China	977 453	4.38	280	8 626	3 491
United Kingdom	873 348	3.91	337	15 908	2 592
Republic of Korea	667 571	2.99	254	13 100	2 628
France	592 738	2.65	95	17 722	6 239
Kuwait	457 918	2.05	42	18 800	10 903
United States	351 895	1.58	206	9 443	1 708
Netherlands	302 313	1.35	646	3 508	468
Turkey	262 955	1.18	512	9 010	514
Norway	229 220	1.03	365	13 102	628
Indonesia	183 479	0.82	410	2 702	448
Israel	178 623	0.80	42	10 062	4 253
Cyprus	174 513	0.78	123	6 969	1 419
Top 20 owners subtotal	20 729 307	92.79	8 534		2 429
Rest of world	1 610 491	7.21	2 616		
World total	**22 339 798**	**100.00**	**11 150**	**19 224**	**2 004**

Source: UNCTAD secretariat calculations, based on data from Clarksons Research. For a complete listing of nationally owned fleets in dwt, see http://stats.unctad.org/fleetownership (accessed 9 September 2017).

Notes: Propelled seagoing vessels of 1,000 gross tons and above; beginning-of-year figures. The table also includes ships other than specialized container ships, with some container-carrying capacity.

Table 2.5. World's top 50 liner shipping companies, 2017

Rank	Company	End-2015		End-2016		May 2017			
		Number of ships	Capacity	Number of ships	Capacity	Number or ships	Capacity	Market share (percentage)	Average vessel size
1	Maersk	629	3 103 266	655	3 323 064	621	3 201 871	16.0	5 156
2	Mediterranean Shipping Company	487	2 734 409	458	2 802 830	469	2 935 464	14.6	6 259
3	CMA-CGM	553	2 449 350	460	2 227 600	441	2 220 474	11.1	5 035
4	China Ocean Shipping (Group) Company	285	1 616 462	254	1 508 207	277	1 603 341	8.0	5 788
5	Hapag-Lloyd	187	999 950	171	987 892	180	1 038 483	5.2	5 769
6	Evergreen	197	955 108	188	990 792	186	995 147	5.0	5 350
7	Orient Overseas Container Line	111	583 969	101	594 550	107	666 558	3.3	6 230
8	Hamburg-Süd	138	670 029	127	638 906	116	594 008	3.0	5 121
9	Yang Ming	101	543 772	101	584 839	100	588 389	2.9	5 884
10	United Arab Shipping Company	51	452 510	59	565 433	56	546 220	2.7	9 754
11	Nippon Yusen Kaisha	101	493 443	95	498 076	97	538 754	2.7	5 554
12	Mitsui Osaka Shosen Kaisha Lines	99	549 987	78	467 389	82	515 880	2.6	6 291
13	Hundai Merchant Marine	56	384 403	67	455 841	69	458 247	2.3	6 641
14	Kawasaki Kisen Kaisha Limited – K Line	71	397 557	63	351 890	64	363 019	1.8	5 672
15	Pacific International Lines	134	336 327	132	360 939	132	361 752	1.8	2 741

Table 2.5. World's top 50 liner shipping companies, 2017 *(continued)*

Rank, company		End-2015		End-2016		May 2017			
		Number of ships	Capacity	Number of ships	Capacity	Number or ships	Capacity	Market share (percentage)	Average vessel size
16	Zim Integrated Shipping Services	88	381 780	80	359 945	69	307 934	1.5	4 463
17	Wan Hai Lines	93	223 374	94	235 596	96	248 880	1.2	2 593
18	X-Press Feeders	78	122 504	102	160 184	92	145 454	0.7	1 581
19	Republic of Korea Marine Transport Company	67	114 833	75	150 386	72	140 365	0.7	1 950
20	Shandong International Transportation Corporation	76	98 572	75	92 043	75	100 195	0.5	1 336
21	Islamic Republic of Iran Shipping Lines	27	92 674	27	92 674	26	89 374	0.4	3 437
22	Arkas Container Transport	45	67 243	46	82 491	48	86 157	0.4	1 795
23	TS Lines	44	91 308	40	86 131	38	74 188	0.4	1 952
24	Simatech Shipping	20	55 984	22	62 816	25	70 602	0.4	2 824
25	Sinokor Merchant Marine	36	45 121	39	55 269	42	59 533	0.3	1 417
26	Transworld Group of Companies	24	40 256	31	52 856	33	57 588	0.3	1 745
27	Emirates Shipping Line	9	41 611	8	38 431	9	48 450	0.2	5 383
28	Regional Container Lines	30	54 771	26	51 631	24	47 782	0.2	1 991
29	China Merchants Group	29	37 238	27	32 208	34	46 181	0.2	1 358
30	Unifeeder	42	44 653	41	45 211	40	43 914	0.2	1 098
31	Heung-A Shipping	35	49 199	39	45 820	34	41 959	0.2	1 234
32	SM Line					11	41 406	0.2	3 764
33	Nile Dutch	16	48 867	10	32 071	11	40 957	0.2	3 723
34	Matson	20	40 952	19	39 806	19	39 806	0.2	2 095
35	Quanzhou Ansheng Shipping Company	8	21 721	9	24 121	12	37 261	0.2	3 105
36	Zhonggu Shipping	6	19 912	9	27 397	11	35 933	0.2	3 267
37	Samudera	26	31 486	26	31 929	26	32 038	0.2	1 232
38	Salam Pacific Indonesia Lines	29	23 260	30	26 258	31	29 576	0.1	954
39	Seaboard Marine	26	37 063	21	30 749	19	28 175	0.1	1 483
40	Temas Line	19	11 630	28	21 449	33	25 671	0.1	778
41	Namsung Shipping Company	28	26 095	26	24 900	26	24 900	0.1	958
42	Meratus Line	26	23 034	27	25 436	27	23 795	0.1	881
43	Tanto Intim Line	32	21 015	34	22 089	35	23 094	0.1	660
44	Shipping Corporation of India	7	23 252	6	22 517	5	20 648	0.1	4 130
45	Swire Group	9	10 542	10	14 144	13	20 318	0.1	1 563
46	National Transport and Overseas Services Company	6	6 600	12	15 122	14	18 622	0.1	1 330
47	Far Eastern Shipping Company	12	13 085	13	17 252	12	18 198	0.1	1 517
48	W.E.C. Lines	18	16 821	17	15 600	19	17 979	0.1	946
49	Log-in Logistica Intermodal	8	19 005	8	19 347	7	16 895	0.1	2 414
50	Far Shipping	14	20 185	9	13 361	10	14 436	0.1	1 444
	Top 50	**4 253**	**18 246 188**	**4 095**	**18 425 488**	**4 095**	**18 745 871**		**4 578**
	Top 50 per cent of total fleet		**92.4%**		**92.2%**		**93.5%**		
	Top 10	**2 739**	**14 108 825**	**2 574**	**14 224 113**	**2 553**	**14 389 955**		**5 636**
	Top 10 per cent of total fleet		**71.5%**		**71.2%**		**71.8**		

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.

Notes: Number of ships and total shipboard capacity deployed ranked by TEUs; includes all container ships known to be operated by liner shipping companies as at 1 May 2017.

C. SHIP REGISTRATION

More than 70 per cent of the commercial fleet is registered under a flag that is different from the country of ownership (table 2.3). This system of open registries can provide opportunities for developing countries, notably small island developing States, such as the Marshall Islands, and the least developed countries, such as Liberia, which are both among the top three registries.

Tables 2.6 and 2.7 provide different insights into nationally flagged fleets. Table 2.6 focuses on the tonnage and vessel numbers, while table 2.7 considers different vessel types and their value. Under both criteria (tonnage and value), Panama continues to be the leading flag of registration. Liberia ranks second in terms of tonnage, and the Marshall Islands ranks second in terms of value. The Marshall Islands has one of the youngest fleets, with many high-value liquefied natural gas tankers, offshore drill ships and other specialized vessels registered under its flag.

Table 2.6. Leading flags of registration by tonnage, 2017

Flag of registration	Number of vessels	Vessel share of world total (percentage)	Dead-weight tonnage	Share of world total dead-weight tonnage (percentage)	Cumulated share of dead-weight tonnage (percentage)	Average vessel size (dead-weight tons)	Dead-weight tonnage growth, 2016–2017 (percentage)
Panama	8 052	8.64	343 397 556	18.44	18.44	45 237	2.75
Liberia	3 296	3.54	219 397 222	11.78	30.23	66 706	5.66
Marshall Islands	3 199	3.43	216 616 351	11.63	41.86	67 968	7.76
Hong Kong (China)	2 576	2.77	173 318 337	9.31	51.17	68 695	6.23
Singapore	3 558	3.82	124 237 959	6.67	57.84	36 942	0.21
Malta	2 170	2.33	99 216 495	5.33	63.17	46 297	5.14
Bahamas	1 440	1.55	79 842 485	4.29	67.46	56 625	0.79
China	4 287	4.60	78 400 273	4.21	71.67	20 555	2.12
Greece	1 364	1.46	74 637 988	4.01	75.68	66 999	1.60
United Kingdom	1 551	1.66	40 985 692	2.20	77.88	30 495	10.42
Japan	5 289	5.68	34 529 405	1.85	79.74	8 574	6.60
Cyprus	1 022	1.10	33 764 669	1.81	81.55	33 798	1.82
Norway	1 585	1.70	21 900 458	1.18	82.73	16 319	6.89
Indonesia	8 782	9.43	20 143 854	1.08	83.81	4 269	7.58
India	1 674	1.80	17 253 564	0.93	84.74	10 899	5.34
Denmark	654	0.70	16 893 333	0.91	85.64	28 344	-1.73
Italy	1 430	1.53	15 944 268	0.86	86.50	13 477	-2.32
Republic of Korea	1 907	2.05	15 171 035	0.81	87.31	9 008	-10.80
Portugal	466	0.50	13 752 758	0.74	88.05	32 744	54.97
United States	3 611	3.88	11 798 309	0.63	88.69	6 329	0.75
Bermuda	160	0.17	10 957 895	0.59	89.27	69 795	2.44
Germany	614	0.66	10 443 699	0.56	89.84	20 084	-6.15
Antigua and Barbuda	964	1.03	10 153 044	0.55	90.38	10 609	-9.68
Malaysia	1 690	1.81	10 058 653	0.54	90.92	7 412	4.70
Russian Federation	2 572	2.76	8 277 175	0.44	91.37	3 292	-2.95
Turkey	1 285	1.38	8 200 982	0.44	91.81	8 055	-3.83
Belgium	185	0.20	8 039 665	0.43	92.24	50 883	-3.57
Viet Nam	1 818	1.95	7 991 039	0.43	92.67	4 745	2.96
Netherlands	1 244	1.34	7 619 143	0.41	93.08	7 263	-5.31
France	547	0.59	6 966 582	0.37	93.45	17 033	0.90
Islamic Republic of Iran	739	0.79	6 583 064	0.35	93.80	11 253	34.49
Philippines	1 508	1.62	6 135 144	0.33	94.13	5 203	-3.63
Cayman Islands	161	0.17	5 549 056	0.30	94.43	36 268	28.52
Thailand	781	0.84	5 374 875	0.29	94.72	8 269	0.13
Kuwait	161	0.17	5 155 256	0.28	95.00	38 761	-3.85
Top 35 flags total	**72 342**	**77.65**	**1 768 707 283**	**95.00**	**95.00**	**24 449**	**4.02**
Rest of world	**20 819**	**22.35**	**94 530 523**	**5.07**	**5.07**	**4 541**	**-12.80**
World total	**93 161**	**100.00**	**1 861 851 750**	**100.00**	**100.00**	**24 062**	**2.94**

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.

Notes: Propelled seagoing merchant vessels of 100 gross tons and above, ranked by dead-weight tonnage; beginning-of-year figures. For a complete list of all countries, see http://stats.unctad.org/fleet (accessed 9 September 2017).

Table 2.7. Leading flags of registration by value, 2017 (Millions of dollars)

Flag of registration	Oil tankers	Bulk carriers	General cargo ships	Container ships	Other	Total
Panama	11 942	36 464	3 867	10 669	53 909	116 850
Marshall Islands	20 130	18 434	662	4 567	50 713	94 505
Bahamas	7 697	3 856	214	301	66 997	79 065
Liberia	16 172	13 647	869	12 615	20 391	63 694
Singapore	10 072	9 863	1 445	7 743	20 658	49 780
Hong Kong (China)	8 669	17 364	2 034	11 513	5 310	44 890
Malta	6 787	8 874	1 733	6 344	18 034	41 771
China	4 614	10 543	2 398	1 274	18 078	36 907
Norway	1 825	1 678	290		24 403	28 196
United Kingdom	2 818	2 026	1 394	3 759	17 485	27 482
Italy	1 572	817	2 726	66	13 869	19 051
Bermuda	410	245	10	33	17 027	17 725
Greece	8 524	3 000	82	239	5 676	17 520
Japan	2 240	2 255	1 594	289	7 129	13 507
Cyprus	877	3 765	776	1 175	4 953	11 545
Netherlands	109	127	3 844	163	7 089	11 332
United States	1 136	21	501	383	8 190	10 231
Malaysia	742	96	89	57	9 209	10 193
Denmark	1 102	51	524	4 192	3 919	9 787
Indonesia	1 445	352	1 336	431	4 379	7 943
Brazil	582	114	38	159	4 982	5 875
Vanuatu		311	13	1	5 179	5 504
Nigeria	123		3		5 264	5 391
India	1 513	721	452	65	2 549	5 301
France	633		320	765	3 475	5 193
Top 25 flags subtotal	**111 733**	**134 622**	**27 214**	**66 801**	**398 870**	**739 240**
Others	**9 349**	**8 005**	**14 617**	**8 174**	**49 232**	**89 378**
World total	**121 083**	**142 628**	**41 831**	**74 975**	**448 102**	**828 618**

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Notes: Propelled seagoing merchant vessels of 1,000 gross tons and above, ranked by fleet value; beginning-of-year figures.

Table 2.8. Distribution of dead-weight tonnage capacity of vessel types by country group of registration, 2017 (Percentage)

	Total fleet	Oil tankers	Bulk carriers	General cargo	Container ships	Other
World total	100.00	100.00	100.00	100.00	100.00	100.00
Developed countries	22.84	24.48	18.88	27.82	27.94	25.91
	0.17	*-0.32*	*0.22*	*-0.08*	*0.84*	*0.39*
Countries with economies	0.68	0.91	0.20	5.38	0.05	1.02
in transition	*-0.03*	*-0.04*	*0.00*	*0.06*	*0.01*	*-0.23*
Developing countries	76.24	74.52	80.88	65.57	71.95	71.85
	-0.09	*0.36*	*-0.21*	*0.10*	*-0.79*	*0.06*
Of which:						
Africa	12.66	15.20	10.37	6.45	19.39	9.19
	-0.43	*-2.04*	*0.29*	*0.42*	*-0.01*	*-0.07*
America	24.84	20.94	28.88	20.79	17.90	28.97
	-0.15	*1.51*	*-0.81*	*-0.19*	*-0.87*	*-0.86*
Asia	26.66	23.19	28.95	34.89	29.23	20.89
	-0.19	*0.39*	*-0.74*	*-0.37*	*0.29*	*0.56*
Oceania	12.09	15.19	12.69	3.44	5.44	12.80
	0.68	*0.50*	*1.05*	*0.24*	*-0.20*	*0.43*
Unknown and other	0.24	0.09	0.04	1.23	0.06	1.22
	-0.04	*0.00*	*-0.02*	*-0.08*	*-0.06*	*-0.22*

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Notes: Propelled seagoing merchant vessels of 100 gross tons and above; beginning-of-year figures; annual growth in italics.

Table 2.9. Deliveries of newbuildings, major vessel types and countries where built, 2016 (Thousands of gross tons)

	China	Japan	Republic of Korea	Philippines	Rest of world	Total
Oil tankers	4 407	1 094	10 500		917	16 918
Bulk carriers	12 346	9 418	2 940	691	540	25 934
General cargo	764	205			169	1 138
Container ships	2 231	599	5 541	397	695	9 464
Gas carriers	553	759	4 887	78	24	6 302
Chemical tankers	561	566	306		39	1 472
Offshore	651	204	603	2	686	2 146
Ferries and passenger ships	105	184			1 148	1 437
Other	561	319	490		76	1 445
Total	**22 179**	**13 349**	**25 266**	**1 168**	**4 295**	**66 257**

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Note: Propelled seagoing merchant vessels of 100 gross tons and above. For more detailed data on other shipbuilding countries, see http://stats.unctad.org/shipbuilding (accessed 9 September 2017).

More than 76.2 percent of the world fleet tonnage is registered in the developing countries (table 2.8). This includes many open registries, such Panama, Liberia and the Marshall Islands. However, some of the nationally flagged fleets are also nationally owned, often because of cargo reservation regimes that limit the options for shipowners to flag out. Many of the ships flying the flags of China, India, Indonesia and the United States are deployed on domestic transport (cabotage) services, which are reserved for nationally registered ships. The implications of such cargo reservation regimes for international maritime connectivity will be discussed in chapter 6.

D. SHIPBUILDING, DEMOLITION AND NEW ORDERS

1. Deliveries of newbuildings

In 2016, 91.8 per cent of shipbuilding (gross tons) took place in three countries: the Republic of Korea, China and Japan. This represents a further increase over 2015, in line with the concentration process observed in many maritime sectors. China continued to have its largest shares in dry bulk carriers and general cargo ships; the Republic of Korea was strongest in container ships, gas carriers and oil tankers; and Japan mostly built oil tankers and dry bulk carriers. The Philippines maintained a 4.2 per cent market share in container ships. All other countries combined constructed 6.5 per cent of gross tonnage in 2016, mostly specializing in ferries, cruise and other passenger ships, as well as some offshore vessels (table 2.9).

2. Ship demolition

Four countries – India, Bangladesh, Pakistan and China – accounted for 94.9 per cent of known ship scrapping in 2016. Turkey maintained a market niche for scrapping some gas carriers, as well as some ferries and passenger ships. All other countries combined accounted for 1.6 per cent of the world total. Key demolition figures are provided in table 2.10.

Table 2.10. Reported tonnage sold for demolition, major vessel types and countries where demolished, 2016 (Thousands of gross tons)

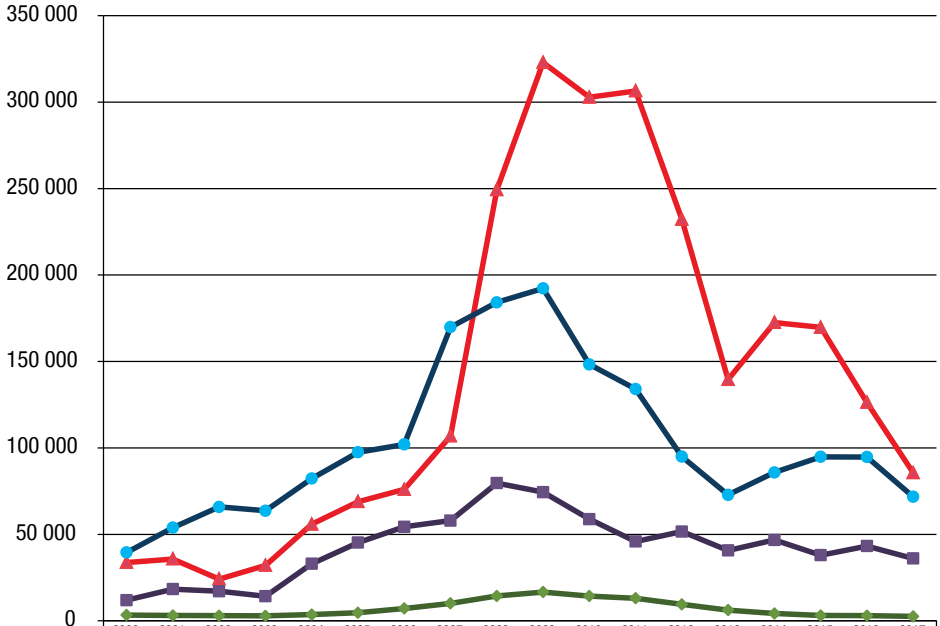
	China	India	Bangladesh	Pakistan	Unknown – Indian subcontinent	Turkey	Others/ unknown	World total
Oil tankers	266	142	224	448	103	7	63	1 253
Bulk carriers	1 823	3 269	5 756	3 742	1 049	121	58	15 818
General cargo	44	519	152	66	37	192	36	1 046
Container ships	569	3 922	1 675	119	1 056	104	110	7 556
Gas carriers	3	147	25	48		171	3	397
Chemical tankers	1	168			28	28	1	226
Offshore	24	340	64	249	218	46	122	1 064
Ferries and passenger ships		51				77	39	166
Other	356	375	344		81	252	33	1 442
Total	**3 086**	**8 934**	**8 240**	**4 672**	**2 572**	**999**	**466**	**28 968**

Source: UNCTAD secretariat estimates, based on data from Clarksons Research.
Notes: Propelled seagoing merchant vessels of 100 gross tons and above. Estimates for all countries are available at http://stats.unctad.org/shipscrapping.

3. Tonnage on order

In 2016, shipbuilding activity contracted by 1.7 per cent, while ship scrapping went up by 25.7 per cent. The higher growth of demolition led to a slowdown in world fleet growth (figure 2.1). Given the order book, this trend can be expected to continue – there is less tonnage on order of all major vessel types in early 2017 than one year before (figure 2.7). For example, the current order book for general cargo ships is below levels recorded during the 2000–2016 period. In addition, the order book for dry bulk carriers finally returned to the levels last seen before the boom and bust period of 2007–2012.

Figure 2.7. World tonnage on order, 2000–2017 (Thousands of dead-weight tons)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Dry bulk carriers	33 721	35 757	24 144	32 066	55 850	68 878	75 988	106 89	249 28	322 90	302 79	306 45	232 13	139 51	172 53	169 73	126 28	85 573
Oil tankers	39 546	53 919	65 896	63 678	82 258	97 474	102 01	169 88	184 19	192 25	148 30	134 04	94 936	72 843	85 844	94 851	94 716	71 743
Container ships	11 922	18 348	17 121	14 225	33 004	45 241	54 351	57 938	79 665	74 408	58 821	45 860	51 614	40 685	46 795	37 977	43 259	36 062
General cargo ships	3 325	3 053	2 984	2 881	3 587	4 638	7 139	10 070	14 389	16 657	14 315	13 051	9 526	6 172	4 226	3 058	2 979	2 553

Source: UNCTAD secretariat calculations, based on data from Clarksons Research.
Notes: Propelled seagoing merchant vessels of 100 gross tons and above; beginning-of-year figures.

E. FUTURE TRENDS IN MARITIME TRANSPORT SUPPLY AND RELEVANT REQUIREMENTS

1. Supply of maritime cabotage services

Cabotage is defined as sea transport of passengers, goods and materials between two ports located in the same country, irrespective of the country in which the seagoing vessel is registered. Cabotage encompasses domestic shipping operations; these include domestic trade, as well as operations related to transhipment. Cabotage may involve tramp or liner operations and a variety of cargo-handling techniques.

In many countries, cabotage is limited to nationally flagged ships for various reasons, including the following: to promote shipping and national transport capacity, reduce the adverse impact of freight expenditures on the balance of payments, facilitate international trade in a predictable and stable environment and ensure strategic deliveries and shipments. The box below provides a summary of how these limitations are expressed in commitments contained in schedules derived from trade negotiations and agreements and in applied regimes. Commitments are usually worded in a manner that contains an overall prohibition to provide cabotage services, although in some conditions the provision of such services is allowed.

In practice, cabotage restrictions are not always rigidly applied in developing countries. Services are often operated by foreign companies, subject to complying with authorizations and other requirements and flagging in the country concerned. In some cases, this way of operating can cause serious disruptions in providing door-to-door services, suggesting that restrictions may be more burdensome than necessary to achieve an efficient maritime industry.

Different regimes for cabotage may have different implications for a country's shipping connectivity, as they may facilitate the combination of national, regional and intercontinental shipping services. This will be discussed in more detail in chapter 6.

Box 2.1. Cabotage in trade agreements: Scenarios, conditions and examples

Overall prohibition: Foreign services providers cannot provide cabotage services

- Cabotage is limited to nationally flagged vessels.
- Cabotage is open solely to national carriers.
- Vessels providing cabotage services must be owned by nationals or companies legally established in the country concerned and registered as shipowners in the national shipowners registry.
- National vessels that operate cabotage services must meet the following conditions: if the owners are natural persons, they must prove they have (local) nationality and domicile; if the owner is a company, it must provide evidence that half plus one of its shareholders are (local) nationals domiciled in the country, that at least 51 per cent of the registered voting shares are owned by nationals, that the company is controlled and managed by nationals and that it is up to date in meeting its social and tax obligations.

Exceptions: Cabotage services can be provided under certain conditions

Allowed for some (trading) partners; subject to reciprocity or in case of regional integration	Allowed for trading partners, in case of bilateral or multilateral agreements that grant cabotage rights to trading partners on a reciprocal basis, to encourage trade and promote regional economic integration
Allowed for some operations or under certain conditions (subject to authorizations and other requirements)	After undergoing registration, foreign shipping companies may transport self-owned or leased empty containers between certain designated coastal ports. National and foreign maritime (cabotage) transport companies must have authorization and an operating permit. These are granted for an indefinite term, provided that the company respects the conditions originally required for their granting. To obtain such a permit, foreign shipping companies must have a shipping agent in the country concerned. Cabotage may be allowed if reciprocal treatment is offered, if the activity is for the purpose of scientific research or environmental protection or if it is in the interest of the State concerned. Foreign ships may perform (cabotage) activities where a non-nationally registered duty-paid ship is available or suitable. There are no limits on the number of waivers for foreign ships to engage in cabotage. A waiver application for a temporary coasting trade licence involves a search for a (national) suitable ship and a labour market test if a company seeks to crew its vessels with foreigners.

Source: UNCTAD secretariat, based on information from the Integrated Trade Intelligence Portal Services database (World Trade Organization and World Bank).

2. Gender issues: Assessing gender aspects in shipping

In shipping, men make up the majority of the workforce. In 2015, out of the estimated 1,647,500 seafarers in marine operation roles employed in the global merchant fleet, about 16,500 seafarers, or 1 per cent, were women (Baltic and International Maritime Council, 2015). In particular, 0.4 per cent of ratings and rating trainees, 0.7 per cent of officers and 6.9 per cent of officer trainees were women. The latter number suggests a likely increase in the number of women seafarers.

A survey conducted in 2016 by the Maritime HR Association indicates that the share of women in global onshore maritime employment strongly depends on the level of hierarchy. The share is largest in administrative positions (74 per cent of the provided data) and balanced in junior positions (55 per cent). The share decreases with regard to senior positions: Women occupy 37 per cent of professional-level positions and 17 per cent of manager-level positions. At the director level, 12 per cent of positions are filled by women, compared with 9 per cent at the executive level.

Women were most likely to be found in corporate support roles such as in human resources and finance. They were least likely to hold positions in ship management (9 per cent) (HR Consulting, 2016). A similar trend can be seen in national shipowner associations. For example, the International Chamber of Shipping found that only 6 per cent of national board members were women, 30 per cent at director or policymaking level and 86 per cent at support level (Orsel and Vaughan, 2015).

Combined with other factors, the lack of women in senior positions translates into a gender pay gap. While no global data are available, in the United Kingdom, there is a national average gender pay gap of 19 per cent. In comparison, the difference between the mean hourly rate of men and women employees in the maritime sector is significantly higher and translates to 39 per cent across the 26,000 employees covered by a survey of the Maritime HR Association (HR Consulting, 2017). When comparing pay by gender within job levels, the pay gap was at 8 per cent at the junior or professional level, increasing with seniority (Spinnaker Global, 2017).

Another dimension to be considered in this area are health-related issues. Owing to concerns that medical handbooks aimed at women seafarers might not take a gendered approach to health or might be outdated, the International Maritime Health Association and its partners conducted a survey on the health and welfare needs of women seafarers. According to the survey, the main health challenges were joint and back pain (particularly on passenger ships in catering and room services, less so on cargo ships), stress, depression, anxiety, obesity and heavy or painful menstrual periods. Some 55 per cent of the respondents linked their health problems to working conditions. About 40 per cent did not have access to a sanitary bin and 17 per cent considered sexual harassment to be a current challenge. In an earlier pilot survey when the question was not restricted to current experiences, 50 per cent stated that sexual harassment was a problem (International Maritime Health Association et al., 2015).

Based on a shortage in the supply of officers and the need to guarantee equal opportunity for all genders, Governments and industry should take measures to facilitate the uptake of women in shipping, ensure equal pay and improve retention rates. It is expected that the estimated shortage of 16,500 officers in 2015 will grow to 147,500 by 2025 (Baltic and International Maritime Council, 2015). Public and private sector initiatives can include targeted recruitment, support for employees with caring responsibilities (such as work arrangements to switch between vessel-based and shore-based positions), unconscious bias awareness training, mentoring, internal networks, talent pipelines and consistency in salary decisions (HR Consulting, 2017). Given the scarce data available on the topic, further research should be conducted to tailor instruments to the needs as fittingly as possible (Women's International Shipping and Trading Association, 2015). Organizations working on the issue should exchange information and collaborate to use resources as effectively as possible and raise awareness in industry and politics.

To improve the working and living conditions of women aboard shipping vessels, simple and low-cost interventions can help substantially. The production and distribution of gender-specific information on the aforementioned health problems can support their mitigation. A diversity charter signed by shipping companies and seafarer organizations can support the change of corporate cultures. Prevention and investigation of cases of sexual harassment and bullying aboard should be standard policy. Solutions for the disposal of sanitary waste on all ships and availability of women-specific products in port shops and welfare centres should be ensured (ILO, 2016; International Maritime Health Association et al., 2015; Orsel and Vaughan, 2015). Furthermore, gender-blind measures such as rejoining and long-service incentives, an open-door policy in company culture, better accommodation aboard and facilitated communication between seafarers and their families can help improve retention rates (Women's International Shipping and Trading Association, 2015).

3. The future of liquefied natural gas fuel

Liquefied natural gas carriers are the vessel type with the highest growth rate in deadweight tonnage (table 2.1), and liquefied natural gas as shipping fuel is experiencing growth as well. This trend is developing in a context of tightening environmental policies. For example, at the seventieth session of the Marine Environment Protection Committee, IMO members decided in its resolution MEPC.280(70) of 28 October 2016 that a 0.5 per cent mass/mass limit on sulphur fuel content in global marine traffic would go into effect in 2020.

Since 2015, even stricter regulations have been in place in the emission control areas encompassing the North American coasts and the United States Caribbean: The sulphur fuel content is limited to 0.1 per cent; comparatively low limits apply as well for the emission of nitrogen oxides (NO_x) and fine particulate matter (United States Environmental Protection Agency, 2010). The 0.1 per cent sulphur cap also exists in the North Sea and Baltic Sea sulphur emission control areas, and their regulatory scope will be extended to nitrous oxides as of 2021, in line with the decision of the seventy-first session of the Marine Environment Protection Committee in July 2017 (Danish Maritime Authority, 2017). Also, greenhouse gas emission regulation is gaining support in the maritime sector: the Committee at its seventy-first session adopted a mandatory data collection system for fuel consumption of ships, which will provide the basis for the comprehensive IMO strategy on greenhouse gas emission reduction scheduled for adoption in 2018 (European Commission, 2016). Other steps are being taken in that direction; for example, the European Union announced that maritime transport would be included in the European Union Emission Trading System as of 2023 if the IMO has not implemented a greenhouse gas reduction scheme by 2021 (*Täglicher Hafenbericht*, 2017). National administrations and ports are offering additional incentives to reduce emissions (European Commission, 2017). An example is the Swedish system for fairway dues, which calculates the fee according to the sulphur content of the fuel used by ships calling in Swedish ports (Swedish Maritime Administration, 2010).

In this context, local emissions can be reduced by using liquefied natural gas as a fuel, or, alternatively, a combination of other measures. For example, low-sulphur oil-based fuels, catalysts, particulate filters, scrubbers or exhaust gas recycling can also be used to this end. Depending on the circumstances, liquefied natural gas can be the more cost-efficient option and potentially reduce greenhouse gas emissions as well, contingent on the applicable well-to-wake pathway (Bureau Veritas, 2017; European Union, 2016). In addition, factors such as new regulatory requirements, an increasingly buyer-dominated liquefied natural gas market (*Shipping and Finance*, 2016; Lloyd's List, 2017) and technological progress, the fleet of vessels capable of using liquefied natural gas as fuel has increased.

While the percentage of liquefied natural gas-capable[3] newbuildings (measured in gross tons) was relatively steady at about 2 per cent from 2002 to 2013, it rose to 5.8 per cent in 2014, 4.3 per cent in 2015 and 5.3 per cent in 2016. The trend becomes particularly evident when considering the order book. While a slight increase is expected in 2017 (to 5.7 per cent), 13.5 per cent of the gross tonnage currently on order for delivery in 2018 onwards are from liquefied natural gas-capable ships (table 2.11 and figure 2.8).

As of 1 January 2017, gross tonnage had been distributed over a total of 325 liquefied natural gas-capable vessels delivered. Of these, 229 were liquefied natural gas carriers, 46 were offshore service and other cargo vessels, 39 were passenger vessels and 11 were other types of vessel. There were 110 liquefied natural gas-capable ships on order. In the category of liquefied-natural-gas-ready vessels – ships that are prepared for future liquefied natural gas retrofit – an additional 1,467,805 gross tons were in the fleet, and 3,708,483 gross tons were on order.

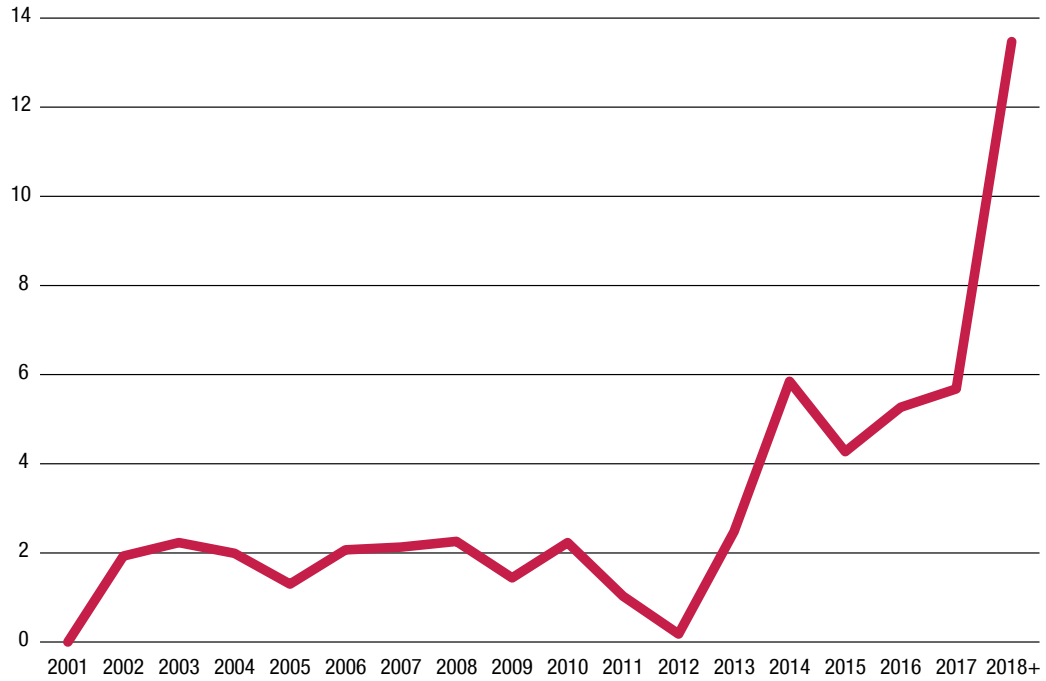
Table 2.11. Liquefied-natural-gas-capable newbuildings (Thousands of gross tons)

	Deliveries 2001–2016																Scheduled orderbook 2017–2018+	
Principal vessel type	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018+**
Oil tankers																	47	
Bulk carriers																		31
General cargo ships			131								4	3			23	30	57	
Container ships											11				34	34	17	149
Liquefied gas carriers		657	674	726	622	1 090	1 100	1 543	1 126	2 182	1 033	114	1 658	3 589	2 788	3 139	4 877	7 551
Chemical tankers						12	22									34	11	79
Offshore supply			10	94			87	6	6		5	31	5	120	19	9	18	169
Ferries and passenger ships						7	23		6	12	13	23	104	32	28	143	248	830
Other/not available																95	20	13
Subtotal built or on order		657	814	820	622	1 109	1 231	1 549	1 138	2 194	1 066	170	1 767	3 740	2 893	3 484	5 295	8 821
All other ships	31 267	33 412	35 662	40 395	47 059	52 454	56 623	67 060	77 878	96 298	102 684	96 444	69 414	60 178	64 862	62 598	87 936	56 669
Total gross tonnage built or on order	31 267	34 068	36 477	41 214	47 681	53 563	57 854	68 610	79 016	98 492	103 750	96 615	71 181	63 918	67 755	66 082	93 232	65 490
Share of liquefied natural gas-capable vessels (percentage)	0.00	1.93	2.23	1.99	1.30	2.07	2.13	2.26	1.44	2.23	1.03	0.18	2.48	5.85	4.27	5.27	5.68	13.47

Sources: UNCTAD secretariat calculations, based on data from Clarksons Research. Data on newbuildings are derived from the existing fleet and order book as of 1 January 2017.

Notes: Propelled seagoing vessels of 1,000 gross tons and above. For the period 2001–2016, information on the fuel type is not available for 6 per cent of the gross tonnage delivered. For 2017 and beyond, information on the fuel type is not available for 20 per cent of the gross tonnage on order.

Figure 2.8. Share of liquefied-natural-gas-capable newbuildings, as of 2001 (Percentage of gross tonnage)



Sources: UNCTAD secretariat calculations, based on data from Clarksons Research. Data on newbuildings are derived from the existing fleet and order book as of 1 January 2017.

Notes: Propelled seagoing vessels of 1,000 gross tons and above. For the period 2001–2016, information on the fuel type is not available for 6 per cent of the gross tonnage delivered. For 2017 and beyond, information on the fuel type is not available for 20 per cent of the gross tonnage on order.

The routing possibilities for liquefied natural gas-powered vessels are limited by the relatively small number of ports providing liquefied natural gas bunkering facilities. However, this number is increasing, particularly along the main shipping lanes (European Union, 2016; DNV GL, 2014). Within the European Union, the Alternative Fuels Infrastructure Directive (2014/94/EU) requires all maritime ports of the core Trans-European Transport Network to provide liquefied natural gas bunkering until 2025 and all inland ports of the Network until 2030 (European Union, 2014).

From a government perspective, besides the environmental advantages, liquefied natural gas helps to broaden the fuel and energy supply and thus reduce oil dependency. Liquefied natural gas and oil exporters are mostly not congruent (International Energy Agency and Organization for Economic Cooperation and Development, 2016; International Gas Union, 2016), which allows for risk diversification. For countries with sustainably available biomass, replacing natural gas to the desired extent with domestic biomethane is an additional possibility – there is no blend wall as is the case with oil-based fuels.

In their approach to market development, Governments should introduce liquefied natural gas bunkering demand and infrastructure supply in a coordinated initiative to overcome the dilemma of one party's unwillingness to invest without an investment commitment from the other parties concerned. Coordination between industries can thus be an effective key to unlocking private sector investment, which is particularly relevant for developing countries, given the high upfront investment cost for liquefied natural gas infrastructure.

A further component of liquefied natural gas market development policy can be the linkage to port operations, hinterland road and inland waterway traffic, where vehicles could be operated using liquefied natural gas or compressed natural gas (German Energy Agency, 2014). To make the use of liquefied natural gas a success, high standards in bunkering and ship operations are required to avoid methane slip and ensure safety. The new mandatory IMO International Code of Safety for Ships using Gases or Other Low-flashpoint Fuels, commonly known as the IGF Code, came into force on 1 January 2017. It details the specific operational requirements for liquefied natural gas as a fuel to minimize risks to ships, crews and the environment. It is accompanied by training requirements for seafarers and the new ISO standard 20519 for the safe bunkering of liquefied natural gas-fuelled ships (IMO, 2017; ISO, 2017).

F. OUTLOOK AND POLICY CONSIDERATIONS

After years of oversupply, the lower growth rates of the world fleet and the declining order book suggest that demand and supply will be more balanced in the medium term. The composition of the fleet is adjusting, albeit slowly, to market demands with newbuildings and ship scrapping of different vessel types.

Given that different countries participate in different maritime sectors, policymakers need to identify their countries' possible niches. Earlier issues of the *Review of Maritime Transport* discussed this topic and options for policymakers in more detail (UNCTAD, 2011). The latest data presented in this 2017 edition of the Review confirm continued concentration and specialization. At times, policymakers will need to make choices between either protecting jobs in national shipping businesses or striving to increase trade competitiveness by improving connectivity and reducing trade costs, as the latter may imply opening up markets to foreign shipping service providers. As discussed above, one way to enhance efficiency may be to make maritime cabotage regimes more flexible.

To meet not only the requirements of importers and exporters, but also the demands and expectations of society and political commitments, maritime businesses should constantly revise and adjust their ways of doing business. Shipping – both onshore and offshore – is traditionally a male-dominated sector. By promoting the employment of women, maritime businesses may not only help to overcome shortages in labour supply, but may also contribute to achieving key Sustainable Development Goals.

Achieving environmental sustainability, including in maritime transport, is an imperative of the 2030 Agenda for Sustainable Development. An important development worth highlighting in this respect is the growing importance of liquefied natural gas as an alternative fossil fuel. In 2016, liquefied natural gas carriers and other gas carriers recorded the highest growth in deadweight tonnage, reflecting growing liquefied natural gas trade flows. Promoting liquefied natural gas-powered ships can reduce costs and promote clean energy, and hence address climate-related Goals.

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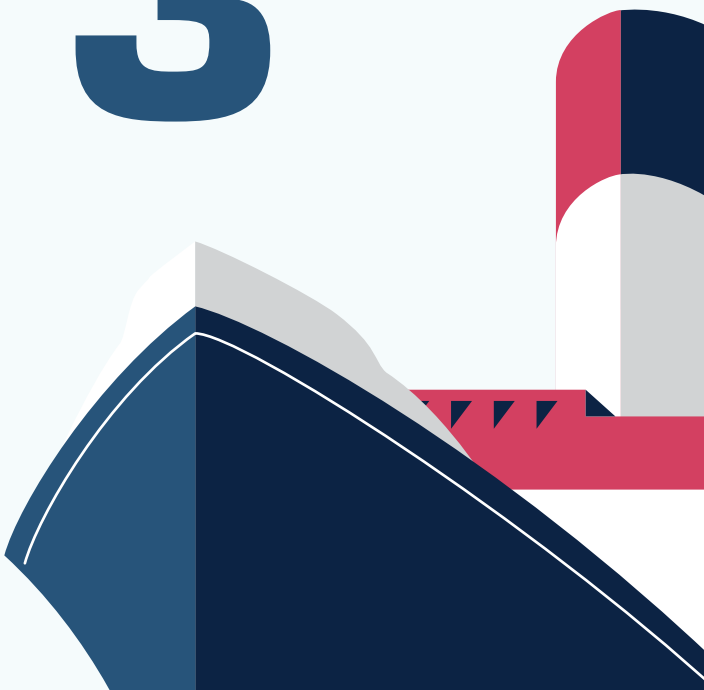
ENDNOTES

1. Data in this chapter concerning tonnage and number of ships in the world fleet was provided by Clarksons Research, London. Unless stated otherwise, the vessels covered in the UNCTAD analysis include all propelled seagoing merchant vessels of 100 gross tons and above, including offshore drillships and floating production, storage and offloading units. Military vessels, yachts, waterway vessels, fishing vessels and offshore fixed and mobile platforms and barges are not included. Data on fleet ownership only cover ships of 1,000 gross tons and above, as information on the true ownership of smaller ships is often not available. For more detailed data on the world fleet (registration, ownership, building and demolition), as well as other maritime statistics, see http://stats.unctad.org/Maritime (accessed 11 September 2017).
2. The aggregate fleet values published by Clarksons Research are calculated from estimates of the value of each vessel based on type, size and age. Values are estimated for all oil/product tankers, bulk carriers, combined carriers, container ships and gas carriers with reference to matrices based on representative newbuilding, second-hand and demolition values provided by Clarksons Platou brokers. For other vessel types, values are estimated with reference to individual valuations, recently reported sales and residual values calculated from reported newbuilding prices. As coverage concerning specialized and non-cargo vessels may not be complete, figures might not accurately represent the total value of the world merchant fleet above 100 gross tons. Desktop estimates are made on the basis of prompt charter-free delivery, as between a willing buyer and a willing seller for cash payment under normal commercial terms. For the purposes of this exercise, all vessels are assumed to be in good and seaworthy condition.
3. In accordance with Clarksons Research, the definition of liquefied-natural-gas-capable vessels used in this report are ships that can use liquefied natural gas either as a dedicated or supplementary fuel for the main engines.

3



FREIGHT RATES AND MARITIME TRANSPORT COSTS

As in 2015, the shipping industry faced continued challenges in most segments in 2016, owing to the persistent mismatch between supply capacity and demand. With global demand for seaborne trade remaining uncertain, freight rates continued to be determined by the way supply capacity management was being handled.

This chapter covers the development of freight rates and transport costs in 2016 and early 2017, describing relevant developments in maritime markets, namely supply and demand in container ships, dry bulk carriers and tankers. It highlights significant events leading to major freight rate fluctuations, discusses recent industry trends and gives a selective outlook on future developments of freight markets. In particular, the chapter explores the recent trend towards consolidation that developed in the container ship market, both in the form of new mergers and acquisitions, as well as through the emergence of mega liner shipping alliances and their implication on the market.

Container freight rates have been very low, and competition on various trade routes has intensified. Market fundamentals in container shipping improved for the first time since 2011, mainly as a result of a contraction in supply growth. The dry bulk sector continued to struggle with existing overcapacity and weak growth in demand, which led to sharp declines in freight rates. Freight rates in all tanker segments went down from the high level of 2015, but were not far from the five-year average across most segments.

With regard to total international transport costs, UNCTAD estimates that in 2016 a country spent on average about 15 per cent of the value of its imports on international transport and insurance. Smaller and structurally vulnerable economies pay significantly more, reaching an average of 22 per cent for small island developing States, 19 per cent for landlocked developing countries, and 21 per cent average for the least developed countries. Lower efficiency in ports, inadequate infrastructure, diseconomies of scale and less competitive transport markets are some of the key factors that underpin the persistent transport cost burden in many developing countries.

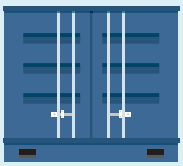
FREIGHT RATES AND MARITIME TRANSPORT COSTS

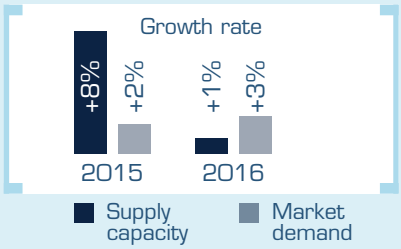
2016 and early 2017

SUPPLY CAPACITY

GLOBAL DEMAND FOR SEABORNE TRADE

CONTAINER freight rates

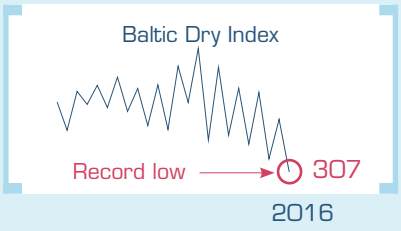




Container spot freight rates weak and unstable throughout 2016

- Record lows in the first part of the year and more positive trends in the second half of the year

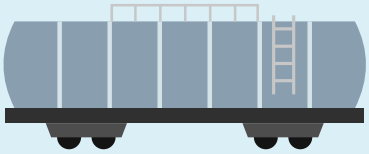
DRY BULK freight rates

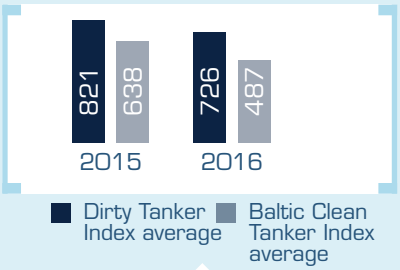


Dry bulk freight rates struggled with overcapacity and weak demand

- Rates sharp declines in freight

TANKER freight rates

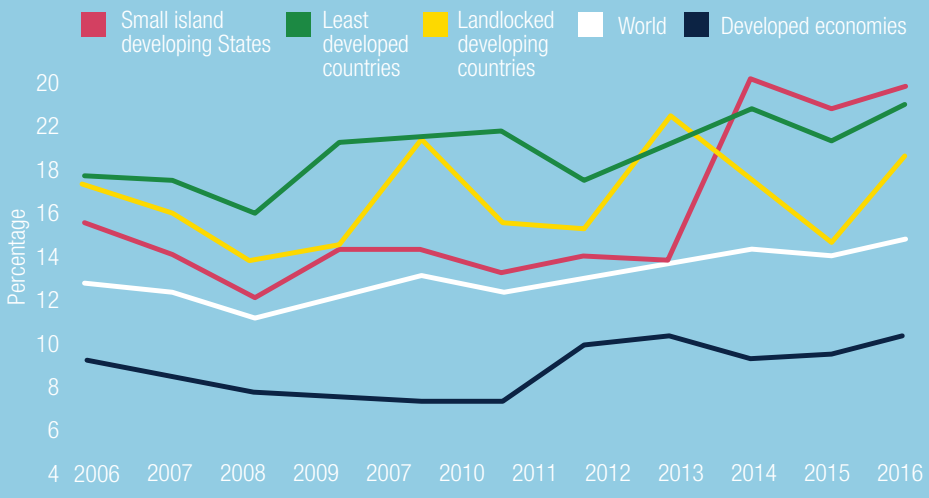




Tanker freight rates went down from the high level of 2015

- But were not far from the five-year average across most segments

TRANSPORT COSTS



Developing countries, in particular small island developing States and the least developed countries, face relatively higher transport costs

A. CONTAINER FREIGHT RATES

1. Major trends

2016 was a challenging year for the container ship sector, although market fundamentals balance improved for the first time since 2011, with growth in demand outpacing that of supply. As illustrated in figure 3.1, the overall market demand growth rate for containers shipping grew by 3 per cent in 2016, slightly better than the 2 per cent annual growth in 2015. In contrast, container supply capacity went up by 1 percent, compared with 8 percent in 2015. This improvement was mainly prompted by a substantial slowdown in fleet growth and a more positive trend in demand, namely in the second half of the year.

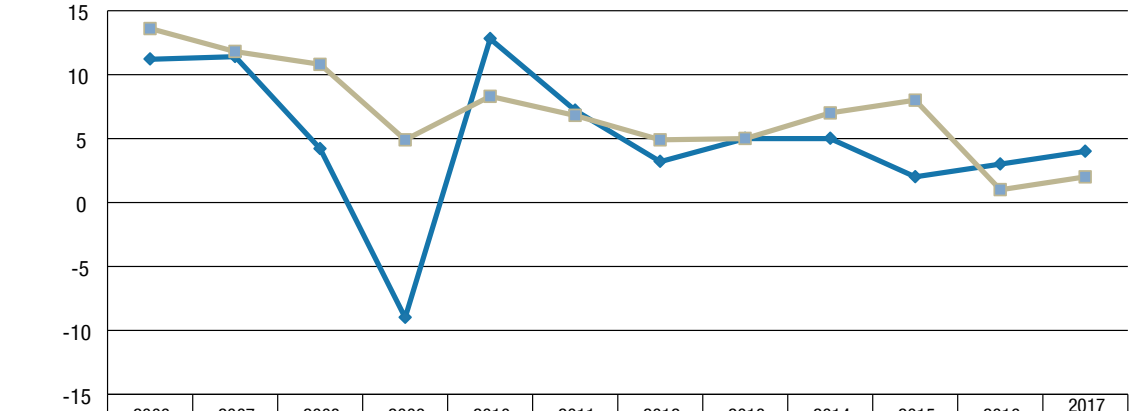
The supply–demand balance was supported by a deep contraction in supply capacity, which was principally driven by a drop in deliveries totaling less than 904,000 TEUs – almost half, compared with the 1.7 million deliveries in 2015, and a high level of container ship demolition activities – especially of Panamax ships – that more than tripled in 2016, compared with 2015, reaching a high record of about 0.7 million TEUs. Idle capacity was also high, at 7 per cent at the end of 2016 (Clarksons Research, 2017a).

On the other hand, increase in demand was mainly steered by improvements in mainlane trade routes, mainly the Far East–Europe trade route (about 1 per cent), which had experienced low levels in 2015, and a good expansion on intra-Asian trade routes (about 5 per cent), which was boosted by positive trends in the Chinese economy. However, the improvement in the supply and demand fundamentals was not sufficient to generate better market conditions and improve freight rates. Overall, growth in demand was limited by a continuous slowdown in world economic growth and a weak commodity price environment, and the level of surplus capacity remained high from excess built up over recent years.

The freight rates market remained under pressure, and carriers struggled to recover operating costs on certain trade routes. Container spot freight rates were generally low and unstable throughout 2016, witnessing record declines in the first part of the year and more positive trends in the second half. The momentum gained in the second half of 2016 was mainly driven by measures taken by shipping lines to manage supply side through network optimization, scrapping and more careful vessels deployment around the peak season (Baltic and International Maritime Council, 2017a).

As shown in table 3.1, average spot freight rates on most trade routes were negative, with some exceptions. Freight rates for Far East–Northern Europe trade routes improved slightly, with an annual average increase of about 8 percent in 2016 ($683 per TEU, compared with $629 per TEU in 2015), yet still below $1,000 per TEU. Annual average spot freight rates from the Far East to Mediterranean ports in Europe declined by 8 percent ($676 per TEU in 2016, compared with $739 per TEU in 2015), plunging as low as $200 per TEU in March 2016. The overly supplied market, combined with slow demand growth, namely slow exports from China, contributed to these low levels.

Figure 3.1. Growth of demand and supply in container shipping, 2006–2017 (Percentage)



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 (estimates)
Demand	11.2	11.4	4.2	-9.0	12.8	7.2	3.2	5.0	5.0	2.0	3.0	4.0
Supply	13.6	11.8	10.8	4.9	8.3	6.8	4.9	5.0	7.0	8.0	1.0	2.0

Source: UNCTAD secretariat calculations, based on data from Clarksons Research, Container Intelligence Monthly, various issues.
Notes: Supply data refer to total capacity of the container-carrying fleet, including multipurpose and other vessels with some container-carrying capacity. Demand growth is based on million TEU lifts. Data for 2017 are projected figures.

Table 3.1. Container freight market and rates, 2009–2016

Freight markets	2009	2010	2011	2012	2013	2014	2015	2016
Trans-Pacific	(Dollars per 40-foot equivalent unit)							
Shanghai–United States West Coast	1 372	2 308	1 667	2 287	2 033	1 970	1 506	1 279
Percentage change		68.2	-27.8	37.2	-11.1	-3.1	-23.6	-15.1
Shanghai– United States East Coast	2 367	3 499	3 008	3 416	3 290	3 720	3 182	2 102
Percentage change		47.8	-14.0	13.56	-3.7	13.07	-14.5	-33.9
Far East–Europe	(Dollars per 20-foot equivalent unit)							
Shanghai–Northern Europe	1 395	1 789	881	1 353	1 084	1 161	629	683
Percentage change		28.2	-50.8	53.6	-19.9	7.10	-45.8	8.6
Shanghai–Mediterranean	1 397	1 739	973	1 336	1 151	1 253	739	676
Percentage change		24.5	-44.1	37.3	-13.9	8.9	-41.0	-8.6
North–South	(Dollars per 20-foot equivalent unit)							
Shanghai–South America (Santos)	2 429	2 236	1 483	1 771	1 380	1 103	455	1 644
Percentage change		-8.0	-33.7	19.4	-22.1	-20.1	-58.7	261.3
Shanghai–Australia/New Zealand (Melbourne)	1 500	1 189	772	925	818	678	492	533
Percentage change		-20.7	-35.1	19.8	-11.6	-17.1	-27.4	8.3
Shanghai–West Africa (Lagos)	2 247	2 305	1 908	2 092	1 927	1 838	1 449	1 181
Percentage change		2.6	-17.2	9.64	-7.9	-4.6	-21.2	-18.5
Shanghai–South Africa (Durban)	1 495	1 481	991	1 047	805	760	693	584
Percentage change		-0.96	-33.1	5.7	-23.1	-5.6	-8.8	-15.7
Intra-Asian	(Dollars per 20-foot equivalent unit)							
Shanghai–South-East Asia (Singapore)		318	210	256	231	233	187	70
Percentage change			-34.0	21.8	-9.7	0.9	-19.7	-62.6
Shanghai–East Japan		316	337	345	346	273	146	185
Percentage change			6.7	2.4	0.3	-21.1	-46.5	26.7
Shanghai–Republic of Korea		193	198	183	197	187	160	104
Percentage change			2.6	-7.6	7.7	-5.1	-14.4	-35.0
Shanghai–Hong Kong (China)		116	155	131	85	65	56	55
Percentage change			33.6	-15.5	-35.1	-23.5	-13.8	-1.8
Shanghai–Persian Gulf (Dubai)	639	922	838	981	771	820	525	399
Percentage change		44.33	-9.1	17.1	-21.4	6.4	-36.0	-24.0

Source: Clarksons Research, Container Intelligence Monthly, various issues.
Note: Data based on yearly averages.

Transpacific freight rates remained weak, for instance, the Shanghai–United States East Coast annual rates averaged at $2,102 per 40-foot equivalent unit (FEU) in 2016, 34 per cent below the full year 2015 average ($3,182 per FEU), and the Shanghai–United States West Coast annual rate was estimated at an average of $1,279 per FEU in 2016, 15 per cent less than in 2015. This decline was mainly due to poor supply side management by operators in face of weak volume growth (Baltic and International Maritime Council, 2017b).

Freight rates from Shanghai to Singapore and the Republic of Korea fell further from the low levels of 2015. They fell to an annual average of $70 per TEU for the Shanghai-to-Singapore leg, compared with $187 per TEU in 2015, a decrease of 63 per cent. Rates for transporting freight from Shanghai to the Republic of Korea slid to $104 per TEU, a decrease of 35 per cent, compared with 2015.

North–South freight rates were also disadvantaged due to imbalanced oversupply of capacity and weak trade volumes into sub-Saharan Africa and South America driven by low commodity prices and their impact on commodity-exporting developing economies (Clarksons Research, 2016). However, freight rates on the Shanghai–South America (Santos, Brazil) trade route rose considerably, with an average annual increase of 261 percent. The drive up in rates was mainly prompted by carriers' dramatically cutting capacity on the route in line with the reduction in demand (JOC.com, 2016a).

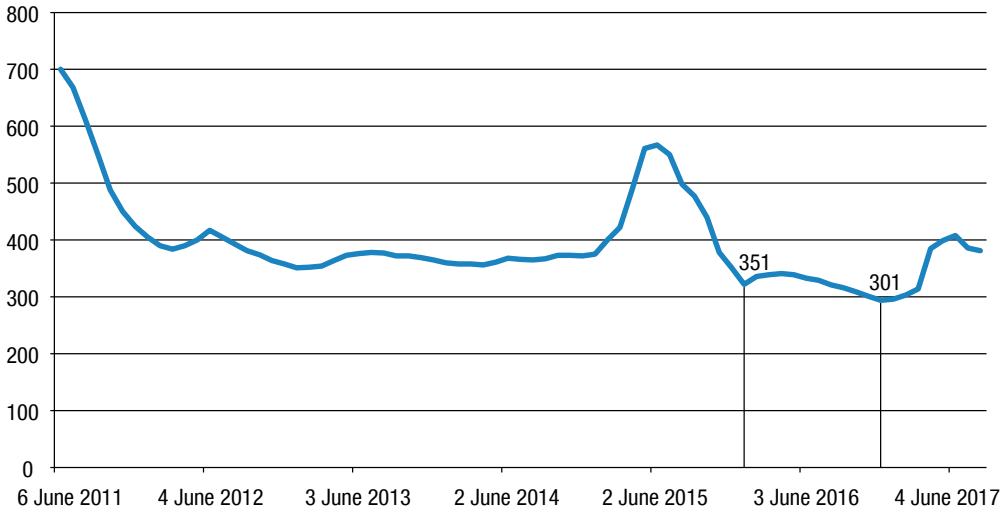
In their effort to manage supply-side capacity, carriers continued implementing strategies such as scrapping, idling of vessels and slow steaming. The cascading of container capacity also remained a key characteristic of the sector, though on some routes, opportunities to cascade vessels were limited due to lack of demand, as in the case of North–South trade. Meanwhile, opportunities to deploy large ships of a capacity of 8,000–12,000 TEUs on the Trans-Pacific route increased, due to the cascading of these units from the Far East–Europe route replaced by mega ships, and the new opportunities of deploying larger vessels on Asia–United States East Coast routes via the new Panama Canal locks (Clarksons Research, 2017b). In the future, cascading of larger ships into the Far East–United States East Coast route, including ships of 14,000 TEUs and above, will be possible with the ongoing enhancements of United States East Coast ports to handle the larger New Panamax vessels.

Charter market vessel earnings remained low throughout 2016, affected by the low market demand and overcapacity of ships for charter. As illustrated in figure 3.2, charter rates dropped to an average of 325 points in 2016, compared with 360 in 2015, evidence of the total mismatch between demand and supply. Charter rates across all vessel sizes continued to be affected, particularly in the former Panamax segment (4,000–5,000 TEUs), which was squeezed out by the flow of large vessels (8,000–10,000 TEUs) into the Asia–United States trade route, following the expansion of the Panama Canal. Moreover, the effect of cascading created some disorder throughout the year among the smaller sizes (3,000 TEUs and above).

Although larger container ships have been deployed on the intraregional trade routes, this trend appears to have slowed significantly due to constraints of infrastructure, volume and other factors that limited redeployment (Clarksons Research, 2017a). The idling of container ships remained high at an average 1.27 million TEUs in 2016, a substantial increase over 0.55 million TEUs in 2015 (Barry Rogliano Salles, 2017). Rates improved during the first quarter of 2017, especially those of the Old Panamax segment. This increase was partly due to strong container demand since the fourth quarter of 2016 and the advent of new alliances, which forced carriers to charter vessels to help fill gaps as their networks took shape (JOC.com, 2017). Whether this revival of the charter market reflects a fundamentally stronger demand for vessels or a temporary effect caused by the reshuffle of alliance networks remained to be seen (Danish Ship Finance, 2017).

The first quarter of 2017 saw some improvement in the container ship market. Both the freight and charter markets showed positive trends, partly supported by improved demand trends and limited fleet growth. The container ship charter market also started to see some improvement in March 2017, having remained at historically low levels throughout 2016 and early 2017 (Clarksons Research, 2017c.)

Figure 3.2. New ConTex index, 2011–2016



Source: UNCTAD secretariat, based on data from the New ConTex index produced by the Hamburg Shipbrokers Association. See http://www.vhss.de (accessed 20 September 2017).

Note: The New ConTex is based on assessments of the current day charter rates of six selected container ship types, which are representative of their size categories: Type 1,100 TEUs and Type 1,700 TEUs with a charter period of one year, and Types 2,500, 2,700, 3,500 and 4,250 TEUs with a charter period of two years.

2. Global container shipping carriers in financial distress

The year 2016 was one of the most challenging for carriers as they struggled to cope with persistent financial pressure caused by extensive overcapacity and poor market conditions. Despite the implementation of organizational and cost-adjustment measures by industry players aimed at mitigating risks and reducing expenses, global container shipping carriers continued to experience financial distress and rising operating losses, estimated collectively at $3.5 billion in 2016 (Drewry, 2017). A few carriers reported positive operating results, namely Hapag-Lloyd, with operating profits of $140 million, compared with $407 million in 2015 (Hapag-Lloyd, 2016). CMA CGM also reported operating profits of about $29 million in 2016, a sharp decrease from the $911 million earned by the company in 2015.[1] Maersk Line, on the other hand, reported operating losses of $376 million in 2016. (Maersk, 2016). Hong Kong (China) carrier Orient Overseas Container Line also reported operating losses of $185 million in 2016[2] (box 3.1).

Box 3.1 Operating profits and losses of selected shipping lines, 2015 and 2016

China Ocean Shipping (Group) Company

Net losses of the company amounted to RMB 9.9 billion ($1.45 billion) in 2016, its weakest annual performance since 2005, owing to persistently low freight rates and restructuring costs. Revenue growth generated from the container shipping business segment of the company was lower than growth in container shipping volumes, and the increase in revenue was less than the increase in costs.

In 2015, the company made net profits of RMB 283 million ($41.7 million).

In the last quarter of 2016, the company expects to realize operating profits (earnings before interest and taxes) of about RMB 700 million ($10.3 million), not including losses from the disposal of vessels.

CMA CGM

The company's net losses amounted to $325 million in 2016, compared with $567 million in profits in 2015. The loss rose to $452 million, including the contribution of Singapore-based Neptune Orient Lines, the parent of American President Lines, which it acquired in June 2016.

Operating profits (earnings before interest and taxes) fell from $911 million in 2015 to $29 million in 2016.

Transport volumes showed 20.4 per cent growth to 15.6 million TEUs, driven by the acquisition of Neptune Orient Lines, which consolidated the ranking of CMA CGM as the world's third largest carrier after Maersk Line and Mediterranean Shipping Company.

The average freight rate per TEU increased by 13.6 per cent for the full year, over 2015.

Revenue grew 1.9 per cent to $16 billion; excluding the share of Neptune Orient Lines, it fell 14.7 per cent from $15.7 billion to $13.4 billion.

Average unit cost: The group deployed its global operating efficiency plan named "Agility" that had led to a 5 per cent reduction of average unit costs in 2016, compared with 2015, excluding the effect of fuel price fluctuation. The company maintains its target to cut costs by $1 billion through December 2017.

Hapag-Lloyd

Operating profits (earnings before interest and taxes) of the company amounted to $140 million in 2016 (2015 financial year: $407 million).

Transport volume increased by 2.7 per cent to 7.6 million TEUs, driven primarily by growth on intra-Asian and Europe–Mediterranean–Africa–Oceania trade routes.

The average freight rate was $1,036 per TEU for the 2016 financial year, a decline of 15 per cent, compared with the prior year period.

Revenue decreased by $1.3 billion (less 13 per cent) in 2016 to $8,546 million.

Transport expenses per unit decreased by 15 per cent to $925 per TEU, mainly due to the implementation of cost-saving and synergy programmes, as well as lower bunker consumption and prices.

Maersk Line

Operating losses (earnings before interest and taxes) of the company amounted to $376 million in 2016.

Revenue was $20.7 billion, 13 per cent lower than in 2015 ($23.7 billion).

The average freight rate was at $1,795 per FEU, a decline of 19 per cent, compared with 2015.

Volumes grew by 9.4 per cent to 10.42 million FEUs. Volumes increased across all trade routes; the biggest contributors were the backhaul of the East–West trade route and the headhaul of the North–South trade route.

Transport unit costs decreased by 13 per cent. The unit cost benefited from improved fleet utilization, lower bunker prices and cost efficiencies.

Source: Annual reports and website of various companies, 2016; Reuters, 2017.

3. Container shipping: Focusing on consolidation in 2016

With a persistent overly supplied market and low freight market rates that placed carriers in prolonged financial distress, a major development that shaped the container shipping industry in 2016 was greater consolidation. Following the emergence of mega vessels, the industry witnessed the advent of mega alliances and new mergers and acquisitions in 2016.

Mergers and acquisitions

In 2016, a wave of consolidations was prompted by large mergers and acquisitions in the shipping industry. The industry, which comprised 20 large-scale international carriers, only numbered 17 by the end of 2016. This was the result of the acquisition of American President Lines by CMA CGM and the merger of China Shipping Container Lines and China Ocean Shipping (Group) Company, as well as the exit of Hanjin Shipping in September 2016 (Danish Ship Finance, 2016).

As of January 2017, these 17 carriers collectively controlled 81.2 per cent of the global liner capacity, compared with 83.7 per cent controlled by the 20 main carriers a year earlier.[3] The number will go down further with a new series of acquisitions concluded in 2017: the Maersk–Hamburg Süd sale and purchase agreement;[4] the Hapag-Lloyd and United Arab Shipping Company merger; and a new joint venture, Ocean Network Express, launched by

the three largest Japanese lines – Nippon Yusen Kabushiki Kaisha, Mitsui Osaka Shosen Kaisha Lines and Kawasaki Kisen Kaisha (K-Line). Operations of the new company are scheduled to begin in 2018.[5]

Mega alliances

In addition to mergers and acquisitions, shipping lines have undergone a transformation by reshuffling existing alliances and creating new ones. The top 10 carriers joined forces in three global alliances, down from four at the beginning of the year. Two new alliances, the Ocean Alliance and "The" Alliance were formed, in addition to the 2M Alliance.

The three alliances, which include the top 10 container shipping lines plus K-Line – the fourteenth largest container shipping line in the world – collectively control 77 percent of global container ship capacity (Baltic and International Maritime Council, 2017c), leaving a 23 percent market share for the world's other container shipping lines. The three alliances also control as much as 92 percent of all East–West trade. The Ocean Alliance will be the dominant player on the East–West routes, with about 34 per cent of total capacity deployed on these trade routes, followed by the 2M Alliance, with a share of 33 per cent, and "The" Alliance, 26 per cent (MDS Transmodal, 2017).

Box 3.2. Shipping alliances

2M Alliance	**Ocean Alliance**	**"The" Alliance**
Maersk (with Hamburg Süd) and Mediterranean Shipping Company	CMA CGM, Evergreen, China Ocean Shipping (Group) Company, and Orient Overseas Container Line	Hapag-Lloyd (with United Arab Shipping Company), Ocean Network Express (K-Line, Nippon Yusen Kabushiki Kaisha, Mitsui Osaka Soshen Kaisha Lines) and Yang Ming
Controls 37 per cent of the global shipping market	Controls 33 per cent of the global shipping market	Controls 21 per cent of the global shipping market

Source: JOC.com, 2016b.

Such alliances have become increasingly important in the global shipping industry, as carriers are seeking to improve utilization of capacity associated with larger vessels and to reduce operational costs by sharing vessels and capacity, for example.

Increasing consolidation among carriers may bring some order in a market that would benefit from a better management of supply and improved efficiency and synergies among carriers. This in turn would improve industry growth through the pooling of cargo, improved economies of scale, reduced operating costs and larger margins. Carriers could also see the benefit of such cooperation by sharing resources, including port calls and networks and developing new services. For example, sharing vessels would allow member carriers to operate without having to increase the number of ships. The advantage is that these shipping lines can also offer more services together than what they can generally offer alone, as a single shipping loop can tie up a vessel for weeks.[6] However, ports, including trans-shipment ports where competition is high and market shares are volatile, may be negatively affected in cases where deployment strategies by the alliances and the stringent requirements of ultralarge container ships result in increased preference for more direct connections. Some ports could be left out, while others may lose their market share.

Shippers could also derive some benefits in this consolidation that would lead to a more stable and healthier industry and result in less fluctuation in freight rates, better pricing because of economies of scale, and more efficient and extensive services offered by carriers including hinterland transport operations. (McKinsey and Company, 2017) Stronger partnerships among shipping lines could also provide for further prevention measures to protect the industry and shippers. That was the case for instance with "The" Alliance that set up an emergency fund for its members to tap into in the event of bankruptcy. The money from this fund will be used to provide a smooth operational flow and prevent supply chain disruption should a member be in financial distress. More specifically, it protects customers' cargo and ensures that goods reach their port of destination without having to confront similar problems experienced by Hanjin when it filed for bankruptcy. At that time, Hanjin had ordered its container-loaded vessels not to dock for fear of vessel seizure; at the same time, ports decided not to allow Hanjin vessels to dock for fear that the company would not pay the corresponding fees, leaving thousands of TEUs in cargo at sea.[7]

However, such a degree of consolidation may bring certain risks. For example, shipping lines may exert market power, limit supply and raise prices in the long run and once the industry reaches stability. As noted in the *Review of Maritime Transport 2016*, the growing concentration of the market has increased the risk that fair competition may become distorted and result in an oligopolistic market structure with potential impacts on the market, freight rates and shippers. Therefore, regulators will need to be watching closely future development of these alliances to ensure fair

competition and prevent anticompetitive behaviour in the liner markets.

In the meantime, consolidation will probably continue and the industry will focus on reducing costs through optimized and efficient networks, better fleet utilization and rationalization of activities, which in turn can bring supply and demand back into balance (McKinsey and Company, 2017).

In 2017, sector fundamentals are expected to continue to improve, following the challenging conditions of 2016. UNCTAD estimates that world GDP will expand by 2.6 per cent in 2017, up from 2.2 per cent in 2016 and that world seaborne trade volumes will reach 10.6 billion tons, reflecting an increase by 2.8 per cent, up from 2.6 per cent in 2016. Based on these projections, world shipping demand can be expected to improve in 2017 and therefore support freight rates. However, for such improvements to materialize, management of the supply side, including through a reduced order book, increased scrapping and cost-reduction strategies by sharing capacity among alliances, for example, is essential.

The new mergers and acquisitions and mega alliances that took place in 2016 and 2017 should lead to better handling of supply and better utilization of fleet, and in turn to better market conditions, improved earnings for the container shipping sector and better services for shippers. However, regulators need to keep a close watch on anticompetitive behaviour in the liner markets, as growing concentration may lead to market abuse, supply constraints and higher prices.

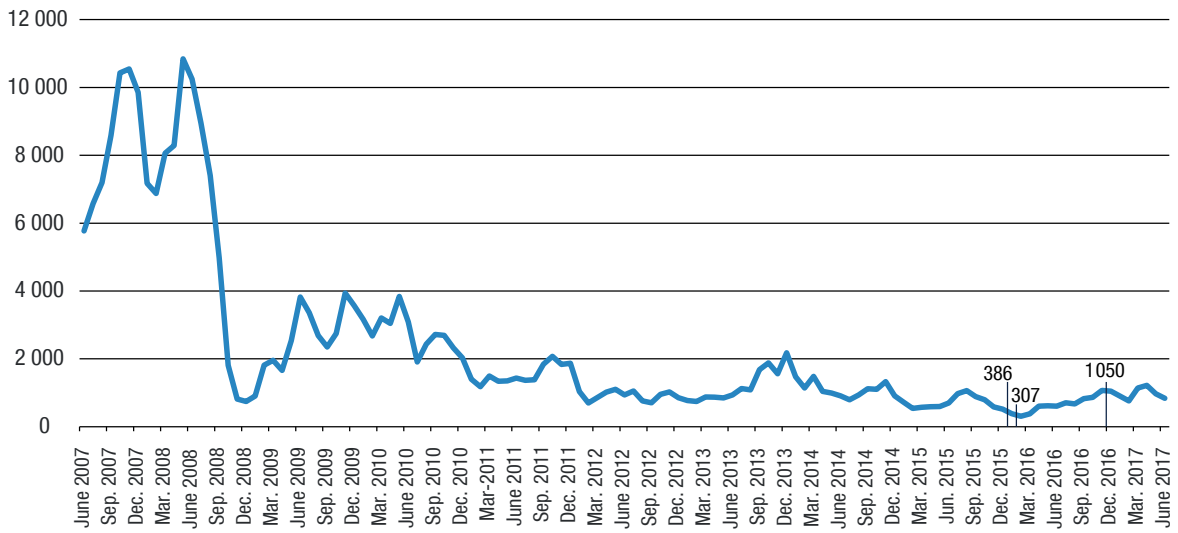
B. DRY BULK FREIGHT RATES

2016 was another difficult year for the dry bulk sector, which continued to face overcapacity and weak growth in demand. The year started with historically low freight rates as demand remained weak and the inflow of new vessels continued.

The Baltic Exchange dry index experienced record lows in 2016. It reached its lowest average – 307 – in February (figure 3.3). Dry bulk demand, especially for iron ore, improved towards year's end, when Chinese imports expanded in response to a new round of fiscal and financial stimuli launched by the Government to boost economic growth (Clarksons Research, 2017d). This mainly benefited the Capesize bulk carriers as they transported the key commodity of iron ore into China. The industry continued taking steps to limit fleet supply growth through increased scrapping and postponing or reducing deliveries of new vessels during 2016. As previously noted, the fleet capacity of bulk carriers grew by 2.22 per cent, one of its lowest rates of growth since 1999 (Clarksons Research, 2017d). As such, the management of supply growth and the boost in demand supported freight rates as they increased in the second half of the year, with the Baltic Exchange dry index reaching 1,050 in December 2016. Nevertheless, freight rates remained relatively low compared with historical data.

As a result of market imbalance in the dry bulk market, average earnings fell in all fleet segments, with figures dropping below $4,000 per day (Clarksons Research, 2017d).

Figure 3.3. Baltic Exchange dry index, 2007–2017



Source: UNCTAD secretariat calculations, based on data from the Baltic Exchange.
Notes: The index is made up of 20 key dry bulk routes measured on a time charter basis and covers Handysize, Supramax, Panamax and Capesize dry bulk carriers, which carry commodities such as coal, iron ore and grain. Index base: 1985 = 1,000 points.

1. Capesize

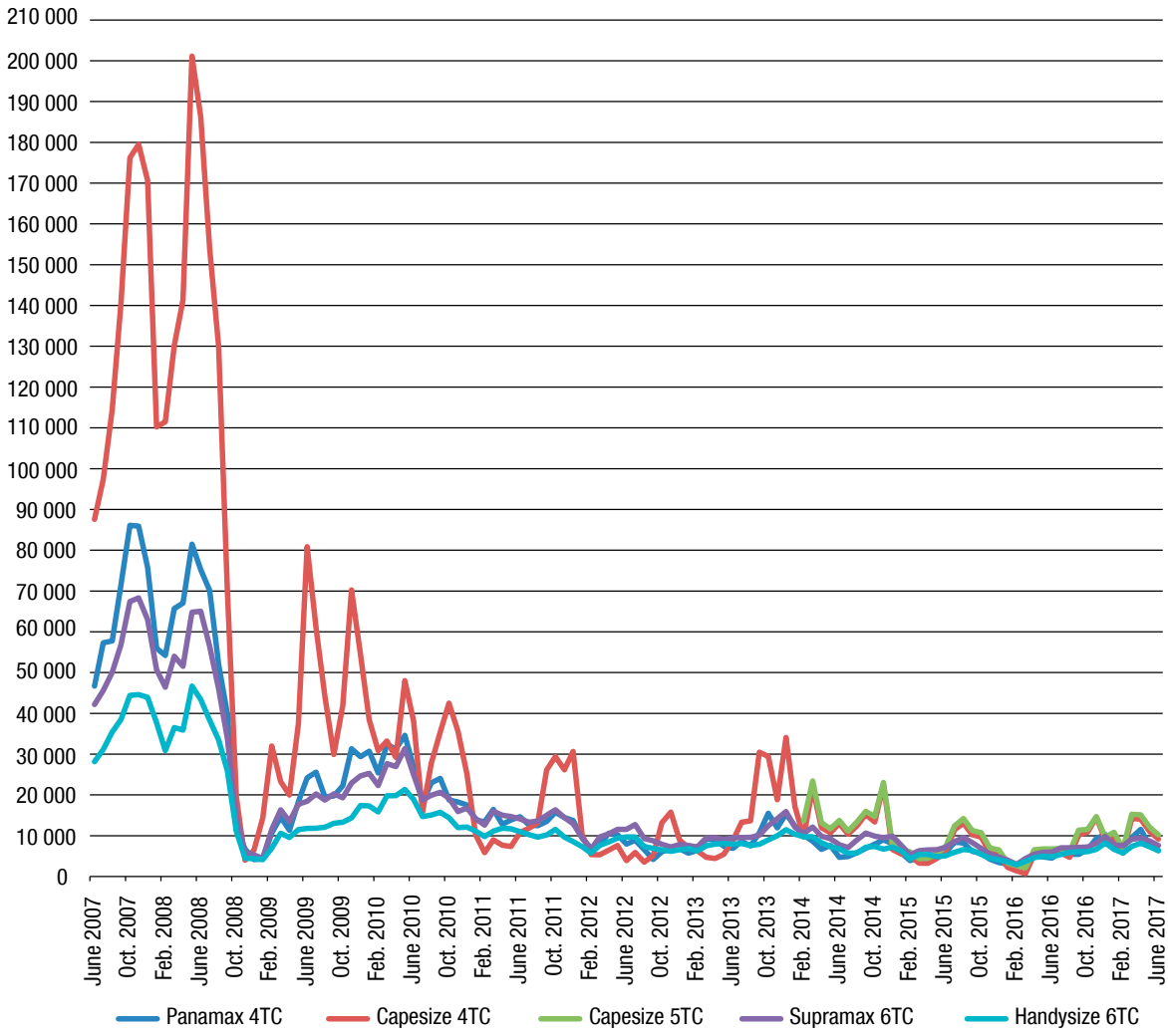
Capesize spot and charter rates continued to be volatile and highly depressed during much of 2016, affected by supply overcapacity and weak demand stemming from weak commodity markets and macroeconomic conditions. Rates dropped to their lowest level in the first half of the year, reaching an unprecedented point, as noted by the Baltic Exchange Capesize four timecharter average, which recorded an all-time low of $696 per day in March 2016 (figure 3.4). This resulted in many owners laying their ships up.

Yet Capesize earnings did improve in the second half of 2016 and into early 2017, supported partly by more positive trends in demand, in particular strong growth in iron ore trade. Furthermore, cheap voyage rates encouraged new long-haul trade, such as coal from Colombia to India and the Republic of Korea (Barry Rogliano Salles, 2017). Nonetheless, the market remained disturbed by oversupply, despite relatively slow fleet expansion (1.9 per cent in dwt) (Clarksons Research, 2017d). Postponement of newbuilding deliveries, along with a high level of scrapping and improved trade towards the end of the year, had a positive impact on earnings. As a result, the Capesize four timecharter average for the fourth quarter was at $11,447 per day, compared with an annual average of $6,360.

2. Panamax

In 2016, the Panamax sector also remained under pressure, reflecting an imbalance in fundamentals, with declining coal trade for the second year in a row and continued oversupply, which was curbed to a certain extent by substantial demolition activity. The average of the four timecharter routes for the Baltic Exchange Panamax index was about $5,615 per day, close to the previous year average of $5,507 per day.

Figure 3.4. Daily earnings of bulk carrier vessels, 2007–2017 (Dollars per day)



Source: UNCTAD secretariat calculations, based on data from Clarksons Research Shipping and the Baltic Exchange.
Abbreviations: Panamax 4TC and Capesize 4TC, average rates of the four time charter routes; Capesize 5TC, average rates of the five time charter routes; Supramax 6TC and Handysize 6TC, average rates of the six time charter routes.

However, in late 2016 and early 2017, Panamax earnings improved slightly, supported by seasonally strong grain shipments from South America and firmer coal trade, as well as tighter expansion in fleet capacity. Overall, Panamax fleet capacity expanded by 0.6 per cent in 2016, the slowest pace of growth recorded since 1992 (Clarksons Research, 2017d). The average of the four timecharter routes for the Baltic Panamax index reached $10,298 per day in December 2016, compared with $3,031 per day in January 2016.

3. Handysize and Supramax

Market conditions in smaller bulk carrier sectors were poor in 2016, with high levels of supply growth impaired by relatively slow demand growth in minor bulk trade and coal. As in other segments, the first half of the year was challenging; as a result, rates decreased and owners were compelled to lay up ships, delay newbuilding deliveries and cancel orders. Adjustments in supply, combined with renewed demand for raw materials (coal, iron ore and grain), led to market recovery and better freight rates in the second half of the year. The final quarter average was at $6,988 per day, whereas, the annual average of the six time charter routes for the Baltic Handysize index was traded at $5,244 per day in 2016, compared with $5,355 per day in 2015.

The annual average of the six time charter routes for the Baltic Supramax index was traded at $6,270 per day in 2016, compared with $6,922 per day in 2015. The final quarter average stood at $8,418 per day.

Sustained growth in demand and low contracting supply capacity will be necessary to produce a shift in fundamentals and raise freight rates.

Although the vessels order book was reduced significantly in 2016 through scrapping, delayed deliveries, low contracting activity and order cancellations, it is still too large, given current oversupply and future demand expectations (Clarksons Research, 2017d). As previously noted, prospects reflect a firming up in demand in the dry bulk trade sector, with the five major bulk commodities projected to expand in 2017. Therefore, it is essential that shipowners manage the supply side of the market carefully and limit its expansion. Charter rates are also expected to improve for most of the dry bulk segments in 2017, with the steepest recovery expected to take place in the Capesize segment.

C. TANKER FREIGHT RATES

In 2016, freight rates in all tanker segments went down from the high level of 2015, but were not far from the five-year average across most segments. Market conditions were altered with the arrival of new vessels and a slowdown in oil demand growth.

As shown in table 3.2, the average dirty tanker index declined to 726 in 2016, compared with 821 in 2015. This represents a decrease of 12 per cent. The average Baltic Exchange clean tanker index reached a low of 487 points in 2016, compared with 638 in 2015, 24 per cent less than the annual average in 2015.

Market fundamentals worsened in the crude tanker segment in 2016, as the fleet expanded rapidly, surpassing demand. This led to steep declines in freight rates. As previously highlighted, global seaborne tanker trade expanded by 4.2 per cent in 2016 over the previous year. Contributing factors included a sharp rise in oil imports into China, India and the United States, as well as the lifting of oil sanctions on the Islamic Republic of Iran, which increased export shipments from the Middle East. At the same time, global tanker deliveries also increased. Carriers of liquefied natural gas and other types of gas continued their high growth (+9.7 percent); oil tankers grew at 5.8 per cent and chemical tankers, at 4.7 per cent, following several years of low growth.

Freight rates for product tankers also fell in 2016 as market fundamentals deteriorated. The market observed about 4.6 per cent growth in the demand for seaborne products trade, together with fast growth of about 6.1 per cent in the product tanker fleet (Clarksons Research, 2017b).

These imbalances in markets fundamentals had a repercussion on earnings which came under further pressure, particularly in the last six months of the year. Overall, tanker earnings averaged about $17,917 per day in 2016, a 42 per cent decline, compared with 2015. This decline was affected by the rise in crude oil prices, which also had an impact on bunker costs. (Clarksons Research, 2017b). As noted in table 3.3, most Worldscale figures were below 2015 levels. Most annual average Worldscale spot rates for very large and ultralarge crude carriers declined in 2017. For instance, Worldscale values for the Persian Gulf–North–West

Table 3.2. Baltic Exchange tanker indices, 2007–2017

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Percentage change (2015–2016)	2017 (first half year)
Dirty Tanker index	1 124	1 510	581	896	782	719	642	777	821	726	-12	838
Clean Tanker index	974	1 155	485	732	720	641	605	601	638	487	-24	631

Source: Clarksons Research, Shipping Intelligence Network – Timeseries, 2017e.
Notes: The Baltic Exchange dirty tanker index is an index of charter rates for crude oil tankers on selected routes published by the Baltic Exchange. The Baltic Exchange clean tanker index is an index of charter rates for product tankers on selected routes published by the Baltic Exchange. Dirty tankers generally carry heavier oils – heavy fuel oils or crude oil – than clean tankers. The latter generally carry refined petroleum products such as gasoline, kerosene or jet fuels, or chemicals.

Table 3.3. Tanker market summary: Clean and dirty spot rates, 2010–2016 (Worldscale 100)

Vessel type	Routes	2010	2011	2012	2013	2014	2015	2016												Dec. 2015–Dec. 2016 (Percentage change)
		Dec.	Dec.	Dec.	Dec.	Dec.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Very large/ultralarge crude carriers (200 000 dwt+)																				
	Persian Gulf–Japan	61	59	48	64	77	90	76	62	62	81	66	53	43	37	37	55	64	80	-11.1%
	Persian Gulf–North-West Europe	57	59	26	..	32	59	43	36	38	44	36	29	25	28	30	30	43	53	-10.2%
	Persian Gulf–Singapore					71	83	63	63	62	67	64	53	43	34	33	52	73	83	0.0%
	Persian Gulf–United States Gulf	36	37	28	37	34	49	38	34	37	38	37	31	25	24	23	33	39	48	-2.0%
	West Africa–China	..	58	47	61	63	77	72	76	71	63	59	59	50	41	41	60	66	78	1.3%
	West Africa-United States Gulf	..	..	..	..	68	90	87	63	65	65	57	53	49	49	49	53	53	53	-41.1%
Suezmax (120 000–200 000 dwt)																				
	West Africa–Caribbean/East Coast of North America	103	83	65	97	79	81	81	76	74	77	68	74	61	36	71	68	65	80	-1.2%
	West Africa–North-West Europe	118	86	70	102	76	80	83	82	80	84	81	79	60	39	72	80	95	106	32.5%
	Mediterranean–Mediterranean	113	86	67	99	84	97	109	86	79	78	76	80	70	64	66	72	117	112	15.5%
Aframax (70 000–120 000 dwt)																				
	Caribbean–Caribbean/East Coast of North America	146	112	91	155	108	130	118	133	120	120	106	95	76	76	91	98	114	115	-11.5%
	Indonesia–Far East	111	104	90	99	116	126	136	115	165	119	90	96	90	76	63	80	85	118	-6.3%
	Mediterranean–Mediterranean	138	130	85	100	106	97	107	93	108	88	108	109	84	66	86	70	128	130	34.0%
	Mediterranean–North-West Europe	133	118	80	107	108	115	107	89	96	83	103	111	80	63	81	76	143	106	-7.8%
	North-West Europe–North-West Europe	162	122	93	135	113	113	112	99	113	111	103	107	90	79	93	93	101	112	-0.9%

Table 3.3. Tanker market summary: Clean and dirty spot rates, 2010–2016 (Worldscale 100) *(continued)*

Vessel type	Routes	2010	2011	2012	2013	2014	2015	2016												Dec. 2015–Dec. 2016 (Percentage change)
		Dec.	Dec.	Dec.	Dec.	Dec.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Panamax 40 000–70 000 dwt)																				
	Caribbean–East Coast of North America	..	..	..	..	113	160	120	130	120	120	115	120	95	88	85	85	120	134	-16.3%
	Mediterranean–Caribbean–East Coast of North America	146	121	160	105	130	n.a.	n.a.	118	98	110	n.a.	120	87	86	82	79	99	115	
	Mediterranean–Mediterranean	168	153	168	113	n.a.	150	n.a.	125	120	114	n.a.	136	108	94	96	104	133	156	4.0%
	North-West Europe–Caribbeean	..	..	..	..	118	129	134	88	123	104	104	93	93	80	84	81	95	129	0.0%
Clean tankers																				
80 000–120 000 dwt	Persian Gulf–Japan	..	..	..	81	102	90	111	97	97	87	86	82	89	104	63	88	75	87	-3.3%
50 000–80 000 dwt	Persian Gulf–Japan	..	..	..	93	110	94	121	102	114	100	102	92	101	111	86	67	67	87	-7.4%
35 000–50 000 dwt	United States Gulf–North-West-Europe	..	..	..	..	142	105	95	109	110	110	84	68	67	62	70	57	92	92	-12.4%
25 000–35 000 dwt	Singapore–East Asia	193	..	220	167	120	110	131	130	131	131	130	130	130	130	130	111	111	125	13.6%

Source: UNCTAD secretariat calculations, based on Drewry Shipping Insight, various issues.
Note: Figures are indexed according to voyage charter rates per ton for a 75,000-dwt tanker.

Europe route stood at 36 points, compared with 63 in 2015. The West Africa–United States Gulf route (TD4) average for December 2015 experienced a 40 per cent drop from December 2015 levels. Worldscale yearly average rates for most Baltic Exchange Suezmax tanker routes were also lower than 2015 levels. The Worldscale average for the West Africa–Caribbean–East Coast of North America route (TD5) was 69 points, compared with 82 in 2015. Worldscale values for the West Africa–North–West Europe route (TD20) stood at 78 points, compared with 80 in 2015. Average clean tanker freight rates were also significantly lower than in 2015.

In 2016, the oil tanker segment experienced a difficult year, spilling over to 2017 as freight rates for all crude oil and product tankers continued their decline, following a brief improvement at the end of 2106. The outlook appears challenging in the short term, given expectations for continued strong supply growth and numerous risks to the demand side.

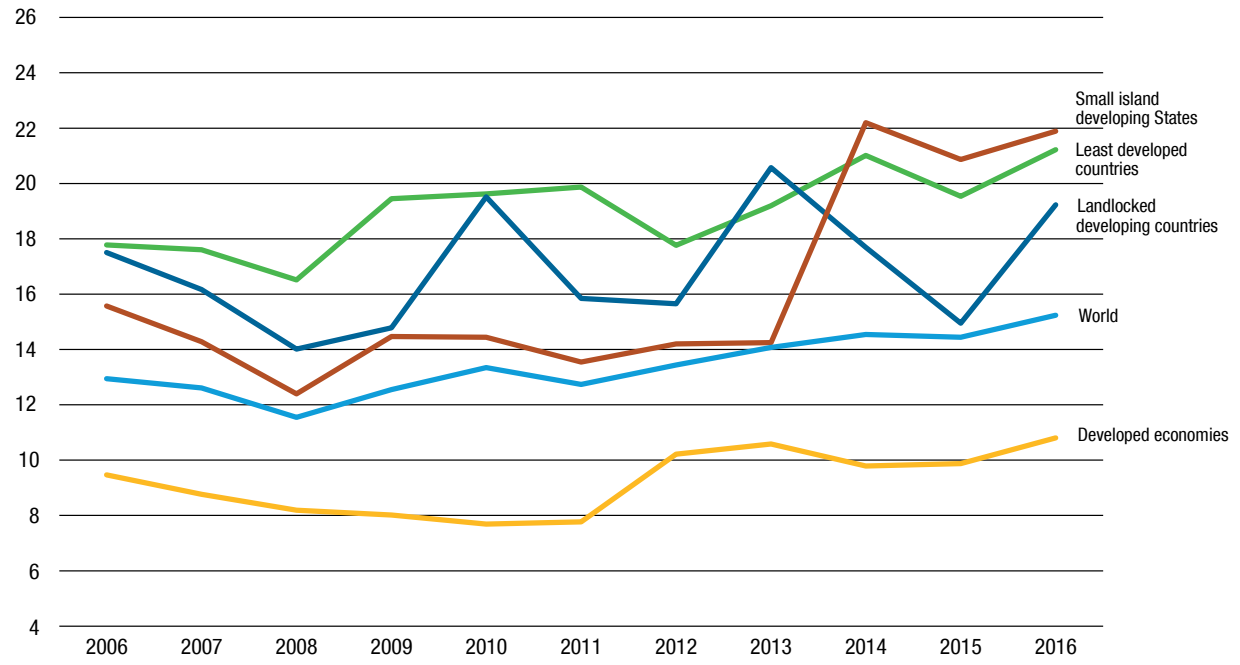
However, one important regulatory development may reduce fleet supply and support freight rates in the future. New IMO ballast water management standards, which became effective in September 2017, require ships using ballast water in international trade to be retrofitted with a ballast water treatment system. This would come at an estimated cost ranging between $1 million and $5 million (Barry Rogliano Salles, 2017) that may push shipowners to increase scrapping of their old tonnage with low earnings potential, instead of incurring the additional cost. This may also lead to better balanced market fundamentals as supply may contract considerably, in particular in the very large ore carrier segment, which constitutes a big fraction of today's older tonnage (Danish Ship Finance 2016).

D. INTERNATIONAL TRANSPORT COSTS

Figure 3.5 shows the transport costs across all modes of transport as a share of the value of imports. Figures are derived by calculating the c.i.f–f.o.b. margins (costs of transport and insurance of international trade) from 2006 to 2016. On average, low-income economies and geographically disadvantaged countries, namely landlocked developing countries and small island developing States, face relatively higher transport costs than other economic groupings.

Given that average transport costs represent about 21 per cent of the value of imports for least developed countries, 19 per cent for landlocked developing countries and almost 22 per cent for small island developing States, compared with a world average of 15 per cent, it is a priority to deal with the factors that drive up transport expenditure in these countries. While other considerations can determine a country's level of participation in value chains – local production costs, policy framework, just-in-time production methods and geographical distance between trading partners, for example – the incidence of relatively more prohibitive

Figure 3.5. Transport and insurance costs of international trade, 2006–2016 (Percentage share of value of imports)



Source: UNCTAD secretariat calculations.
Note: All modes of transport; the least developed countries grouping includes 48 countries for all periods up to 2016.

transport costs in the least developed countries, landlocked developing countries and small island developing States may be an important factor in their marginalization from global and regional transport and trading networks.

Distance and connectivity may be relevant factors in the case of landlocked developing countries and small island developing States, as illustrated by estimates showing that intercontinental trade increases transport and insurance costs by 2–4 per cent, as compared with comparable intracontinental trade (OECD, 2016). Other estimates show that for imports of electrical machinery for example, c.i.f.–f.o.b. margins are significantly lower for Chinese imports from Viet Nam and Hong Kong (China) than from other Asian economies and from Brazil and South Africa. Similarly, United States imports from Mexico and Canada have much lower c.i.f.–f.o.b. margins than those from other trading partners, as do French imports from European partners (OECD, 2016). However, economic distance, which is captured by shipping connectivity and a country's position within global shipping networks, may contribute more to rising international transport costs than geographical distance, it may be that is of important factor for international transport costs.

Fuel costs are also a key cost-factor heading in overall transport costs. An increase at the global level of oil prices from $25 to $75 per barrel increases the estimated c.i.f.–f.o.b. margin by 1.4 percentage points, all other factors being equal (Miao and Fortanier, 2017). Likewise, a reduction in oil prices from, for example $100 per barrel to $50 per barrel reduces the c.i.f.–f.o.b. margin by nearly 1 percentage point. These findings were corroborated in an UNCTAD study estimating the elasticity of shipping freight rates to oil price and bunker fuel costs. The study concluded that container freight rates, as well as the rates for shipping iron ore and oil, were positively correlated with fuel costs (UNCTAD, 2010).

However, recent trends suggest that the relatively lower oil and fuel cost environment prevailing since mid-2014 had not been reflected in the c.i.f.–f.o.b. margins (figure 3.5). This is particularly evident in the case of the landlocked developing countries and small island developing States. This may suggest that other transport cost determinants, such as product and trade composition, size and economies of scale or their lack, remoteness, transport connectivity, insufficient or inadequate infrastructure, as well as trade imbalances may have had a larger impact. Furthermore, it is also possible that lower fuel costs may have produced a rebound effect through increased demand and expenditure for transport services.

It is generally recognized that the incidence of higher transport costs is more significant in developing countries that specialize in low value goods with little potential for differentiation. This trend is more prominent in rural areas where transport challenges are greater and where access to market places is more difficult. For example, port cargo-handling charges in the Caribbean small island developing States are estimated to vary between $200 and $400 per container, compared for example, to $150 per container charged in Argentina. Similarly, the cost of transport and insurance is reported to be some 30 per cent higher than the world average. Freight rates between Miami, Florida (United States) and the Caribbean are similar to those paid for the much longer distance between Miami and Buenos Aires, Argentina. A container shipped between the port of Shanghai and the port of Los Angeles over a distance of over 19,000 nautical miles attracts a freight rate of approximately $700, while a box shipped from port of Kingston, Jamaica to Oranjestad, Aruba over 513 nautical miles attracts an average freight rate of $2,800 (UNCTAD, 2014). Overall, these trends create an effective barrier to trade which undermines their growth and prospects for sustainable development. However, research shows that lowering transport costs and improving infrastructure can foster trade and reduce the impact of barriers such as remoteness and distance in the case of the small island developing States (Borgatti, 2008).

In landlocked developing countries, transport costs represent an average of 77 per cent of the value of exports. Poor road infrastructure is responsible for 40 per cent of the transport costs in coastal countries, compared with 60 per cent in landlocked countries (Limão and Venables, 2000). Reflecting the particular challenge of landlocked developing countries, revenue losses from inefficient border procedures may exceed 5 per cent of GDP (an increase by $2.6 trillion) (Moïsé and Le Bris, 2013). Together, these factors heighten the overall costs of transport, which account for a larger share of the value of imported goods. The cost burden in landlocked developing countries is a constraint not only to imports but to exports – so is the cost premium associated with exporting a container from landlocked developing countries versus neighbouring coastal countries, which can range from 8–250 per cent (Arvis et al., 2010).

E. OUTLOOK AND POLICY CONSIDERATIONS

The weak trade economy since the 2008 recession and the overcapacity of the shipping industry have continued to limit growth in shipping. This was still true in 2016, where low demand and high overcapacity brought down freight rates and led to low profitability and a depressed year for all market segments. Despite some encouraging signs in early 2017 for most segments, the market situation is still challenging. Rates and demand levels remain low, which is why it is important to effectively manage overcapacity.

In the container ship segment, new mergers and acquisitions and mega alliances established in 2016 and 2017 may lead to better handling of supply and fleet

utilization, which in turn could lead to improved markets and profitability for the container shipping sector and services for shippers. However, there might be a risk that shipping lines exert market power, constrain supply and raise prices in the long run. Therefore, regulators will need to be vigilant of future developments in these alliances to ensure fair competition. It is also important to assess the implications of recent trends in liner shipping, including for small countries, and to revisit the rules governing consortiums and alliances to determine whether these should be regulated differently, with a view to balancing the interests of shippers and carriers and prevent abuse of market power.

Well-functioning, efficient, resilient freight transport systems are a prerequisite for successful trade and economic integration. They are also necessary to attract investment, develop business and build productive capacities. Helping countries, in particular small island developing States and landlocked developing countries, to manage the factors behind the increases in transport costs is key. This can be done by implementing soft measures, such as providing support for enabling frameworks and training, and facilitating technology transport; as well as hard measures, such as upgrading infrastructure and improving equipment procurement.

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ENDNOTES

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4

PORTS

The importance of well-functioning seaports for industrial activity, merchandise trade, globalized production processes and economic growth cannot be overemphasized. Global ports handle over 80 per cent of global merchandise trade in volume and more than two thirds of its value. As key nodes in global transport chains that provide access to markets, support supply chains, and link consumers and producers, ports are under constant pressure to adapt to changes in the economic, institutional, regulatory and operating landscape.

Growing competitive forces affecting ports emphasize the need for greater performance levels that extend beyond criteria such as the optimization of operations, cost reduction, time efficiency and trade promotion. More and more, ports are expected to improve performance in other areas – security, safety, resource conservation, environmental protection and social inclusion, for example. These factors are relevant to the global sustainability agenda and achievement of the Sustainable Development Goals.

At the same time, several megatrends are affecting the port industry, in particular the container port segment. These trends include the growing concentration and consolidation in the liner shipping market, the growing size of ships and the emergence of mega-alliances. In this context, attaining higher port performance levels and enabling the participation of the private sector in container port operations, in particular through public–private partnerships and port concessions, have become key considerations.

Section A addresses developments in container port traffic at the country and container port levels. Section B considers potential implications of the heightened concentration and consolidation in the liner shipping market, as well as the establishment of mega-alliances and the upsizing of ships. The importance of port performance in the face of growing competitive pressure is also addressed. Section C highlights the potential of public–private partnerships and port concessions as favoured mechanisms for private sector participation in ports. Section D concludes with an overall outlook and some policy implications.

TRENDS IN WORLD CONTAINER PORTS

Cybersecurity

Consolidation and concentration

Mega-ships

Mega-alliances

"The" Alliance | Ocean Alliance | 2M

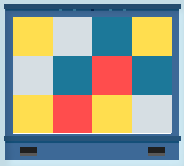
secondary routes

WORLD CONTAINER PORT VOLUMES BY REGION

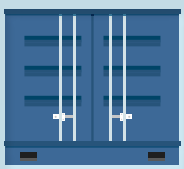
Asia	64%
Europe	16%
North America	8%
Developing America	6%
Africa	4%
Oceania	2%

TYPE OF TRAFFIC

76% of total volumes handled accounted for by full containers



24% empty containers



A. WORLD CONTAINER PORT DEVELOPMENTS

Despite modest improvement in world seaborne trade volumes in 2016, weaker world economic growth, dwindling merchandise trade volumes and rising cost pressures continued to weigh on the performance of world seaports. While these trends affect all ports, container ports are affected the most.

Throughout 2016 and until mid-2017, world container ports continued to deal with the deployment of ever larger ships, cascading of vessels from main trade lanes to secondary routes, growing concentration in liner shipping, heightened consolidation activity, a reshuffling of liner shipping alliances and growing cybersecurity threats.

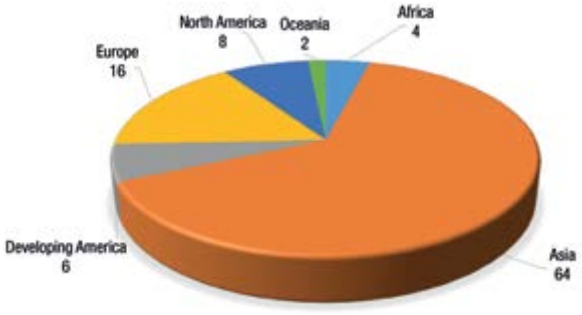
1. World container port handling and throughput

As shown in table 4.1, UNCTAD estimates that world container port throughput increased by 1.7 per cent in 2015, with total volumes reaching 686.8 million TEUs. This is less than half the growth recorded in 2014, reflecting the difficulties experienced by world containerized trade flows in 2015.

For 2016, preliminary UNCTAD figures indicate that world container port throughput increased by 1.9 per cent, with volumes totalling 699.7 million TEUs. According to data from Clarksons Research, 76 per cent of total volumes handled in 2016 were accounted for by full containers, and 24 per cent, by empty containers. (Drewry Maritime Research, 2017a). Trans-shipment incidence was estimated at 26 per cent, although a marginal drop in absolute TEU figures handled was observed in 2016.

Regional shares of world port container traffic for 2016 are illustrated in figure 4.1. Asia accounted for 64 per cent of world container port throughput, with Eastern and South-East Asia being the key players. Remaining container cargo flows were handled by ports in Europe (16 per cent), North America (8 per cent), Developing America (6 per cent), Africa (4 per cent) and Oceania (2 per cent).

Figure 4.1. World container port volumes by region, 2016 (Percentage shares)



Source: UNCTAD secretariat calculations, based on data from table 4.1.

In 2015 and 2016, container port-handling growth rates remained below the historical trends of the 1980–2016 period. They are also among the lowest growth rates recorded between 2000 and 2016, with the exception of 2009, when volumes fell by 8.1 per cent (Drewry Maritime Research, 2016a). As shown in figure 4.2, volumes handled by container ports in Asia increased by 2.6 per cent, with handling activity in Southern Asian ports expanding at a rate of 11.2 per cent. Selected ports in India, such as Cochin, Kolkata and Krishnapatnam, performed particularly well. Elsewhere in Europe and North America, port-handling volumes expanded by 2.4 per cent and 1.3 per cent, respectively. In addition, a decline in port volumes handled in some regions hindered overall container port throughput expansion. Contractions were recorded in Africa (-0.7 per cent), developing America (-1.2 per cent) and Western Asia (-0.7 per cent).

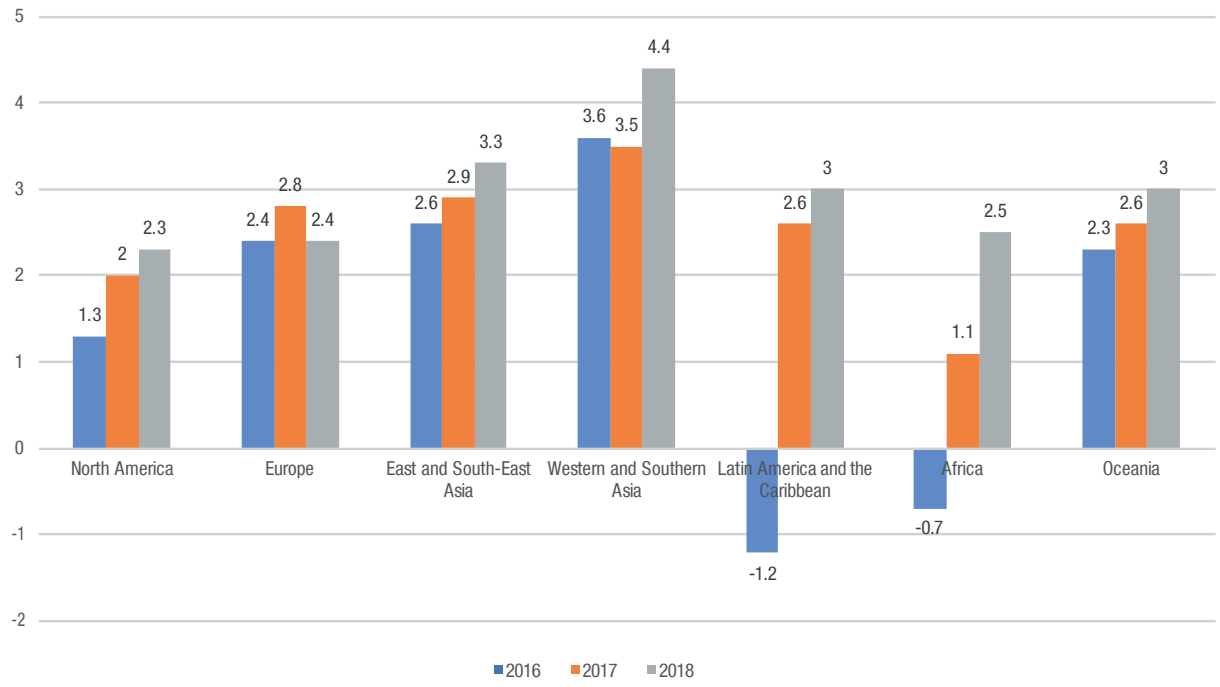
Table 4.1. World container port throughput by region, 2014 and 2015) (Twenty-foot equivalent units and annual percentage change)

	2014	2015	2016
Africa	28 027 967	28 122 893	27 909 132
Asia	429 641 660	439 573 985	446 813 796
Developing America	45 615 876	45 804 387	45 915 853
Europe	109 018 957	108 359 396	113 831 821
North America	51 659 185	53 689 663	54 120 207
Oceania	11 017 084	11 139 239	11 112 739
Total	**674 980 729**	**686 689 563**	**699 703 546**
Annual percentage change	**5.7**	**1.7**	**1.9**

Sources: UNCTAD secretariat calculations, based on data from various sources, including Lloyd's List Intelligence, Hofstra University, Dynamar B.V., Drewry Maritime Research, *Containerization International* (up to 2014) and information published on websites of port authorities and container port terminals.

Note: Data are reported in the format available. Where current-year figures are not available, estimates are made based on averages and extrapolations from data of previous years. Country totals may conceal the fact that minor ports may not be included; therefore, in some cases, the actual figures may be different from the totals reported in the present table. Individual country data and relevant updates are available at *http://unctadstat.unctad.org* under "maritime transport".

Figure 4.2. Container port volume growth, 2016–2018



Source: Drewry Maritime Research, 2017.
Note: Data for 2017 and 2018 are projected figures.

Volumes in Jebel Ali, for example, fell by 5.3 per cent, partly because more and more liner services in the region were eschewing trans-shipment services altogether, given excess ship capacity and low bunker costs. Also, the removal of sanctions that had been levied against the Islamic Republic of Iran diverted some business away to Bandar Abbas. Today, the medium- to longer-term growth prospects of Jebel Ali remain uncertain as the situation of neighbouring ports, such as Bandar Abbas, Karachi and ports on the Indian West Coast, continues to improve.

2. Leading world container port terminals

Table 4.2 ranks the top 40 container ports by volumes handled. Together, these ports handled a total of 415.9 million TEUs, nearly 60 per cent of the world total. The 10 leading ports, mainly in Asia, accounted for about one third of the market. Only 21 ports increased volumes handled by more than 1 per cent; the largest increases were recorded by Piraeus (14.1 per cent); Kelang (10.7 per cent), which overtook Rotterdam as the eleventh leading port worldwide; Colombo (10.6 per cent); and Cat Lai (Ho Chi Minh City) (10 per cent).

Despite the recent slowdown in China of container port volumes, which reflects the rebalancing of its economy away from a growth path focused on exports and investment, the country continues to dominate the container port sector: seven of the top 10 container ports are in China. Nearly half of the volumes handled by the top 40 rankings in 2016 were attributed to container ports in China. Only the ports of Hong Kong (China) and Shenzhen recorded a contraction in volumes, while other major players such as Guangzhou and Ningbo–Zhoushan reported positive performances. Dalian improved its handling volumes over 2015 and is involved in projects aimed at boosting hinterland demand, such as sea-to-rail intermodal transportation and cross-border trains (Lloyd's Loading List, 2017a).

According to some reports, port congestion at key hub terminals in China could affect other Asian ports and disrupt feeder operations in the region. The ports of Shanghai, Qingdao and Ningbo have been struggling with congestion caused by the increased volumes, as well as by liner alliance networks, poor weather, strong demand and the deployment of larger vessels by carriers (Lloyd's Loading List, 2017b).

In 2016, the Port of Singapore improved its position over the previous year but continued on a downward trend, with volumes falling by 0.1 per cent. Ranked sixth, Busan exchanged places with the Port of Hong Kong (China), which moved back one rank. Volumes in Tanjung Pelepas declined by 8.8 per cent. Positive trends in the Philippines, Thailand and Viet Nam helped offset the impact of slower growth in the Chinese manufacturing sector (Lloyd's Loading List, 2017a). Meanwhile, Colombo continued to record throughput growth following the opening of a third terminal, the only deep-water terminal in Southern Asia capable of handling ships with a capacity of 18,000 TEUs and above (Lloyd's Loading List, 2017a).

Table 4.2. Container port volumes handled at top 40 container terminals, 2015 and 2016 (Twenty-foot equivalent units, percentage shares and rank)

Port	Country	2016 (Throughput)	2015 (Throughput)	2015–2016 (Percentage change)	2016 (Rank)
Shanghai	China	37 135 000	36 537 000	1.6	1
Singapore	Singapore	30 930 000	30 962 000	-0.1	2
Shenzhen	China	23 980 000	24 204 000	-0.9	3
Ningbo	China	21 565 000	20 593 000	4.7	4
Hong Kong	Hong Kong (China)	19 580 000	20 114 000	-2.7	5
Busan	Republic of Korea	19 378 000	19 296 000	0.4	6
Guangzhou	China	18 859 000	17 457 000	8.0	7
Qingdao	China	18 050 000	17 465 000	3.3	8
Dubai	United Arab Emirates	14 772 000	15 592 000	-5.3	9
Tianjin	China	14 523 000	14 109 000	2.9	10
Port Kelang	Malaysia	13 167 000	11 891 000	10.7	11
Rotterdam	Netherlands	12 385 000	12 235 000	1.2	12
Kaohsiung	Taiwan Province of China	10 460 000	10 264 000	1.9	13
Antwerp	Belgium	10 037 000	9 650 000	4.0	14
Xiamen	China	9 614 000	9 179 000	4.7	15
Dalian	China	9 584 000	9 449 000	1.4	16
Hamburg	Germany	8 900 000	8 825 000	0.8	17
Los Angeles	United States	8 857 000	8 160 000	8.5	18
Tanjung Pelepas	Malaysia	8 029 000	8 799 000	-8.8	19
Cat Lai	Viet Nam	7 547 000	6 863 000	10.0	20
Laem Chabang	Thailand	7 227 000	6 821 000	6.0	21
Long Beach	United States	6 775 000	7 192 000	-5.8	22
New York	United States	6 250 000	6 372 000	-1.9	23
Yingkou	China	6 087 000	5 921 000	2.8	24
Colombo	Sri Lanka	5 735 000	5 185 000	10.6	25
Tanjung Priok	Indonesia	5 515 000	5 201 000	6.0	26
Bremerhaven	Germany	5 489 000	5 546 000	-1.0	27
Suzhou	China	5 479 000	5 102 000	7.4	28
Lianyungang	China	4 829 000	5 009 000	-3.6	29
Algeciras	Spain	4 745 000	4 511 000	5.2	30
Valencia	Spain	4 660 000	4 668 000	-0.2	31
Tokyo	Japan	4 653 000	4 623 000	0.6	32
Jawaharlal Nehru	India	4 475 000	4 468 000	0.2	33
Manila	Philippines	4 427 000	4 135 000	7.1	34
Jeddah	Saudi Arabia	3 997 000	4 188 000	-4.6	35
Piraeus	Greece	3 750 000	3 287 000	14.1	36
Felixtowe	United Kingdom	3 745 000	4 043 000	-7.4	37
Savannah	United States	3 645 000	3 737 000	-2.5	38
Seattle	United States	3 529 000	3 529 000	0.0	39
Santos	Brazil	3 564 000	3 774 000	-5.6	40
Total		**415 928 000**	**408 956 000**	**1.7**	

Source: UNCTAD secretariat calculations, based on data from Drewry Maritime Research, 2016a.

In Northern Europe, Antwerp reported 4.0 per cent growth, while volumes in Rotterdam increased by 1.2 per cent. The Port of Hamburg continued to experience the negative impacts of growth in direct services heading for Baltic and Scandinavian ports, resulting in reduced demand for services to these regions. Partly supported by trade with China and an improving trade situation in the Russian Federation, the Port of Hamburg recorded an increase of 0.8 per cent (Lloyd's Loading List, 2017a).

Algeciras ranked first in the Mediterranean, with a volume increase of 5.2 per cent. In comparison, volumes in Valencia Port declined by 0.2 per cent. Performance of both ports was affected by labour disputes. However, recent labour disruptions in Piraeus seem to have ceased with its privatization. The port reported a 14.1 per cent increase in volumes, owing to the presence of China Ocean Shipping (Group) Company. The impact of carriers' growing preference for ships making more direct calls seems to be affecting trans-shipment ports in the Mediterranean and in Northern Europe. Reflecting this trend, volumes handled in 2016 by the top nine trans-shipment ports remained static, at about 125 million TEUs. Together, slow steaming, low bunker prices and cascaded ships have contributed to creating more direct port pairs, taking away some business from the hub ports.

Performance of North American ports was mixed. Volumes increased by 8.5 per cent in Los Angeles, owing to the improved economic situation and consumer confidence in the United States. Growth in North American port volumes also reflected rising Asian import demand, which was supported by a favourable exchange rate. In contrast, throughput in the Port of Long Beach contracted by 5.8 per cent, owing to the collapse of Hanjin Shipping. Yet the expansion of the Panama Canal does not seem to have supported growth in Atlantic Ocean ports such as Charleston and Virginia.

3. Global and international terminal operators

World container port volumes, including in the context of the top 40 container ports, are largely handled by global and international terminal operators. In 2015, terminals owned in full or in part by global and international terminal operators accounted for 65 per cent of global throughput; the remaining shares were handled by other private interests (18 per cent) and the State (19 per cent). The share of global and international terminal operators grew slightly with the arrival of a new member (Yildirim Group) in 2015. The top 10 global and international terminal operators are listed in table 4.3.

In 2015, global and international terminal operators accounted for about 60 per cent of world capacity, up from 57 per cent in 2014. About 20 per cent of capacity was represented by other private operators; if all global and international terminal operators were to be considered private operators, about 80 per cent of global capacity would be in the hands of the private sector. The remaining balance is controlled by the State.

4. Trends in capacity expansion

Against a backdrop of weaker global demand, terminal operators and investors have been reconsidering their capacity expansion plans, in particular longer-term projects that have not been committed or initiated. Drewry Maritime Research estimates that overall growth in confirmed capacity will outpace demand projections, which may require cancelling capacity expansion plans in the future. Nevertheless, some regional variations remain, with projected demand expected to surpass planned capacity growth in some regions (e.g. East Coast of North America, China and Oceania). In contrast, capacity expansion is expected to outweigh demand growth elsewhere, for example, in Northern and Western Africa, Southern Asia and the Gulf Coast of North America (Drewry Maritime Research, 2016b).

Assuming all planned projects are implemented, it is likely that capacity growth in Africa and Southern Asia will be significant. In Western Africa, for example, a sharp increase in port development projects is being observed, fuelled mostly by Chinese investment in African infrastructure projects. Several projects are under way, and others are in the pipeline. Dredging works are in progress at ports such as Abidjan, while ground and soil improvements are being carried out in Lomé. In some cases, new greenfield sites have been selected to boost capacity, as illustrated by the $1.5 billion project in the Port of Lekki, Nigeria. The expansion project of Tema Port, estimated at $1.5 billion, is expected to reach completion by the end of 2019, while the Takoradi Port expansion project of $197 million is well under way. Similarly, the Ghana liquefied natural gas import terminal project ($500 million) and the Atuabo Freeport project ($700 million) are in the final stages of construction. A $690 million expansion project is being implemented in Dar es Salaam Port (Port Development West Africa, 2017). Other important developments include the Mombasa–Nairobi Standard Gauge Railway, which opened in May 2017, and the Lamu Port–South Sudan–Ethiopia Transport Corridor project. However, many projects are uncertain, given the overall economic situation and obstacles to container trade growth. While some projects are likely to go through, others may require further backing, especially from carriers (Drewry Maritime Research, 2017b).

Port project developments are also a prominent feature of the One Belt One Road Initiative. Several Asian countries, including Malaysia, Myanmar, Pakistan and Sri Lanka, have been at the forefront of these plans. Greece has also been a notable case, while developments and relevant port expansion discussions are under way in Georgia, Indonesia and Viet Nam. The feasibility of a new canal across the Kra Isthmus in Thailand is also being investigated (Richard, 2017).

Table 4.3. Top 10 global and international terminal operators, 2015

Rank		Milllion 20-foot equivalent units	Share in world container port volumes (Percentage)	2014–2015 (Annual percentage change)
1	PSA International	53	7.7	-3.7
2	Hutchison Port Holdings	47	6.9	-0.1
3	DP World	37	5.4	3.3
4	APM Terminals	36	5.2	-3.0
5	China Merchants Port Holdings	26	3.8	2.0
6	China Ocean Shipping (Group)	20	3.0	1.8
7	Terminal Investment	18	2.7	9.2
8	China Shipping Terminal Development	9	1.3	13.5
9	Evergreen	8	1.1	-3.8
10	Eurogate	7	1.0	0.9

Source: UNCTAD secretariat calculations, based on data from Drewry Maritime Research, 2016a.
Note: Figures include total annual throughput for all terminals in which shareholdings held on 31 December 2015 were adjusted according to the extent of equity held in each terminal. Figures cover 2015, when China Ocean Shipping Liner (Group) Company and China Shipping Terminal Development were still separate companies (they merged in 2016).

B. WORLD CONTAINER PORTS AND LINER SHIPPING MARKET DEVELOPMENTS

1. Container ship upsizing

The deployment of mega-ships affects port terminals across the ship–port interface, and with regard to yard and terminal operations, as well as gate and hinterland operations.

As maritime access may be limited by draft restrictions, larger container ships normally call at fewer ports. The physical features of such ships and handling requirements add pressure to berth and crane operations. To quickly service the larger-sized ships, terminal operators use cranes over longer working hours and more shifts. For example, it was reported that in the ports of Los Angeles and Long Beach, terminals are regularly deploying six cranes per ship, given that calls by 8,000 TEU-capacity ships are becoming the norm. With ship sizes further increasing to 14,000 TEUs, the use of seven or eight cranes can be expected (JOC.com, 2014). Additionally, larger port calls may require ships to spend more time at berth, which in turn reduces crane availability. More time is also required to lash and unlash container berths (Port Economics, 2017).

Larger ship calls are often associated with lower service frequency and periods of peak volumes at port terminals. Peak volumes handled by larger vessels lead to overutilization of port capacity on some days and underutilization on others (Drewry Maritime Research, 2016b). As a result, a reduction in berth utilization measured in TEUs per metre of berth has been observed.

Less frequent calls, but greater cargo volumes being handled per call resulting from the deployment of larger vessels create surges and pressure on yard operations, given the ensuing peaks. The global average measured in TEUs handled per hectare is estimated to have increased by 2.5 per cent in 2015. As more equipment is required to move containers to and from stacking areas, additional equipment and labour are necessary. Pressure is also imposed on the restacking of containers through increased requirements for gantry cranes of yards and stacking density. For specialized cargo such as refrigerated goods, larger port call volumes exert pressure on the usage of reefer slots.

Sharp increases in cargo volume also create greater demands on gate access, with more trucks arriving and leaving with larger numbers of containers. This creates more local congestion as more trucks are waiting to enter the port. Overall, large container ships provide economies of scale at sea, but these economies do not necessarily extend to ports. One study finds that a 1 per cent growth in ship size and its auxiliary industry operations increases time in port by nearly 2.9 per cent and creates diseconomies of scale at ports, indicating that economies of scale that are gained at sea are lost at ports (Guan et al., 2017). The challenge with larger

ships is how to avoid lost time at berths, as ships take up more space and remain in port longer (JOC Group, 2014). Another challenge, especially for smaller ports in developing regions, is how to decide on the design of terminals, type of cargo-handling equipment to invest in, extent of automation and digitalization of equipment, type of technology to adopt, and port and staffing-level management (Lloyd's Loading List, 2017c).

While there will be winners and losers in this new operating landscape, the extent of the associated gains and losses are yet to be fully understood.

2. Liner shipping alliances and market concentration

As ships and alliances become larger, the number of ports and terminals that can accommodate their ship calls becomes limited. As the scale expansion in shipping is rarely matched with an equivalent expansion in ports, some ports and terminals – especially secondary ports with relatively lower volumes and weaker bargaining power – are likely to lose their direct connections.

Direct mainline services are becoming more frequent, as mega-alliances have created more direct port pairs. The implications for trans-shipment ports, where the level of competition forces terminals to increase productivity and reduce prices, can be significant (Drewry Maritime Research, 2017a). Trans-shipment ports are more vulnerable to market share volatility, as lines can easily switch to competing ports. In contrast, ports that handle a mix of gateway cargo and trans-shipment are more resilient to such a practice (Notteboom et al., 2014).

In the current context of larger and more powerful alliances, decisions made by mega-alliances are of strategic importance for ports (Drewry Maritime Research, 2017c). Ports will be increasingly required to increase productivity and could be expected to harmonize and streamline customs procedures, reduce cabotage restrictions and provide suitable infrastructure (Lloyd's Loading List, 2017c). To accommodate an alliance, a trans-shipment port in South-East Asia, for example, may require a capacity of 7–9 million TEUs. This creates a barrier to entry, given the associated investment requirements. It is no longer possible for an operator to enter the market with 600–800 metres of berth.

Mega-alliances and continued consolidation trends in liner shipping might lead to concentration of market power in the hands of a few major players. Alliances will focus on faster transit times and reliability by raising network efficiency and reducing port calls. Shippers can be expected to pay higher prices for shipping services, which in turn can undermine their competitiveness in the global marketplace. Shippers may also required to redefine their supply chains because of changes or reductions in port calls (MDS Transmodal, 2017).

The precise impact of mega alliances and growing ship sizes has yet to be fully understood and will require further monitoring. Clearly, trans-shipment services are key to liner shipping operations – trans-shipment boxes account for one in four TEUs handled at world ports today. While the trans-shipment of cargo is essential to optimize utilization of ultra-large container ships because it helps generate required cargo volumes, the level of trans-shipment incidence – estimated at 26 per cent of total port volume traffic in 2016 – may stabilize and possibly decline (Drewry Maritime Research, 2017c).

3. World container ports performance

Productivity gains and improved efficiency and operational performance are becoming even more important, given recent developments affecting the liner shipping market. Adapting to the new paradigm means that ports will need to upgrade their performance, including in terms of turnaround time (time in port of ships), dwell time (time in port of cargo), gate operations, hinterland connections and intermodal connectivity.

Various metrics have been used over the years to determine the performance of ports. These include indicators that assess the utilization rates and productivity of cranes, berths, yards, gates and gangs: TEUs per year per crane, vessel per year per berth, TEUs per year per hectare and moves per crane-hour. For instance, average performance levels in a large port can reach 110,000 TEUs per year per crane, 25–40 crane moves per hour, a dwell time of 5–7 days for imported boxes and 3–5 days for exported boxes (OECD, 2013).

While recognizing the inherent limitations of such a measure, ship time in port or turnaround time could, nevertheless, provide a proxy for overall port performance, as it measures the average time that ships spend in a port before departing to another destination. Using information on vessel movement data collected by Marine Traffic, tables 4.4–4.8 illustrate some examples of time in port, measured in days. The average time in port corresponds to the difference between the time a ship enters a port's limits, and the time it leaves those limits. Regardless of whether a ship's visit is related to cargo operations or other operations, such as bunkering, repair, maintenance, storage and idling, time in port includes the time prior to berthing, time spent at berth (dwell and working times) and time spent undocking and transiting beyond port limits. While the average time does not measure the precise efficiency of time in port since it does not distinguish between waiting time, berth time, and working and idle time, the data provide an estimation of overall time in port.

Bearing in mind these considerations, the average time in port worldwide is estimated at 1.37 days or 33 hours. Container ships boast the best performance – less than 24 hours spent within port limits. In contrast, tankers and bulk carriers seem to have longer port stays. Countries where ports seem to take less time to service

calling ships include Japan (all ship types), the Republic of Korea and Singapore. Many factors may explain why ships are spending less time in ports. Therefore, more analysis of the observed ship movement data is required to improve understanding of these factors.

Another study using data collected by monitoring vessel movements between 1996 and 2011 indicates an overall reduction in port turnaround time (figure 4.3). Between 2006 and 2011, Asia improved to levels matching those in Europe and North America and exceeded the world average. The best performing ports in terms of time efficiency or port turnaround time were Singapore (0.5 days), Hong Kong (China) (0.72 days), and Shanghai (0.79 days) (Ducruet et al., 2014).

Emphasizing regional differences, berth productivity per ship call reveals that Asian container terminals attain a higher performance than their counterparts in Europe and the United States. Some observers attribute the differences to ports and gates being open 24 hours a day, a high level of automation and large trans-shipment volumes in Asia (JOC Group, 2014). While differences in vessel size and call volumes affect and amplify differences in port productivity (World Bank, 2016a), operational models and costs per move also play a role.

Table 4.4. Average time in port: All vessels, 2016

Vessel type	Days in port	Total arrivals	Total vessels	Total dead-weight tonnage (thousands of tons)
Container ships	0.87	445 990	288 148	18 288 135
Tankers	1.36	309 994	205 034	8 504 418
Gas carriers	1.05	59 183	32 404	765 328
Bulk carriers	2.72	213 497	169 851	12 150 088
Dry cargo and passenger ships	1.10	2 065 505	474 982	6 372 305
Grand total	**1.37**	**3 094 169**	**1 170 419**	**46 080 274**

Source: Marine Traffic, 2017.
Note: Average time in port is equivalent to the average of median per world ports.

Table 4.5. Average time in port: Container vessels, 2016

Country	Days in port	Total arrivals
China	0.83	60 795
Japan	0.29	38 415
Republic of Korea	0.49	23 545
United States	0.97	19 844
Taiwan Province of China	0.40	16 895
Singapore	0.80	16 159
Malaysia	0.93	15 678
Germany	0.46	14 784
Spain	0.51	14 018
Netherlands	1.14	12 264
World total	**0.87**	**445 990**

Source: Marine Traffic, 2017.
Note: Average time in port is equivalent to the average of median per port per country.

Table 4.6. Average time in port: Tanker vessels, 2016

Country	Days in port	Total arrivals
Japan	0.45	54 015
Singapore	0.98	19 047
China	3.12	18 702
Netherlands	0.95	18 077
United States	1.54	17 526
Republic of Korea	0.92	11 894
Russian Federation	1.40	10 560
United Kingdom	0.94	9 950
Germany	0.58	8 509
France	0.96	8 205
World total	**1.36**	**309 994**

Source: Marine Traffic, 2017.
Note: Average time in port is equivalent to the average of median per port per country.

Table 4.7. Average time in port: Bulk carriers, 2016

Country	Days in port	Total arrivals
China	2.60	41 908
Japan	1.08	32 239
United States	1.88	14 104
Australia	2.12	12 840
Canada	1.50	11 278
India	2.83	8 885
Brazil	2.70	7 814
Indonesia	3.48	7 338
Republic of Korea	2.89	5 987
Russian Federation	3.40	4 579
World total	**2.72**	**213 497**

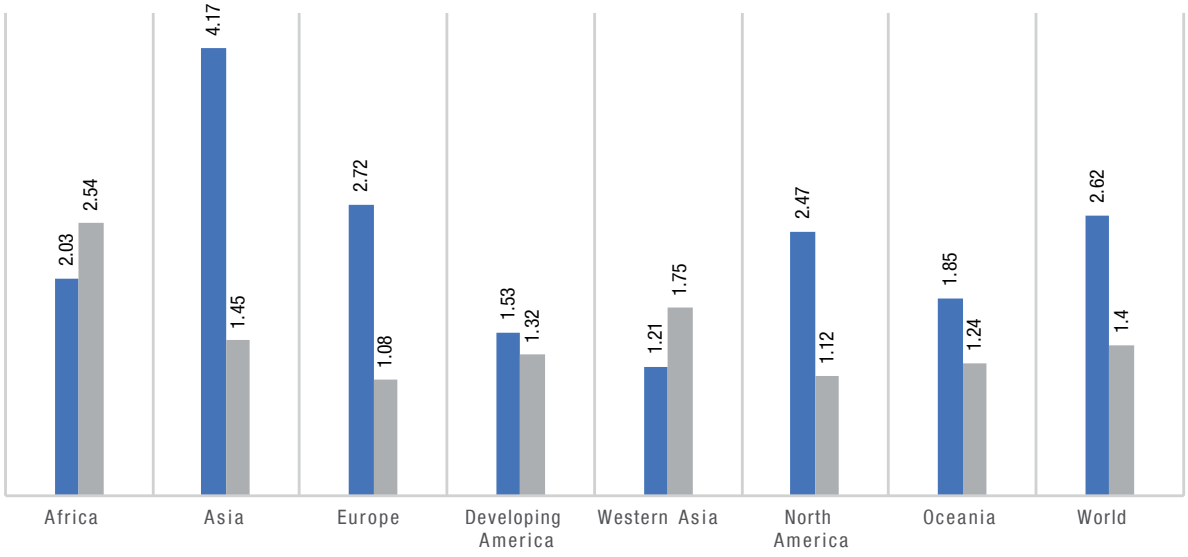
Source: Marine Traffic, 2017.
Note: Average time in port is equivalent to the average of median per port per country.

Table 4.8. Average time in port: Gas carriers, 2016

Country	Days in port	Total arrivals
Japan		22 279
Thailand	0.88	6 318
China	1.16	4 904
Republic of Korea	0.95	2 827
Indonesia	1.41	2 146
United Kingdom	0.99	1 932
Qatar	1.20	1 400
Singapore	1.10	1 219
Belgium	1.26	1 159
Netherlands	0.88	1 156
World total	**1.05**	**59 183**

Source: Marine Traffic, 2017.
Note: Average time in port is equivalent to the average of median per port per country.

Figure 4.3. Container port turnaround time, 1996 and 2011 (Number of days)

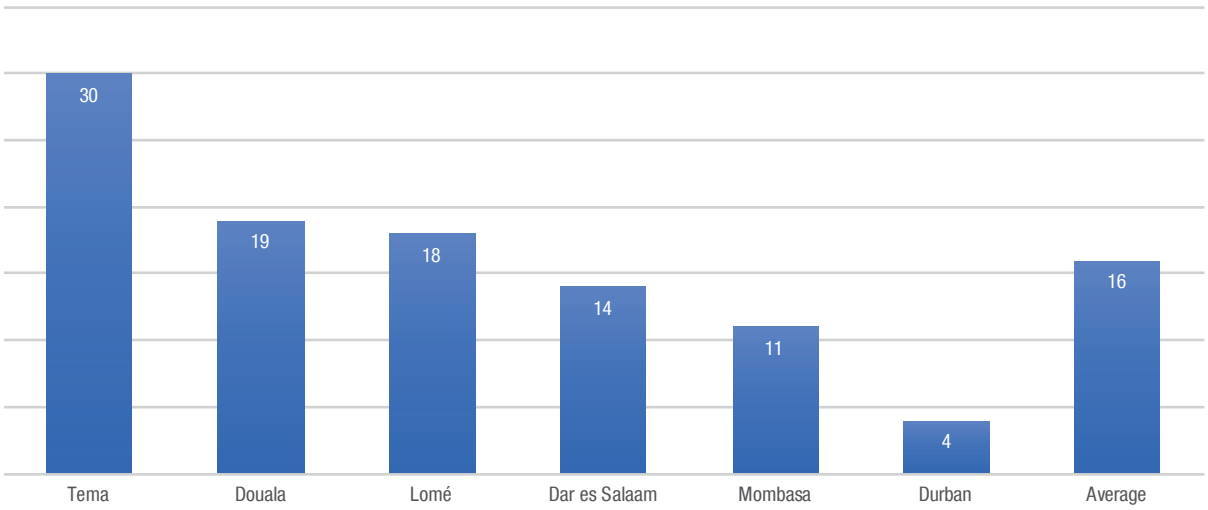


Source: Ducruet et al., 2014.

A measure complementing berth productivity and ship time in port is cargo dwell time. Efficient cargo handling operations as measured by crane productivity contribute significantly to cargo being able to rapidly leave the port. Reaffirming some of the observed trends, most effective operations seem to be concentrated in Asia, followed by those in Northern Europe. According to Drewry Maritime Research, the average crane productivity in 2009 was 136,531 TEUs per crane per year in Western Asia, 124,581 TEUs in Eastern Asia and 119,276 TEUs in South-East Asia; the lowest scores were reached in Eastern Europe (56,063 TEUs) and North America (71,741 TEUs) (OECD, 2013). Crane productivity is typically an average of 20 moves per crane per hour in Western Africa, 25 to 30 in South Africa and 35 to 40 in Asia.

Figure 4.4 provides examples of cargo dwell times in sub-Saharan Africa, which are unusually long, compared with performances in other regions such as Asia and Europe, where cargo dwell times in large ports are usually under one week. Not including Durban and Mombasa, the average cargo dwell time in most ports in sub-Saharan Africa is estimated at 20 days (Raballand et al., 2012). Recent data indicate that import container dwell times in Mombasa have improved, falling from

Figure 4.4. Average cargo dwell time in sub-Saharan Africa, 2011 (Number of days)



Source: Raballand et al., 2012.
Note: Average does not include Durban.

12 days in 2008 to 4.8 days in 2015. Delay after release declined from 72 hours in 2010 to 43 hours in 2015. For comparison, existing benchmarks for container dwell time and delay after release are 48 hours and 24 hours, respectively (Dooms and Farrell, 2017).

Enhancing port efficiency and reducing port dwell time is necessary to cut costs and enhance trade competitiveness. Some estimates indicate that increasing the port efficiency score of a given country – on a scale from 0 (most inefficient) to 1 (most efficient) by 0.1 unit – would reduce the maritime transport cost of its exports by 2.3 per cent. This, in turn, would lead to a 1.8 per cent increase in the country's exports (Herrera Dappe and Suárez-Alemán, 2016).

It is estimated that more than 50 per cent of total land transport time from port to hinterland cities in landlocked countries in sub-Saharan Africa is spent in ports (Arvis et al., 2010). On average, delays caused by poor handling and operational factors are found to generally account for no more than 2 days out of at least 15 days of dwell time. Delays are mainly due to transaction and storage time associated with controlling agencies' performance and, more importantly, strategies of importers and customs brokers, which tend to use port facilities as storage. To improve port performance and competitiveness, it is therefore necessary to have a better understanding of the various components of cargo delays in ports and address the underlying causes (Raballand et al., 2012). The Northern Corridor Performance Dashboard, which draws upon the Corridor's Transport Observatory – a performance monitoring tool with an online platform that tracks over 31 performance indicators for the Mombasa Port Community – provides useful information concerning factors that increase port cargo dwell times and delays (Northern Corridor Transit Transport Coordination Authority et al., 2017).

Relevant initiatives seeking to advance the work on port performance measurement include the Portopia project, which brings together an international consortium of academic, research and industrial partners with experience in port performance management. The aim is to support the European Port industry with performance data, in particular, to inform policy formulation and monitor implementation (Portopia, 2017). Another example is the work carried out under joint working group 174 on sustainability reporting for ports of the International Association of Ports and Harbours and the World Association for Waterborne Transport Infrastructure. One of the key objectives of this working group is to develop guidance relating to sustainability reporting for ports.

Apart from operational upgrades, equipment procurement, infrastructure development, efficient communications among port stakeholders, improved business practices, faster processes, streamlined and coordinated activities and reduced administrative and procedural inefficiencies are key to enhancing port performance in general and container port management in particular. In this respect, port community systems can help improve transactional efficiency, reduce costs and enhance reliability, while customs reforms and automation can support faster cargo clearance and reduce dwell time (box 4.1). Building the security of these systems and enhancing their resilience to security breaches and threats will be essential, given the growing exposure and vulnerability of port and shipping systems to security attacks.

Box 4.1. Port community systems, developments in information technology and collaborative arrangements

The UNCTAD Train for Trade Port Management Programme, and in particular, its Modern Port Management Programme, provides an opportunity for ports worldwide to share their experiences by carrying out case studies on the challenges faced by local ports, exploring solutions and formulating recommendations for the way forward. Useful insight, lessons learned and good practice in port operation and management are being generated in over 80 completed case studies and others are under way. An overview of selected case studies focusing on port community systems, developments in information technology, stakeholder collaboration and public–private partnerships, as well as their potential to enhance port performance, is given below.

Port Autonome de Cotonou. The Port of Cotonou uses various methods to deploy a new enterprise resource planning system and capture the perceptions and usage trends of its main users. Promoted by the Government of Benin, the new system is part of integrated management system of the Port of Cotonou, which carries out the following tasks: vessel traffic management, stevedore operation management, invoicing, apron side and shed management, management of goods and utility, provision of supplies for ships and user resource management. This enterprise resource planning system is part of a port strategy aimed at improving port management and port efficiency, through the use of information and communications technology. User participation in the inception phase and data transfer between systems was low, and a revision and adaptation process was lacking. Furthermore, hands-on training and administrator support for users were limited. Given these factors, it was recommended that additional consultants be engaged to help improve the situation, that stronger buy-in from management and port users be obtained, that work be prioritized and that proper training be provided to improve skills and change prevailing mindsets.

Port of Douala. The case study proposed methods and procedures to increase revenue collection and better manage the port land (1,000 hectares). The port's domain revenue represents 8.4 per cent of sales revenue, while those of the ports of Dakar and Abidjan represent 18 per cent and 13 per cent, respectively. It was recommended that the Cargo computer system application, which includes a domain management component, be implemented. Moreover, a proper scheme for domain utilization and allocation should be established and supervised by a dedicated commission.

Port of Dakar. The important role of specialized installations for improving port efficiency and attracting more traffic in a highly competitive range of ports in the subregion was highlighted in the case study. The Port of Dakar generates 30 per cent of State income, 90 per cent of external trade and 90 per cent of customs revenue, and caters for direct and indirect jobs in Dakar. It was recommended that the support of public–private partnerships be sought to deal with capital-intensive investments and develop transnational synergies between Senegal and landlocked countries that depend economically on the performance of the Port of Dakar. Achieving economies of scale, ensuring effective time management and enhancing land connections and global access are a must for its sustainable development.

Port of Tema. Cargo operators were identified as an integral part of the chain of actors in the port community, and their services constitute the prime criteria in the customer satisfaction index. Cargo handling is the largest cost heading in the total costs of moving goods through a port (40 per cent for bulk, 50 per cent for containers and 60 per cent for general cargo). The case study noted that investment in equipment by private stevedores was inadequate and was not in conformity with the relevant licensing agreement. Ten licensed stevedores operate in competition with the Ghana Ports and Harbour Authority's own section. Data show that private operators are working with 50–65 per cent of required equipment, which is below the 80–90 per cent rate envisaged by the agreement. This has a negative impact, including a 25 per cent delay in working container vessels, due to limited access to equipment and failure in the course of operations. Capital investments required to purchase equipment are too costly for private stevedoring companies. It was recommended that the Authority guarantee the loans.

Maldives Ports Limited. Challenges facing the Maldives Ports include limited space and infrastructure and insufficient room for rearranging the space used. Cargo is handled by ship gear, as the vessels in operation have 9.5 metres of draft and do not exceed 150 metres of length overall. Electronic services are one of the few options that could improve port performance. In addition, capitalizing on data modelling can help determine the best possible scenarios for cargo positioning in the port area. Expected benefits of adopting an electronic service model in Male's commercial harbour include reduced overhead costs, reduced time for completion of procedures, minimized error rates, improved customer services, a better organizational image and increased revenues. Electronic services technology provides a unique opportunity to simplify complex working procedures and improve port service delivery. Moreover, implementation costs are expected to be low, as most of the infrastructure and resources are already available. One challenge remains – the port community must accept the new system and opt for a comprehensive solution that would not simply combine existing single systems. Staff training would be important to combat fear of change and encourage the use of the future system.

Source: UNCTAD secretariat, Train for Trade Programme, June 2017; based on data from UNCTAD, 2014, 2015a and 2015b.

C. PRIVATE SECTOR PARTICIPATION IN PORTS

Ports and terminals benefit from the participation of private terminal operators, not only in terms of capital participation, but also in relation to the transfer of expertise and technologies. Over the last three decades, public–private partnerships have emerged as a mechanism to leverage greater private investment participation in port development and most importantly, to access specialized skills, innovations, and new technologies associated with infrastructure development, operation and maintenance. As today's ports systems require highly specialized managerial and operational skills, as well as cutting-edge technologies, the expertise of private partners for building, operating and maintaining transport infrastructure and services is significant and along with funding, constitutes an important resource.

1. Public–private partnerships

Building, operating and maintaining a port or terminal generally requires significant financial investment and highly developed managerial and technical skills and cutting-edge technologies. The increasing need to provide modern ports and cargo-handling facilities with terminal management and security systems has substantially increased capital and technical requirements of ports in recent years. Consequently, greater collaboration between the private and public sector has become necessary. While ports have been traditionally regarded as infrastructure and services to be provided by the public sector, a global shift towards private sector involvement, both in port infrastructure development and port operations, has taken place in recent decades.

Major changes in the ownership and operating structure of many ports have occurred, driven by the increasingly prominent role of the private sector, both as a source of finance and provider of services required for the successful operation of ports (Holman Fenwick Willan, 2015). This, in turn, has led to a change in the institutional structure of the port business and the role of the traditional owner and operator of a port – the port authority.

Today, the typical institutional structure in the port sector is the landlord port model. It is estimated that 85–90 per cent of global ports are landlord ports, which account for about 65–70 per cent of global container port throughput (Drewry Maritime Research, 2016). A typical landlord is a model where a port authority enters into concession agreements or public–private partnership schemes – or a combination thereof – for a series of individual terminals. The public or State-owned body would own and manage the port land and infrastructure, including common facilities such as breakwater and entrance channels, utilities and inland access (road, rail and so forth). It also acts as a landlord to tenants on long-term arrangements that invest in superstructure and equipment, and carry out cargo handling (Drewry Maritime Research, 2016).

Private partners acting on the basis of concessions is, on the other hand, responsible for terminal operations and related investments such as superstructure, equipment, cranes and wharf expansion. Concessions are generally awarded on a leasehold basis for 20 to 50 years and may include the rehabilitation or construction of infrastructure by the concessionaire. Concessions permit Governments to retain ultimate ownership of port land and responsibility for licensing port operations and construction activities and to safeguard public interests. At the same time, they relieve Governments of substantial operational risks and financial burdens. Private investments tend to range from minimum stakes of 20 or 30 per cent to total financing, depending on the host country and port authority (Holman Fenwick Willan, 2011).

In a concession, the port authority can indicate a minimum throughput to be guaranteed by the concessionaire. This encourages the lessee to market the facility and optimize terminal and land usage. Failure to meet this obligation will incur a penalty to be paid by the terminal operator or the lease can be subject to termination. Throughput guarantees are considered a powerful governance tool, enabling more effective land management and land productivity. Performance targets incentivize better terminal utilization rates. The more optimal the use of space within a port, the lower the barriers to new port entrants, providing an opportunity for the port to further diversify its activities (MDS Transmodal, 2017). In a way, these minimum throughput guarantees can be compared to minimum traffic guarantees in other transport modes, where the situation is, however, inverted where a Government may provide guarantees to ensure private sector participation. To take the example of the road sector, Governments often consider it their responsibility to provide a minimum traffic guarantee to a private partner, for example, toll road operators in greenfield projects, where income risk may be considered too high and would limit private investor participation. However, the practice of imposing minimum throughput guarantees on a private partner, even for greenfield projects, seems to indicate that there is a higher potential of private participation and risk taking and that markets are functioning better for the maritime and port sector than for the infrastructure side of land transport modes. Nonetheless, accurate studies and forecasts are also necessary for port terminal development in order to determine realistic throughput levels and terminal service demand.

Other types of port management structures and ownership models are described in box 4.2.

Box 4.2. Alternative port management structures and ownership models

There are four main port management models: public service ports, tool ports, landlord ports and private service ports. These characteristics may vary, depending on differing public and private sector responsibilites .

Each model has its own characteristics concerning the ownership of infrastructure, equipment, terminal operation and provision of port services to ships such as pilotage, towage and mooring. Service and tool ports mainly focus on the realization of public interests, whereas landlord ports aim to promote a balance between public interests (port authorities) and private interests (port industry). Fully privatized ports focus on private (shareholder) interests.

Public service ports. The port authority owns the infrastructure and performs the complete range of services required for the functioning of the port system, which means that the authority owns, maintains and operates all port infrastructure, superstructure, equipment and port assets, including cargo handling. Some ancillary services can be allocated to private companies. Service ports are generally a branch of a government ministry. The number of public service ports is declining.

Tool ports. These are similar to public service ports but differ in that cargo operations are handled by the private sector. However, terminal equipment, such as quay cranes and forklift trucks, is owned by the port authority. Cargo handling on board vessels and on the quay is carried out by private cargo-handling or stevedoring firms. In some cases, tool ports are used to transition from public service ports to landlord ports.

Landlord ports. These are the most common port management model, where the port authority acts as a regulatory body, while port operations – especially cargo handling – are carried out by private companies. Infrastructure, particularly terminals, are leased to private operating companies or to industries such as refineries, grain terminals, tank terminals, and chemical plants. In this case, the port authority retains ownership of the land. The most common form of lease is a concession agreement, whereby a private company is granted a long-term lease in exchange for rent, which is commonly a function of the size of the facility as well as the investment required to build, upgrade or expand a terminal. Private operators are also responsible for providing terminal equipment to ensure that operating standards are observed. Private port operators provide and maintain their own superstructure, including buildings (for example, offices, warehouses, container freight stations and workshops). Dock labour is employed by private terminal operators, although in some ports part of the labour force may be provided by the port authority.

Private service ports. These port facilities are fully privatized, but retain their maritime role. Likewise, the port authority is entirely privatized. Most of the port functions are under private control, although the public sector enjoys standard regulatory oversight powers and can own port shares.

Sources: Rodrigue, 1998–2017 and World Bank, 2007.

2. Private participation in infrastructure in ports

Table 4.9 highlights some key data on private participation in infrastructure (private participation in infrastructure) in ports in emerging and developing economies between 2000 and 2016. Some $68.8 billion of private investment was committed across 292 projects. Areas covered include port infrastructure, superstructures, terminals, and channels for container, dry bulk, liquid bulk and multipurpose terminals. Most of the investments were related to greenfield and brownfield projects, representing 58 per cent and 38 per cent, respectively, of the total investment share, followed by divestiture and a small number of management and lease projects (figures 4.5 and 4.6).[1]

The largest investment share was in Latin America and the Caribbean, representing 31 per cent of total investments, followed by Eastern Asia and the Pacific (23 per cent), sub-Saharan Africa (15 per cent) and Southern Asia (15 per cent) (figure 4.5). Western Asia and North Africa and Europe and Central Asia had 7 per cent and 6 per cent respectively. Latin America and the Caribbean had the largest number of projects with 87 projects, followed by Eastern Asia and Pacific (76 projects), sub-Saharan Africa (49 projects), Southern Asia (40 projects). The Middle East and North Africa had 21 projects, and Europe and Central Asia 19 projects.

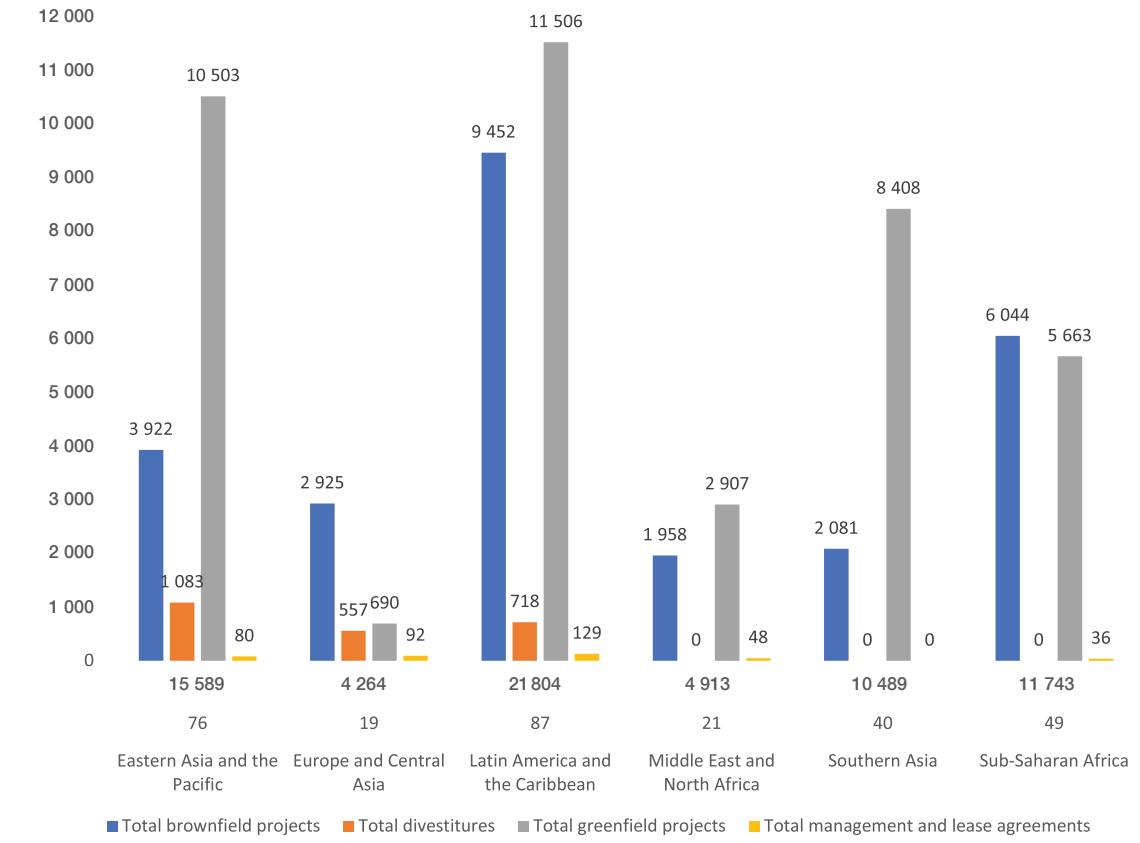
Table 4.9. Private participation in infrastructure port projects in emerging and developing economies, 2000–2016

Number of countries with private participation	63
Projects reaching financial closure	292 projects, total investment $68.8 billion
Region with largest investment share	Latin America and the Caribbean (31%)
Type of project with largest share in investment	Greenfield project (58%)
Type of project with largest share in projects	Greenfield project (47%)
Projects cancelled or in distress	8 (2% of total investment)

Source: World Bank, 2017a.

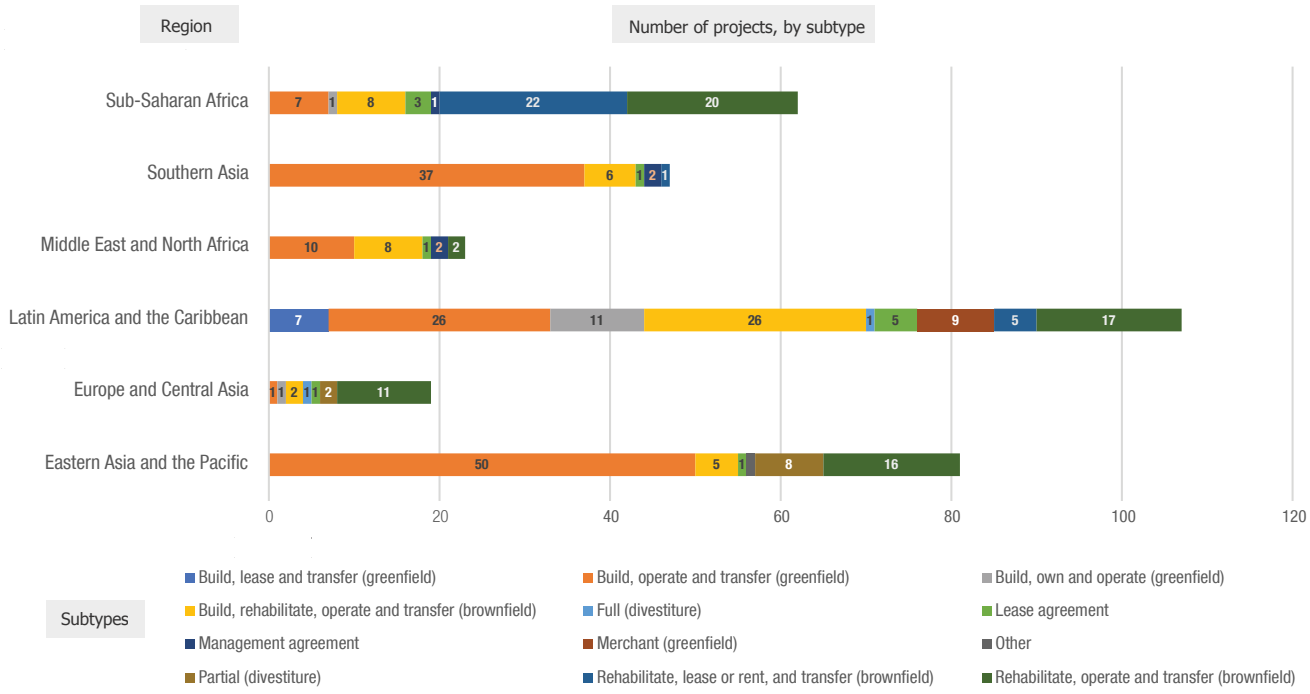
The majority of port projects are based on build–operate–transfer concession agreements. Under such an agreement, a private consortium or company builds a facility, operates it for a specified period of time and returns it to the public sector at the end of that period. Contract duration is usually determined by the amount of time a concessionaire would realistically need to

Figure 4.5. Private participation in port infrastructure investments and number of projects by region and type, 2000–2016 (Million dollars)



Source: UNCTAD secretariat calculations, based on World Bank, 2017a (as at July 2017).

Figure 4.6. Private participation in port infrastructure projects by region and subtype, 2000–2016



Source: UNCTAD secretariat calculations, based on World Bank, 2017a (as at July 2017).

recoup its investment through user charges. The term "concession" covers the rights and risks involved in collecting these fees, as well as in building and operating the facility. Such concessions are generally suited to projects involving considerable investment and operating content.

Investors in port developments are predominantly global port management companies. As noted in table 4.10, the AP Moller–Maersk Group accounted for the lion's share of total investment ($12.4 billion) and projects (43 projects) in 2000–2016, followed by the Port of Singapore, with about $5 billion in investment for 18 projects. Hutchison Whampoa ranks third, with a total investment of $4.6 billion for 17 projects. In general, these companies invest in various projects and have extensive geographical coverage but tend to specialize in certain regions. For example, CMA CGM has been a major player in Northern Africa and Western Asia; Hutchison Whampoa, in Asia; and Bolloré Group, in sub-Saharan Africa. In liner shipping companies, such as the AP Moller–Maersk Group or the Mediterranean Shipping Company, terminal operations are generally subordinate to their maritime shipping business, which is not the case for port terminal developers such as the Port of Singapore.

In recent years, newcomers have entered the market and increased competition in the sector. This includes the China Ocean Shipping (Group) Company and International Container Terminal Services, as well as Yildrirm and Noatum groups.[2] These companies are building up their portfolio of port terminals, feeder operations and forwarding activities, as well as other support and logistics services and value added businesses.

Some private terminal operators are also expanding their investment beyond ports into hinterland connectivity, investing in rail and road infrastructure and related services, thereby improving access to markets and enabling door-to-door delivery. Since many port project developments are associated with the One Belt One Line initiative, the role of Chinese investment in ports, port hinterlands, and related services will be key in the future. In May 2017, China Ocean Shipping (Group) Company and Lianyungang Port Group agreed to acquire the Khorgos Gateway. The two Chinese companies will each hold a 24.5 per cent stake in the container transportation company affiliated with the Government of Kazakhstan.[3]

Bulk and tank terminals are mainly controlled by commodity trading organizations, which tend to control their own supply chain and logistics network. In addition to owning a quarry or mine and operating a terminal and inland transport services, some bulk operators are also investing in ships to carry their cargo into the respective markets (Holman Fenwick Willan, 2011).

In 2016, ports attracted the third-highest level of investment, compared with other transport segments. The largest investments in the transport sector were in roads ($12.4 billion), followed by rail and metro ($10.1 billion). Some $3.1 billion in commitments were delivered across 10 projects: 6 in Latin America and the Caribbean, including 4 port projects in Brazil. Ghana, the Islamic Republic of Iran and Myanmar registered transport projects for the first time in over 10 years, all in the ports sector: Tema Port expansion, Chabahar Port development and Myanmar Industrial Port modernization, respectively (World Bank, 2016b). See table 4.11.

3. Challenges in the application of public–private partnerships

Legal complexity is one of the main challenges associated with public–private partnerships, as a number of jurisdictions and procedures are involved, requiring an understanding of local conditions by the private sector. The lack of clear regulatory and institutional frameworks that enable proper application and enforcement of

Table 4.10. Leading global port investors, 2000–2016

Global investors	Country	Investment (million dollars)	Number of projects
AP Moller–Maersk Group	Denmark	12 425	43
Port of Singapore	Singapore	5 064	18
Hutchison Whampoa	Hong Kong, China	4 558	17
DP World	United Arab Emirates	3 922	27
Bollore Group	France	3 301	11
Marubeni	Japan	2 541	5
International Container Terminal Services Inc.	Philippines	2 029	21
EIG Global Energy Partners	United States	1 858	3
Mediterranean Shipping Company	Switzerland	1 419	4
Hutchison Port Holdings	Hong Kong, China	1 276	3

Source: World Bank, 2017a.

Table 4.11. Selected port projects, 2016

Economy	Project	Investment (million dollars)	Sponsors	Type of private participation in infrastructure
Brazil	Salvador Port Passenger Terminal	4.4	Socicam, Aba Infraestrutura e Logistica	Brownfield project (rehabilitate, operate and transfer)
Brazil	Santos Port Ponta da Praia Terminal	146.0	Louis Dreyfus (50%), Cargill (50%)	Brownfield project (build, rehabilitate, operate and transfer)
Brazil	Santos Port Macuco Terminal	81.4	Fibria Celulose (100%)	Brownfield project (rehabilitate, lease or rent, and transfer)
Brazil	Suape Port Sugar Terminal	63.7	Odebrecht (75%), Agrovia (25%)	Greenfield project (build, operate, and transfer)
Ghana	Tema Port Expansion	1 500.0	AP Moller–Maersk Group (35%), Bollore Group (35%), other (30%)	Brownfield project (build, rehabilitate, operate and transfer)
Iran, Islamic Rep.	Chabahar port development	235.0	Other	Brownfield project (build, rehabilitate, operate and transfer)
Jamaica	Kingston Freeport Terminal Limited	452.0	CMA CGM (51%), China Merchant Holdings (International) Company (49%)	Brownfield project (build, rehabilitate, operate and transfer)
Myanmar	Myanmar Industrial Port Modernization	200.0	Other (100%)	Brownfield project
Panama	PSA Panama International Terminal, phase 2	400.0	PSA (100%)	Greenfield project (build, operate, and transfer)
Viet Nam	Dinh Vu Port acquisition	4.5	Other (51%)	Partial divestiture

Source: World Bank, 2017a.

contracts can also be a major barrier for public–private partnerships. Furthermore, there are often regulations that limit private and/or foreign participation, owing to the strategic nature of ports and terminals. For example, private concession may be limited to certain sections within a port or a foreign investor may be required to form a partnership with a majority domestic shareholder (Holman Fenwick Willan, 2011). Yet, not all countries have the necessary legal frameworks to grant concessions. In some cases, general legislation deals with concessions, which may cover ports. It may be necessary to pass legislation specifically to enable a port authority to grant a concession. Generally, such legislation spells out the modalities relating to the concession, including its duration and ports services for which a port operator may or may not take responsibility under the concession (Holman Fenwick Willan, 2015). Hence, a Government that is beginning to work with public–private partnerships in ports may wish to conduct a comprehensive review of the legal and regulatory framework governing the port sector in order to determine whether amendments to existing laws may be necessary or whether new legislation is required. (World Bank, 2017b). Identifying and mobilizing basic administrative and technical resources to prepare and manage public–private partnerships would also be important. Choosing a suitable public–private partnership port model (box 4.2) is essential to determine private sector involvement, ranging from low to high participation and would define responsibilities and risk allocation between the public and private sectors. Thus, setting up a public–private partnership policy framework that addresses and mitigates risks is key and requires a broad set of legal, managerial and technical capacities (UNCTAD, 2016). Moreover, it is important for Governments to fully understand the consequences and ramifications of such mechanisms, and be mindful of potential costs and benefits over the entire life of a project in order to avoid any unexpected fiscal shocks (UNCTAD, 2015b). In the case of a landlord port, the set-up of a public port authority and the accurate definition of its mandate are vital, as well as clear rules ensuring the transparency of tender procedures and of managing partnership contracts.

Increasingly stringent environmental and climate policies are taking on greater importance in port development. Port development and operations can have an impact on air and water quality, and land use; ports are increasingly shifting towards policies that promote environmentally friendly operating and handling practices in order to meet local and international standards and regulations. These may cover waste and ballast water, dangerous cargo handling, carbon emissions, noise and other forms of pollution. Complying with such requirements would entail significant investment by private sector operators. At the same time, when awarding concessions, port authorities are increasingly examining port operators'

green port credentials and carbon dioxide footprints. Cold ironing, clean technology for port equipment and vehicles, sustainable wind and solar power generation, sustainable buildings, water protection, effective dust suppression systems for dry bulk cargoes, recycled concrete and other green construction materials are often required. These developments can be expected to continue affecting how ports are constructed and operated and will require additional investment from the private and public sectors (Holman Fenwick Willan, 2011).

Achieving efficiency gains – a key objective of the public–private partnership model – depends on how risks and responsibilities can be transferred from the public sector to the private sector, according to the principle that risks should be borne by the party best able to manage them.[4] Solid risk analysis and appropriate risk allocation between the public and private sectors is paramount to achieve a win-win partnership for both.

D. OUTLOOK AND POLICY CONSIDERATIONS

The container port sector remains vulnerable to unfavourable developments in the world economy and global demand. However, in line with the projected recovery in containerized trade flows, global container port throughput is projected to increase by 2.8 per cent in 2017. It is expected that Asian ports will record the fastest growth (2.9 per cent), followed by Europe (2.8 per cent), North America (2.0 per cent) and developing America (2.6 per cent).

Projected growth is underpinned by a recovery in key markets and the strength of the North American economy. Growth in Africa, developing America and China will contribute to the projected expansion in global port volumes, reflecting, among other factors, the rebound in Western African economies, the gradual recovery in Brazil, growth reported at Panamanian ports and port productivity in China (Lloyd's Loading List, 2017d). The impacts of mega-alliances, consolidation in the liner shipping market and deployment of vessels in excess of 18,000 TEU capacity are likely to further materialize in the short to medium term. Based on this scenario, ports and their stakeholders may wish to consider the recommendations set forth below.

All ports

Ports should formulate policies and devise plans on how best to adapt to the requirements of the changing liner shipping market environment.

Terminal operators, ports and shipping lines should engage in closer cooperation to mitigate the negative impact of growing cost pressures. Of concern is that cost pressures may lead to increasing port charges, although this may prove difficult, given the current market conditions. Also, if terminal operators are forced to leave the market because of lower margins or refrain from investing in new capacity because of uncertain returns, the container port industry may find it difficult to service the liner shipping sector, in particular larger ships (Drewry Maritime Research, 2016a).

With carriers increasingly requiring less fragmented terminal capacity – fewer but larger terminals are needed in each port – physical and ownership consolidation of terminals will probably become necessary. Some observers expect to see increased cooperation between neighbouring ports, as in the case of the ports of Seattle and Tacoma (Lloyd's Loading List, 2017c). More mergers and acquisitions are also expected, as illustrated by the takeover by APM Terminals of the Spanish Group TCB and Yilport's purchase of the Portuguese group Tertir, and others (Lloyd's Loading List, 2017c).

Smaller and secondary ports

Ports servicing the trade of developing countries, especially, relatively smaller and secondary ports, will need to adjust to remain competitive and continue to attract business, whether through direct connections or feedering services. In addition to safeguarding the business of smaller ports, it is important from a shipping and trade perspective to minimize the costs and delays affecting trade and supply chains that are serviced by these ports.

Trans-shipment ports

Competing on the maritime operations side for trans-shipment traffic may not be always sustainable in the context of the new operating landscape. Ports will need to reconsider their offering by considering other services to customers, which would also increase their revenue streams. Depending heavily on cargo handling activities for generating port income may not be a good strategy in the long term and more attention should be given to areas such as inland ports, warehousing, cold stores and distribution facilities (Lloyd's Loading List, 2017c). Apart from generating new sources of revenue, ports will be establishing stronger partnerships and links with shippers and cargo owners (Lloyd's Loading List, 2017c).

Governments

Government has a role to play by supporting small to medium-sized ports in adapting to the new situation, including through policy work and other facilitative arrangements that would support the improvement of their services in their respective hinterlands, rather than competing for international trans-shipment hub status (Lloyd's Loading List, 2017e). To help secondary and smaller ports maintain their market position, steps should be taken to clearly identify which strategy to follow to attract mainline or feeder service providers.

Improving understanding of the determinants of cargo dwell time is crucial. Governments can help address inefficiencies and unlock the capacity constraints

associated with ports through regulation, incentives, policy support measures and investment, including to ensure efficient operations by border management and clearing agencies.

Furthermore, the participation of private terminal operators through public–private partnerships is evolving as an important mechanism to leverage greater private investment participation in port development and most importantly, to access specialized skills, innovations, and new and clean technologies associated with infrastructure development, operation and maintenance. Governments can build on the extensive public–private partnership models to define a suitable public–private partnership strategy that would ensure successful collaboration and generate sustainable development outcomes. Important prerequisites for a successful public–private partnership are as follows: well-designed public–private partnership agreements that ensure appropriate risk sharing and flexibility, a clear policy framework that addresses and mitigates risks, a legal and regulatory system that ensures that agreements are effective and enforceable, and an institutional framework within government, including technical and managerial capacities, to properly manage the process. Private operators are key partners for port development and competitiveness. Not only do they help improve the movement of goods efficiently and cost effectively through enhanced infrastructure and services, but they also contribute to better port sustainability and competitiveness through new technologies, improved supply chain management, hinterland connectivity and door-to-door delivery.

All port stakeholders and partners

The efficiency of port operations is a major driver of trade competitiveness and the ability of ports to compete in a complex and evolving market structure. Steps should be taken to support the adoption of relevant technologies and solutions in ports, including for customs automation and port community systems.

Port performance indicators are essential to determine the standing of ports. Understanding the performance of ports helps inform relevant port-related planning and decision-making processes. Efforts should be pursued to refine port performance measurements, including by investing in data collection capabilities and supporting information and communications technology platforms that lower data collection and analysis costs. Given that it is difficult to make effective international comparisons of port performance, standardization of port performance measures and metrics will support meaningful benchmarking and reliable comparisons and rankings. Another suggestion would be to examine the perceptions of users and stakeholders regarding port performance or user or stakeholder satisfaction measurement.

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ENDNOTES

1. For further information on the classification of types and subtypes of private participation in infrastructure projects, see the World Bank Private Participation in Infrastructure Projects Database, available at http://ppi.worldbank.org/methodology/glossary (accessed 2 October 2017).
2. In June 2017, Noatum ports entered into a partnership with China Ocean Shipping (Group) Company. The signed sale and purchase agreement includes the container terminals of Noatum ports in Valencia and Bilbao, as well as the dry ports of Madrid and Zaragoza. See http://www.noatum.com/media/wp-content/uploads/20170611-PR-Noatum-Ports-partnership-CSP-EN_2.pdf (accessed 3 October 2017).
3. See https://port.today/cosco-acquires-dry-port-kazakhstan/ (accessed 3 October 2017).
4. Risk allocation is used as a best practice in many mature public–private partnership markets such as Australia and the United Kingdom.

5

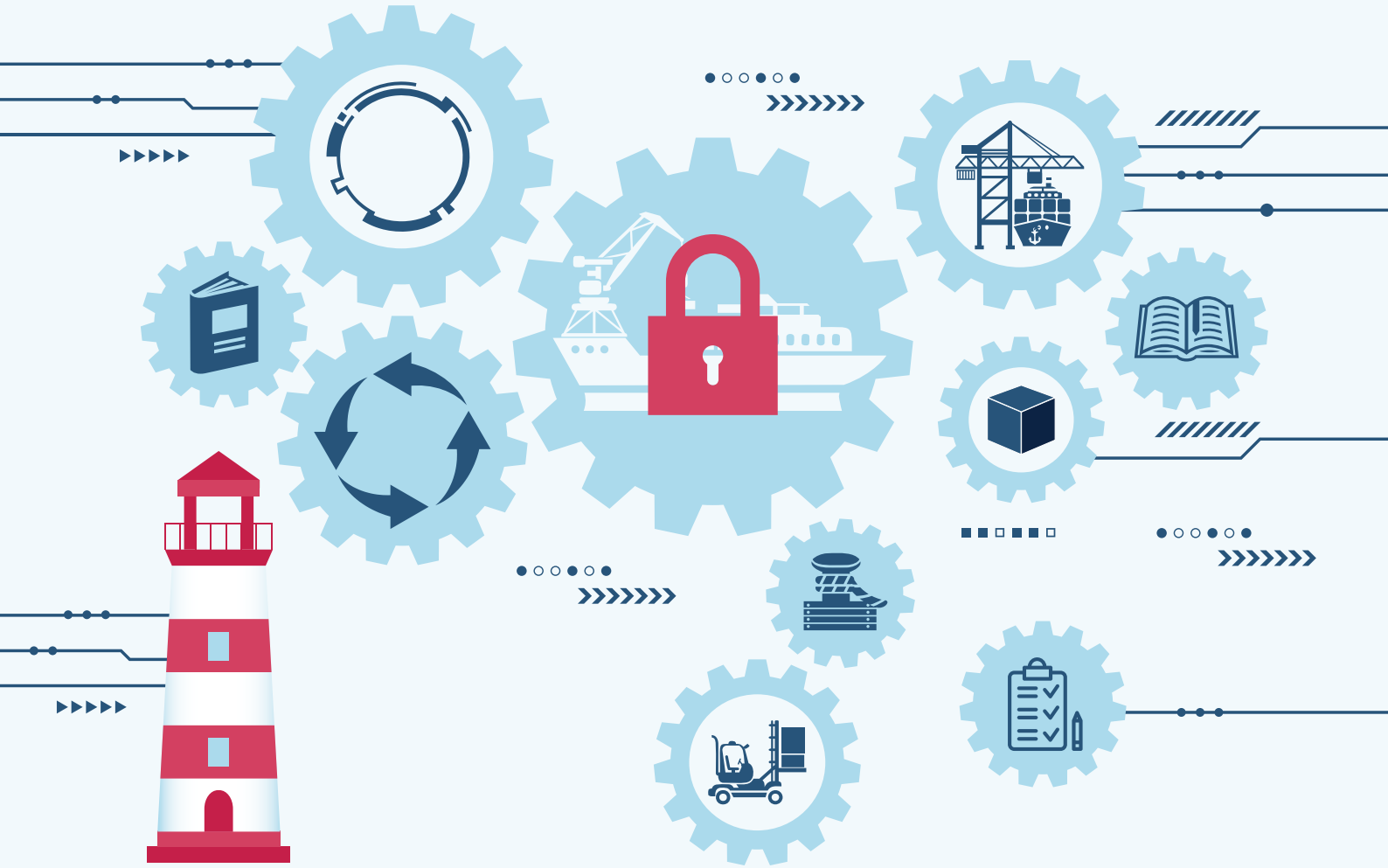
LEGAL ISSUES AND REGULATORY DEVELOPMENTS

Along with economic benefits and connectivity and efficiency-related benefits from the use of new technologies, maritime shipping faces complex challenges, including cybersecurity threats and risks. Improved understanding and awareness raising is important, and relevant international regulations, including recent IMO guidelines on maritime cybersecurity risk management, as well as industry best practices, guidance and standards aimed at effectively addressing related vulnerabilities and threats, may be noted.

International regulatory developments over the period under review include the entry into force of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (known as the Ballast Water Management Convention, 2004), on 8 September 2017, and of the International Labour Organization Work in Fishing Convention, 2007 (No. 188), on 16 November 2017. Significantly for both human health and the environment, the IMO Marine Environment Protection Committee adopted a decision to implement a cap of 0.50 per cent on sulphur in fuel oil used on board ships from 1 January 2020.

CYBERSECURITY IN MARITIME SHIPPING

Raising awareness about and the careful consideration of cybersecurity threats, risks and potential consequences for ships, ports and cargo handling and operations is important, as is the development of and compliance with relevant national and international regulations, best practices, guidance and standards



SHIP-SOURCE POLLUTION

Shipowners and operators should make practical plans to meet the cap of

0.5%

on sulphur in fuel from 1 January 2020

In the light of Goal 14, all countries are encouraged to consider becoming parties to relevant international conventions for marine pollution prevention and control, as a matter of priority

A. TECHNOLOGICAL CHALLENGES AND OPPORTUNITIES IN THE GLOBAL SHIPPING INDUSTRY

1. Cybersecurity[1]

Risks and threats in the maritime sector

Facing commercial pressure and an ever-increasing demand to optimize logistics management systems and operations and improve connectivity, including digital connectivity, maritime shipping has become highly dependent on computerized systems and information and communications technology. Similar to other industry sectors that rely on such technology, computer systems on board vessels or in marine facilities face the same risk of cyberattacks, including through hacking, malware, phishing, Trojan horses, viruses, worms and denials of service, among others, and these can originate from hackers and criminals anywhere in the world. Cyberattacks are most likely to first target vulnerabilities along a supply chain, including negligent users, wireless access points and removable media devices. Unauthorized use of data or systems by authorized persons, such as ship or platform crew, can also have significant negative impacts. Cybersecurity-related incidents may also arise from extreme weather events, including climate-change related events, which pose significant risks to individuals and businesses, including on ships and in ports and marine facilities. In such circumstances, security measures need to be in place to ensure that even in the event of a partial or total destruction of facilities, data is secure and systems can resume operations as soon as possible.

The malicious exploitation and/or failure of information technology systems on board ships may disrupt their safe navigation and propulsion. Similarly, cyberattacks on other systems and technologies used for container terminal operations and cargo handling, including inventory and container tracking systems, can cause significant disruptions to such operations. Offshore platform stability and the positioning of offshore supply vessels can be equally vulnerable to cybersecurity-related impacts, either by modern pirates and smugglers or through non-targeted malware, insider threats and legitimate functions performed at the wrong time or under the wrong conditions (United States Coast Guard, 2016). All such attacks have safety and security repercussions, with potentially serious impacts on human life, the environment and the economy. Other cyberattacks may be aimed at stealing information, such as sensitive company data, which includes production and processing techniques or strategies for negotiating with trading partners. In addition to economic repercussions for companies directly involved, such attacks could have national security, wider financial and other implications. Potential consequences and costs of disruptions from malicious cyberattacks have been compared to those caused by past major incidents involving the maritime transport sector, such as the explosion of the Deepwater Horizon drilling platform in 2010 and the Exxon Valdez oil spill in 1989, although they may have not been caused by a cybersecurity failure (Rouzer, 2015).

In the last decade, concerns have been expressed regarding the low level of cybersecurity awareness and culture in the maritime sector, including in developed countries, such as knowledge of cybersecurity-related incidents that have taken place. Cybersecurity is often considered a theoretical issue, or a technical matter for information technology specialists, which does not directly involve others. In addition, risk assessments and management appear to focus primarily on physical security in ships and ports, with inadequate attention to cybersecurity and the sharing of information on mitigating cybersecurity threats.

For example, an analysis of initiatives and efforts within member States of the European Union with regard to cybersecurity in the maritime sector identified, among others, a generally insufficient focus on cybersecurity, which reduced the capabilities of the sector to consistently assess and deal with related challenges. Insufficient awareness among key stakeholders, including Governments, port authorities, shipping companies and telecommunications providers, of the security challenges, vulnerabilities and threats specific to this sector, was considered one of the main causes of this situation. Other problems identified were the complexity of the maritime information and communications technology environment and the fragmentation of governance at different levels, whether international, regional or national. The study highlighted, among others, the need to define appropriate measures to protect the maritime sector, as a critical infrastructure sector, against increasing cybersecurity threats, and suggested a road map for relevant stakeholders, containing short-term, midterm and long-term priorities for action (European Union Agency for Network and Information Security, 2011).

Threats to ships

With regard to cybersecurity threats affecting ships and their safe navigation, useful findings have been made with regard to automatic identification systems (AIS), global systems that use global positioning system coordinates and exchange up-to-date information about the positions, names, cargoes, speeds and headings of ships with other ships and maritime authorities via radio transmissions. AIS are frequently used by port authorities to warn ships about various hazards at sea. In open seas, they are also used to signal and locate people that may have fallen overboard. AIS are a useful tool for navigation, traffic monitoring, collision avoidance, search-and-rescue operations, accident investigation and piracy prevention, providing additional maritime traffic safety and supplementing

conventional radar installations. In 2000, IMO, through revisions to the International Convention for the Safety of Life at Sea, chapter V, adopted a new requirement for all ships to carry AIS from 31 December 2004. Ships shall therefore maintain AIS in operation at all times, except where international agreements, rules or standards provide for the protection of navigational information. Shipowners and operators can at times manipulate AIS data on their own vessels, most commonly to shut down the systems if "the continual operation of AIS might compromise the safety or security of his/her ship, or where security incidents are imminent" (IMO, 2015), for example when in transit through areas at high risk for piracy, to prevent pirates from locating ships and planning attacks.

A recent evaluation indicated that attackers could penetrate AIS easily, and outlined a range of possible weaknesses and threats, including spoofing, hijacking and availability disruption, each of which was analysed to determine whether the threat was based on software or radio frequency or both. It also reconfirmed the findings of earlier reports on the vulnerability of ship navigation systems (Trend Micro, 2014). Other threats include indiscriminate jamming, which could cause difficulties in determining the correct location of multiple ships (*The Maritime Executive*, 2017).

In 2013, researchers at the University of Texas demonstrated that they could gain navigational control and redirect a ship's course by generating a fake global positioning system signal that overrode the genuine signal. Neither AIS nor global positioning systems for civilian use are encrypted or authenticated and therefore present a potentially easy target. Moreover, the security gaps identified did not require expensive equipment or capabilities; the devices used by Trend Micro and the University of Texas to identify security gaps cost €700 and $2,000 respectively (Marsh, 2014).

In 2009, IMO amended International Convention for the Safety of Life at Sea, chapter V, regulation 19.2, and made it mandatory for ships engaged on international voyages to be fitted with electronic chart display and information systems, in stages depending on vessel type, from July 2012 until July 2018. Such systems are a computer-based alternative to paper-based navigation charts that integrate electronic navigation charts, global positioning system information and data from other navigational sensors, such as radar, fathometer and AIS. Electronic chart display and information systems provide valuable information for navigation, yet are vulnerable to cyberattacks, and their compromise could lead to loss of life, environmental pollution and financial losses (NCC Group, 2014).

A recent study analysed the security risks and weaknesses related to electronic chart display and information systems. Connectivity between such systems and office and communications platforms, combined with access to the Internet, could allow attackers to gain access by various means, such as the introduction of a virus through a portable memory card used by a crew member or the exploitation of an unpatched vulnerability through the Internet. Once such unauthorized access is gained, attackers may interact with shipboard networks and everything connected to them and could, among many possible intentional and unintentional consequences, subvert sensor data and misinterpret it for electronic chart display and information systems. Such actions could influence the decision-making process of navigation personnel and lead to collisions or ships running aground. Several other vulnerabilities in electronic chart display and information systems software could lead to severe disturbances in ship navigation, and related recommendations to remedy the situation include, for example, installing systems properly and isolating them from the rest of a ship's information technology systems with a firewall, to protect them from hacking and the potential diversion of the ship off course (NCC Group, 2014). Managing cybersecurity risks effectively may become more important as the industry is starting to use autonomous ships.

In 2014, the investigation of a collision between a cargo ship and an unstaffed crane barge revealed that a memory card connected to the system had been used to store media files. Although it had not directly contributed to the incident, such abuse of equipment has the potential to corrupt valuable data required to determine the circumstances of an accident. In August 2016, a naval contractor in France was hacked, resulting in the leak of more than 22,000 documents detailing the design of a submarine under construction, and, in October 2016, the computer of an employee of Hewlett Packard Enterprise Services was hacked, resulting in the opening of more than 134,000 personal records of sailors (Marine Link, 2017).

Offshore oil platforms are also at risk, with potential repercussions. For example, hackers may have caused a floating oil platform to tilt, forcing it to be temporarily shut down. It took one week to identify the cause and mitigate the effects. Globally, cyberattacks against oil and gas infrastructure may cost energy companies close to $1.9 billion by 2018, and the Government of the United Kingdom estimates that cyberattacks cost national oil and gas companies around $672 million per year (Reuters, 2014).

Threats to ports

As also highlighted in chapters 4 and 6, seaports are of strategic economic importance. Cyberattacks can have major repercussions for those that rely on computers and related systems, as such systems usually contain information pertaining to a number of different stakeholders. As a result, attackers could, for example, gain access to systems in order to seize a ship, close a port or its terminal or access sensitive information such as pricing documents or time

schedules, manifests, container numbers and others. Even a small cyberattack can cause business losses of millions of dollars (Belmont, 2014; Cyber Keel, 2014; Hazard Project, 2017). For example, in the United States, an attack launched in September 2001 against the Internet systems of the Port of Houston, one of the world's busiest maritime facilities, affected the performance of its entire network and caused data – including on tides, water depths and weather – used to help pilots and ships navigate through the harbour to become inaccessible and, although no injury or damage was caused, could have had major repercussions for those who relied on the computers (*The Register*, 2003). In addition, in 2013, the Port of Long Beach reported several cyberattacks by hackers using distributed denial of service or other methods. In response, the facility undertook a number of cybersecurity measures, including developing a computer network that integrated secure data from federal agencies and private terminal operators; banning commercial Internet traffic from its network; investing nearly $1 million in commercial applications to monitor network activity, intrusions and firewalls; mapping its networked systems and access points; designating controlled access areas for its servers; and backing up and replicating key data offsite (Ship-technology.com, 2013).[2]

Threats to cargo handling and terminal operating systems

Examples of such threats are as follows:

(a) Islamic Republic of Iran, 2011: The State-owned shipping line, which had the largest shipping fleet in the Middle East at the time, was targeted by a cyberattack that damaged data related to shipping rates, loading, cargo numbers, dates and locations, and caused confusion with regard to container location, whether containers had been loaded and which boxes were on board or on shore. In addition, as a result of the attack, the company's internal communications network was lost and, although the data was eventually recovered, operations were significantly disrupted, a considerable amount of cargo was lost and other cargo was sent to the wrong destinations, causing significant financial losses (Cyber Keel, 2014);

(b) Netherlands, 2011: For two years, drug traffickers concealed heroin and at least one ton of cocaine with a street value of £130 million inside legitimate cargo, and recruited hackers to infiltrate a computerized cargo tracking system at the Port of Antwerp, Belgium, to identify the shipping containers in which consignments of drugs had been hidden. The traffickers drove the containers from the port and retrieved the drugs before the legitimate owners arrived. The breach started with phishing attacks, including sending emails with malicious content to employees of transportation companies at the port. After the security breach was discovered and a firewall installed, the perpetrators broke into company offices and concealed sophisticated data interception hardware in cabling devices and computer hard drives, with the aim of stealing credentials in order to obtain the necessary certificates and release codes to retrieve the containers and unload them at the time and location of their choosing (Ship-technology.com, 2013);

(c) 2013: A security company published information about ongoing attacks since 2011, aimed at targets in business sectors in Japan and the Republic of Korea, including shipping and maritime operations. The attackers gained access to the networks of targeted companies, to extract documents, email account credentials and passwords allowing access to further resources in the networks. In contrast to other attacks, these lasted only a few days or weeks, with the attackers withdrawing once the targeted industry knowledge had been obtained (Cyber Keel, 2014);

(d) July 2014: A security company published information about a highly sophisticated malware targeting systems in the shipping and logistics industry worldwide. The malware was embedded at a supplier factory into the operating system of handheld scanners – used to check and inventory items being loaded on and off ships, trucks and airplanes – which were sent to shipping and logistics companies. The malware infiltrated servers and obtained financial and other data (Trap X Security, 2014);

(e) June 2017: A cyberattack affected the worldwide operations of Maersk, delaying shipments due to the closure of terminals in several ports, including the Port of Rotterdam, Netherlands; Jawaharlal Nehru Port, the largest container port in India; and terminals in the United States. Similar to the attacks that affected digital infrastructure worldwide in May 2017, this attack involved ransomware that hijacked control of a computer and demanded payment to an online address in return for regaining access to data and systems (JOC.com, 2017).

International regulatory aspects

To date, international regulations and policies, such as the IMO International Ship and Port Facilities Security Code and other measures, have mainly addressed the physical aspects of maritime security and safety, and the regulation of cybersecurity in maritime operations has mostly been voluntary. Recent developments include the adoption by IMO of guidelines on maritime cybersecurity risk management, which provide high-level recommendations regarding protection against current and emerging cybersecurity threats and vulnerabilities for all participants in international shipping (IMO, 2017a). The guidelines contain five functional elements for effective risk management in the maritime sector, as follows: "1. Identify: Define personnel roles and

responsibilities for cyberrisk management and identify the systems, assets, data and capabilities that, when disrupted, pose risks to ship operations; 2. Protect: Implement risk control processes and measures, and contingency planning to protect against a cyberevent and ensure continuity of shipping operations; 3. Detect: Develop and implement activities necessary to detect a cyberevent in a timely manner; 4. Respond: Develop and implement activities and plans to provide resilience and to restore systems necessary for shipping operations or services impaired due to a cyber-event; 5. Recover: Identify measures to back up and restore cybersystems necessary for shipping operations impacted by a cyberevent" (IMO, 2017b). The guidelines also list best practices, guidance and standards that provide further information for better understanding and addressing cybersecurity vulnerabilities and threats.[3]

As many cybersecurity-related incidents constitute crimes, international standards related to cybercrime are also worth noting. For example, the Convention on Cybercrime, 2001, includes jurisdiction clauses related to ships flying the flag of a party and the nationality of offenders (article 22), and the United Nations Convention against Transnational Organized Crime, 2004, defines transnational crime as, among others, an offence that is committed in one State but has substantial effects in another State, and may be applicable in the context of cybercrime acts that affect maritime operations.

2. Blockchain technology

Overview

Blockchain is a new, distributed ledger technology that has not yet been fully defined or understood. A blockchain is a distributed database (that is, with multiple copies existing on different computer systems) that records information shared by a peer-to-peer network using cryptography and other techniques to create secure and immutable records of transactions (see *Harvard Business Review*, 2017). Such transactions may involve many types of value such as currency (money, stocks or bonds), proof of ownership of tangible assets (goods, property or energy) and intangible assets (votes, identity, ideas or personal data). The use of blockchain technologies is expected to improve the speed and lower the cost of doing business, by simplifying operations and reducing the need for human intervention, automating processes and removing human errors (Knect365, 2016).

The first application of this technology was in finance, with the introduction of the digital currency bitcoin, providing a distributed system of trusted assets and transactions without the need for a central trust authority to act as a third-party guarantor. New blockchain technologies have since evolved, such as ethereum, which allows for the implementation of smart contracts that execute transactions based on the meeting of predefined conditions.

Blockchain technology is still in its early stages, and integrating it with other new technologies and platforms, and adopting relevant business processes, skills and regulations, is a challenge and requires time and investment (Cognizant, 2016). In addition, concerns remain with regard to the cybersecurity implications of blockchain implementation. A recent analysis of the technology identified security benefits, challenges and good practices, and found that some principles of the security of both traditional information technology systems and blockchain technology, such as encryption and key management, were largely the same and faced the same risks (European Union Agency for Network and Information Security, 2016). Blockchain use also faces new challenges related to, among others, consensus hijacking,[4] issues of interoperability between various platforms and smart contract management.

Blockchain technology in maritime shipping

In maritime shipping, the use of blockchain technology has been suggested, for example, for the transfer and sharing of data, including on the status of shipments. This is increasingly done electronically, through electronic data interchange messages, rather than exchanges of paper documents (see United Nations Economic Commission for Europe, 1996). Some major maritime carriers implement shipping portals, such as Cargo Smart, Inttra and GT Nexus, which provide essential digital processes and functionalities for booking, tracking and tracing and documentation, and which allow customers to communicate with carriers. However, in many steps in the shipping process, paper documents are still widely used. Port community systems that play an important role in handling port operations often use the same technology as shipping portals.

Blockchain technology could add important additional functionalities to transport and maritime information and communications technology and electronic data interchange systems, such as data verification and tracking and tracing. At the same time, it is important to develop and apply standards[5] that facilitate the secure exchange of data between such technologies and all relevant stakeholders (*Combined Transport Magazine*, 2016). Early-stage uses and pilot implementations of blockchain in supply chains and the transport and maritime industry include blockchain-enabled verified gross mass data exchanges, under the new International Convention for the Safety of Life at Sea requirements, which could lead to accelerated electronic data interchange standardization (see http://solasvgm.com and http://www.imo.org/en/OurWork/Safety/Cargoes/Containers/Pages/Verification-of-the-gross-mass.aspx); Blockfreight, an open network blockchain system for supply chains; a blockchain logistics consortium project at the Delft University of Technology, Netherlands; a pilot blockchain logistics project at the Port of Antwerp; and Maersk and Walmart pilot projects with International Business Machines

(see https://www.nytimes.com/2017/03/04/business/dealbook/blockchain-ibm-bitcoin.html; for the use of blockchains in customs declarations, see https://youtu.be/LeKapqAQimk).

With regard to transport documents, the main challenge in efforts to develop electronic alternatives to traditional paper documents has been the effective replication of each document's functions in a secure electronic environment, while ensuring that the use of electronic records or data messages benefits from the same legal recognition as that afforded to the use of paper documents. For bills of lading, with the exclusive right to the delivery of goods traditionally linked to the physical possession of original documents, this includes, in particular the replication, in an electronic environment, of the unique document of title function (UNCTAD, 2003). Following earlier attempts to digitize bills of lading, including Bolero[6] and, more recently and with some success, essDOCS (see http://essdocs.com), some shipping companies have recently been reported to be exploring the use of blockchain technology in this context (JOC.com, 2016).

Blockchain technology has not yet been widely implemented in maritime shipping, however, and it is unclear whether this is likely to change soon. Challenges include ensuring interoperability and a range of legal issues (Takahashi, 2017), as well as the need to devise mechanisms for the effective incorporation of substantive maritime contract clauses and the replication of the processes involved in blockchain-enabled smart contract-based information technology systems. In addition, despite the new possibilities that blockchain may offer for identity generation and management, there are potential concerns regarding its use in applications that involve identity authentication or the protection of privacy or financial data. Developments regarding blockchain technology, as well as related legal issues, costs and infrastructure and other implications should therefore be monitored and further considered.

An international regulatory development relevant to the legal recognition of electronic transferable records is the recent finalization by the United Nations Commission on International Trade Law Working Group IV on Electronic Commerce of a model law on electronic transferable records, adopted in July 2017 (see http://uncitral.org/pdf/english/texts/electcom/MLETR_ebook.pdf). The model law contains, among others, the definition of an electronic transferable record that must contain data and information identifying it as the functional equivalent of a transferable document or instrument such as, for example, bills of lading, receipts, certificates and other documents used in shipping. The model has four sections, as follows: general provisions (articles 1–7); provisions on functional equivalence (articles 8–11); use of electronic transferable records (articles 12–18); and cross-border recognition of electronic transferable records (article 19). It also sets out requirements to ensure the singularity and integrity of an electronic transferable record, as well as its ability to be controlled from its inception until it ceases to have any effect or validity, in particular in order to allow for its transfer. Since 2015, the United Nations Commission on International Trade Law has been addressing legal issues related to identity management and trust services and to contractual aspects of cloud computing (see http://www.uncitral.org/uncitral/en/commission/working_groups/4Electronic_Commerce.html).

B. REGULATORY DEVELOPMENTS RELATING TO THE REDUCTION OF GREENHOUSE GAS EMISSIONS FROM INTERNATIONAL SHIPPING, AND OTHER ENVIRONMENTAL ISSUES

1. Reduction of greenhouse gas emissions from international shipping and energy efficiency

Greenhouse gas emissions from international shipping

Maritime transport emits around 1 billion tons of carbon dioxide annually and is responsible for about 2.5 per cent of global greenhouse gas emissions from fuel combustion. By 2050, depending on future economic growth and energy developments, shipping emissions may increase by between 50 and 250 per cent (IMO, 2014a). This is not in keeping with the internationally agreed goal of limiting the global average temperature increase to below 2°C above pre-industrial levels, which would require worldwide emissions to be at least halved from the 1990 level by 2050. The implementation of technical and operational measures for ships could increase efficiency and reduce the emissions rate by up to 75 per cent, and further reductions could be achieved by implementing innovative technologies (IMO, 2009).

The Marine Environment Protection Committee, at its session in July 2017, continued to build on previous work to address greenhouse gas emissions from international shipping, in particular through the adoption of an IMO strategy on the reduction of greenhouse gas emissions from ships in 2018, in accordance with a road map approved at its session in October 2016 (IMO, 2016a, annex 11). The Committee considered various proposals with regard to the strategy from States and industry representatives, and noted the draft outline for its possible structure, which included the following elements: preamble, introduction and context, including emission scenarios; vision; levels of ambition and guiding principles; list of candidate short-term, midterm and long-term measures with possible timelines and their impacts on States; barriers and supportive measures, capacity-building and

technical cooperation and research and development; follow-up actions towards the development of the revised strategy; and a periodic review of the strategy (IMO, 2017c). Delegations expressed concern with regard to the need for proper references in the road map to consideration of the special needs of small island developing States and the least developed countries, in accordance with the Small Island Developing States Accelerated Modalities of Action Pathway, to ensure both progress and inclusiveness, and the need for a high level of ambition with regard to the strategy was highlighted.[7]

Energy efficiency for ships

Energy efficiency measures, legally binding for the entire maritime industry since 2013, include the Energy Efficiency Design Index that sets standards for new ships, and associated operational energy efficiency measures for existing ships. However, no agreement has been reached to date on global market-based measures or other instruments that would reduce emissions from the entire shipping sector.

The Marine Environment Protection Committee, at its session in July 2017, was advised that nearly 2,500 new ships had been certified as complying with energy efficiency standards. Among others, the Committee adopted guidelines for administration verification of ship fuel oil consumption data for ships of 5,000 gross tonnage and above, starting from 2019, and guidelines for the development and management of the IMO ship fuel oil consumption database (IMO, 2017c, annexes 16 and 17). These guidelines make it mandatory for ships of 5,000 gross tonnage and above to collect consumption data for each type of fuel oil they use, as well as additional specified data, including proxies for transport work. The aggregated data will be reported to the flag State after the end of each calendar year, and subsequently transferred to the IMO database.

2. Ship-source pollution and protection of the environment

Air pollution from ships

With regard to NO_x, the Marine Environment Protection Committee adopted amendments designating the North Sea and the Baltic Sea (which are emission control areas for sulphur oxide (SO_x)) as NO_x emission control areas under the International Convention for the Prevention of Pollution from Ships, annex VI, regulation 13. Marine diesel engines operating in these areas will be required to comply with the stricter tier III NO_x emissions limit when installed on ships constructed on or after 1 January 2021. Guidelines on selective catalytic reduction systems were also adopted (IMO, 2017c, annex 13).

With regard to SO_x, the Committee adopted an important decision with regard to human health and the environment, namely to implement a global limit of 0.5 per cent on sulphur in fuel oil used on board ships, as set out in the International Convention for the Prevention of Pollution from Ships, annex VI, regulation 14.1.3, from 1 January 2020 (IMO, 2016a, annex 6). This represents a significant reduction from the 3.5 per cent limit currently in place outside emission control areas.[8] To meet requirements, shipowners and operators continue to adopt various strategies, including installing scrubbers and switching to liquefied natural gas and other low-sulphur fuels. The Committee approved guidelines providing an agreed method for sampling to enable the effective control and enforcement of sulphur content of liquid fuel oil used on board ships under the provisions of the International Convention for the Prevention of Pollution from Ships, annex VI (IMO, 2016b), and amendments to the information to be included in the bunker delivery note related to the supply of fuel oil to ships that have fitted alternative mechanisms to address SO_x emission requirements (IMO, 2017c).

Ballast water management

An important development is the entry into force of the Ballast Water Management Convention, 2004, on 8 September 2017.[9] The Convention aims to prevent the risk of the introduction and proliferation of non-native species following the discharge of untreated ballast water from ships. This is considered one of the four greatest threats to the world's oceans and one of the major threats to biodiversity, which, if not addressed, can have extremely severe public health-related and environmental and economic impacts (see http://globallast.imo.org). From the entry into force date, ships are required to manage their ballast water to meet standards referred to as D-1 and D-2; the former requires ships to exchange and release at least 95 per cent of ballast water by volume far away from a coast and the latter raises the restriction to a specified maximum amount of viable organisms allowed to be discharged, limiting the discharge of specified microbes harmful to human health. Draft amendments to the Convention as approved by the Marine Environment Protection Committee, to be circulated after its entry into force and adopted in April 2018, clarify when ships must comply with the D-2 standard. New ships, constructed on or after 8 September 2017, shall meet the D-2 standard from the date they are entered into service. Existing ships constructed before 8 September 2017 shall comply with the D-2 standard after their first or second five-year renewal survey associated with the International Oil Pollution Prevention Certificate under the International Convention for the Prevention of Pollution from Ships, annex I, conducted after 8 September 2017, and in any event not later than 8 September 2024 (IMO, 2017c).

Hazardous and noxious substances

In April 2017, the Legal Committee of IMO approved a draft resolution calling on States to consider ratifying the

International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996, as amended by its 2010 Protocol, and to implement it in a timely manner (IMO, 2017d, annex 2). This key instrument has not yet entered into force as, to date, it has been ratified by only one State (Norway). This leaves an important gap in the global liability and compensation framework, while a comprehensive and robust international liability and compensation regime is in place with respect to oil pollution from tankers (International Oil Pollution Compensation Fund regime),[10] as well as with respect to bunker oil pollution from ships other than tankers (International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001).

Pollution from offshore oil exploration and exploitation

The Legal Committee of IMO finalized guidance to be taken into consideration by States when negotiating bilateral and/or regional arrangements or agreements on liability and compensation issues connected with transboundary oil pollution damage resulting from offshore exploration and exploitation activities (IMO, 2017e). The need for a global legal instrument has been considered at IMO since 2011, but no agreement has been reached. While the reluctance of IMO to deal with this issue appears to be related to its mandate, which focuses on ship-source pollution (IMO, 2014b), the continued absence of an international liability regime leaves an important gap in the international legal framework and is a matter of concern, in particular for potentially affected developing countries.

C. OTHER LEGAL AND REGULATORY DEVELOPMENTS AFFECTING TRANSPORTATION

1. Combating maritime piracy and armed robbery

The Maritime Safety Committee, in June 2017, reported a total of 221 piracy and armed robbery incidents worldwide in 2016, a decrease of about 27 per cent compared with 303 incidents in 2015. However, an increase of 77 per cent was observed in West Africa. Piracy off the coast of Somalia remained active, with eight incidents reported between January and April 2017, and around 39 crew members taken hostage. To address the possible underreporting of piracy and armed robbery incidents within the Gulf of Guinea region, the Maritime Safety Committee urged all concerned to report incidents in a timely manner to reporting organizations, to allow for better response and risk management (IMO, 2017a).

2. Legally binding instrument under the United Nations Convention on the Law of the Sea, 1982

Under this Convention, the seabed beyond the limits of national jurisdiction is subject to the principle of the common heritage of humanity, and resources found there are to be used for the benefit of humanity as a whole, and taking into particular consideration the interests and needs of developing countries (article 140). Marine genetic resources are commercially valuable and hold considerable potential for the development of advanced pharmaceuticals; their exploitation may in the near future become a promising activity in areas beyond the limits of national jurisdiction. In the absence of a specific international legal framework regulating related issues, negotiations have been ongoing since 2016 at the United Nations on key elements for an international legally binding instrument under this Convention, on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction. The outcome of the fourth meeting of the preparatory committee established in accordance with General Assembly resolution 69/292 of 19 June 2015 (see http://www.un.org/Depts/los/biodiversity/prepcom.htm), held in July 2017, included a number of elements recommended for consideration by the General Assembly in the elaboration of a text. The suggested elements reflected convergence among most delegations during the discussions, and were not exclusive. The outcome also included a list of main issues related to these elements, on which there was divergence of views, as well as a recommendation to the General Assembly to take a decision, as soon as possible, on the convening of an intergovernmental conference. Suggested elements included, among others, the following: general principles and approaches; international cooperation; marine genetic resources, including questions on the sharing of benefits; measures such as area-based management tools, including marine protected areas; environmental impact assessments; and capacity-building and the transfer of marine technology. In this context, it is important for the special requirements of developing countries, in particular the least developed countries, landlocked developing countries, geographically disadvantaged States, small island developing States and coastal African States, to be taken into account when drafting the instrument.

3. Seafarers' issues: International Labour Organization Work in Fishing Convention, 2007 (No. 188)

This Convention, which enters into force on 16 November 2017, aims to provide updated and comprehensive international labour standards for fishing workers.[11] Over 38 million people work in capture fisheries globally, in an industry that is one of the most dangerous professions

(International Labour Organization, 2016). Sustainable Development Goal 14, to conserve and sustainably use the oceans, seas and marine resources for sustainable development, includes several targets dedicated to fisheries, in particular targets 14.4, 14.7 and 14.b. Although the targets do not include direct references to the labour dimension of sustainable fishing, the rights of fishing workers are relevant in this context. Earlier studies have, for example, linked overfishing and illegal fishing to the increasing hazardousness and deterioration of working conditions for fishing workers (Environmental Justice Foundation, 2015; International Labour Organization, 2013a; Pocock et al, 2016). Due to conservation measures aimed at protecting fishing stocks from unsustainable fishing practices, fishing vessels may be forced to travel further out to sea, to hazardous and isolated environments, increasing the possibility for the abuse of fishing workers (International Labour Organization, 2013b). Other problems relate to the practice of flagging fishing vessels to countries that have inadequate labour protection regulations or using open registers that allow for the preservation of anonymity of ownership, which may complicate the issue of vessel labour inspection responsibilities (Food and Agriculture Organization of the United Nations, 2002).

The Work in Fishing Convention, 2007 (No. 188), establishes minimum labour standards for fishing workers on all types of commercial fishing vessels globally. Its objective is to "ensure that fishers have decent conditions of work on board fishing vessels with regard to minimum requirements for work on board; conditions of service; accommodation and food; occupational safety and health protection; medical care and social security" (International Labour Organization, 2007a). The Convention lists commitments undertaken by States Parties in these areas and requires them to implement and enforce national laws, regulations or other measures they have adopted to fulfil the commitments (article 6). The Convention addresses the work agreements of fishing workers, which shall be in writing (articles 16–20); recruitment and placement (article 22); and regular payment and means to transmit payments to their families at no cost (articles 23 and 24). Provisions related to social security protection aim to protect migrant workers' rights, requiring States to "achieve progressively comprehensive social security protection for fishers, taking into account the principle of equality of treatment irrespective of nationality" (article 36 (a)). The Convention also establishes mechanisms for inspection, compliance and enforcement. In its capacity as a flag State, a State Party "which receives a complaint or obtains evidence that a fishing vessel that flies its flag does not conform to the requirements of this Convention shall take the steps necessary to investigate the matter and ensure that action is taken to remedy any deficiencies found" (article 43.1) and, in its capacity as a port State, if a State Party in whose port a fishing vessel calls "receives a complaint or obtains evidence that such vessel does not conform to the requirements of this Convention, it may prepare a report addressed to the Government of the flag State of the vessel [and] may take measures necessary to rectify any conditions on board which are clearly hazardous to safety or health" (article 43.2). In addition, the Convention shall be applied "in such a way as to ensure that the fishing vessels flying the flag of any State that has not ratified this Convention do not receive more favourable treatment than fishing vessels that fly the flag of any member that has ratified it" (article 44). This article, along with port State control, may provide an incentive for a wider implementation of the Convention, to vessels flagged to States that are not Parties to the Convention.

Two sets of International Labour Organization guidelines provide practical guidance for the implementation of flag State and port State inspections (International Labour Organization, 2011 and 2017). In addition, the Work in Fishing Recommendation, 2007 (No. 199), provides guidance on the implementation of the Convention (International Labour Organization, 2007b).

D. POLICY CONSIDERATIONS

The use of new technologies in the maritime industry is associated with increased cybersecurity threats and risks. To ensure that ships navigate safely, important information on board and on shore remains secure and that seafarers and other staff are aware of the dangers and risks involved, Governments, public and private companies and other stakeholders should work together to better understand, assess, manage and implement new technologies. In implementing new technologies, cybersecurity should be carefully considered, along with other important issues, to facilitate risk reduction and mitigation efforts and to increase cybersecurity resilience. Collaborative approaches are important in this context, to raise awareness about possible cybersecurity threats, risks and consequences, and to effectively address these through information exchanges, coordination and dialogue, as well as by upgrading outdated systems, increasing the physical security of information technology facilities and data networks and providing cybersecurity training for employees. Where appropriate, cybersecurity elements should be mainstreamed into regulatory frameworks governing the maritime sector and regulatory compliance should be encouraged and supported. The enforcement of existing cybersecurity regulations is important, as is the development of additional standards and policies. In addition, best practices, guidance and standards adopted to date should be considered, along with the five functional elements in the IMO guidelines on maritime cybersecurity risk management, namely identify, protect, detect, respond and recover.

In the light of the entry into force and widespread adoption of the Paris Agreement under the United Nations Framework Convention on Climate Change,

ongoing efforts to reduce greenhouse gas emissions from international shipping should be pursued as a matter of urgency, including through the implementation of technical and operational measures, as well as innovative technologies for ships. Discussions on a global greenhouse gas reduction strategy should properly reflect and take into account the special needs of small island developing States and the least developed countries, to ensure progress and inclusiveness. With respect to ship-source air pollution, it is important for shipowners and operators to continue to consider and adopt various strategies, including installing scrubbers and switching to liquefied natural gas and other low-sulphur fuels. In addition, practical plans should be in place to implement the cap of 0.5 per cent on sulphur content in fuel oil used on board ships from 1 January 2020.

Given the importance of implementing and effectively enforcing strong international environmental regulations and in the light of the policy objectives inherent in Sustainable Development Goal 14, developed and developing countries are encouraged to consider becoming parties to relevant international conventions for marine pollution prevention and control, as a matter of priority. In this context, the entry into force of the Ballast Water Management Convention, 2004, in September 2017 may be noted. Widespread adoption and implementation of international conventions addressing liability and compensation for ship-source pollution, such as the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 2010, is also desirable, in view of the important gaps that remain in the international legal framework.

Progress is being made in ongoing negotiations at the United Nations on an international legally binding instrument under the United Nations Convention on the Law of the Sea, 1982 on the conservation and sustainable use of the marine biological diversity of areas beyond national jurisdiction. In this context, and in particular with regard to questions on the sharing of benefits from marine genetic resources, capacity-building and the transfer of marine technology, it is important for the special requirements of developing countries, in particular the least developed countries, landlocked developing countries, geographically disadvantaged States, small island developing States and coastal African States, to be taken into account when drafting the instrument.

The entry into force of the Work in Fishing Convention, 2007 (No. 188), will assist the achievement of the Sustainable Development Goals, in particular those related to ocean governance and the sustainable use of the oceans and seas and of marine resources, including fisheries, by adding a labour and social sustainability dimension. All countries, in particular developing countries for which employment in capture fishing is important, may wish to consider becoming parties to this Convention.

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ENDNOTES

1. For a definition of the concept, see http://www.itu.int/en/ITU-T/studygroups/com17/Pages/cybersecurity.aspx.
2. For further information on enhancing cybersecurity at United States ports and related recommendations, see United States Government Accountability Office, 2015.
3. Including the following: joint industry guidelines on cybersecurity on board ships, second edition, adopted, July 2017 (see https://www.bimco.org/news/press-releases/20170705_cyber-g); ISO and International Electrotechnical Commission standard No. 27001 on information technology: security techniques – information security management systems and requirements; and the United States National Institute of Standards and Technology framework for improving critical infrastructure security. For general information on cybercrime and on addressing cybercrime, see https://www.unodc.org/unodc/en/organized-crime/expert-group-to-conduct-study-cybercrime-feb-2013.html.
4. That is, allowing the creation of changes by hijacking the majority of nodes on a network, which can be an issue on private or permissioned networks with relatively smaller nodes.
5. For example, standardized information technology data dictionaries such as the United Nations Economic Commission for Europe core components library.
6. Bill of lading electronic registry organization; see UNCTAD, 2003, and http://www.bolero.net.
7. Cook Islands, supported by Palau, Papua New Guinea, Solomon Islands, Tuvalu and Vanuatu, as well as interventions by Bahamas and Norway.
8. Within emission control areas in which more stringent controls on SO_x emissions apply, the sulphur content of fuel oil must be no more than 0.1 per cent (1,000 parts per million), from 1 January 2015. The first two SO_x emission control areas were established in Europe, in the Baltic Sea and the North Sea, and took effect in 2006 and 2007, respectively; the third was established in North America and took effect in 2012; and the fourth was established as the United States Caribbean Sea, covering waters adjacent to the coasts of Puerto Rico and the United States Virgin Islands, and took effect in 2014.
9. As at 13 September 2017, there were 65 States Parties to the Convention, representing 73.92 per cent of the gross tonnage of the world's merchant fleet. For more information on related developments see UNCTAD, 2011, and UNCTAD, 2015.
10. International Convention on Civil Liability for Oil Pollution Damage, 1969, and its 1992 Protocol and International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971, and its 1992 and 2003 Protocols. For an analytical overview of the international legal framework, see UNCTAD, 2012. See also UNCTAD, 2013, pp. 110–111.
11. The Convention revises the following: Minimum Age (Fishermen) Convention, 1959 (No. 112); Medical Examination (Fishermen) Convention, 1959 (No. 113); Fishermen's Articles of Agreement Convention, 1959 (No. 114); and Accommodation of Crews (Fishermen) Convention, 1966 (No. 126).

6

MARITIME TRANSPORT CONNECTIVITY

Globalized production, trade, communication and finance depend on connectivity, that is, the possibilities for people, companies and countries to connect with each other. UNCTAD has led the research on shipping connectivity since the first publication of the liner shipping connectivity index in 2004.

More recently, "[c]onnectivity has become a buzz word in development and international economics … . Viewing economic and social ties as isolated point-to-point interactions is losing ground to more comprehensive approaches, in which 'networks' are increasingly becoming the unit of analysis" (World Bank, 2013a). The Group of 20 launched the Global Infrastructure Connectivity Alliance to improve the "linkages of communities, economies and nations through transport, communications, energy and water networks" (Global Infrastructure Connectivity Alliance, 2016). In the same vein, Aid for Trade at a Glance 2017 focuses on promoting trade, inclusiveness and connectivity for sustainable development (World Trade Organization, 2017). In a contribution to the aforementioned report, OECD and UNCTAD (2017) point out that "while digital connectivity can provide new opportunities for developing countries to participate in international trade, traditional trade costs related to physical connectivity can still represent a significant barrier to the physical delivery of goods". World Bank (2013b) concludes that "[m]aritime transport connectivity and logistics performance are very important determinants of bilateral trade costs: in some specifications, their combined effect is comparable to that of geographical distance". Improved liner shipping connectivity can help reduce trade costs and has a direct, positive bearing on trade volumes. This is confirmed by numerous studies on trade, seaports and shipping networks (see Wilmsmeier et al., 2006; Sourdin and Pomfret, 2012; Wilmsmeier, 2014; Ducruet, forthcoming; Fugazza and Hoffmann, 2017; Hoffmann et al., 2017; Wilmsmeier et al., 2017; and Geerlings et al., forthcoming, and the extensive literature referred to therein).

Given that maritime shipping continues to be the main mode of transport for most developing countries' foreign trade, this chapter begins by introducing the concept of maritime transport connectivity at the country level and for bilateral connections (section A). It then discusses in more detail two areas where maritime connectivity could be improved, notably the potential of connecting domestic and international shipping services (section B) and trade and transport facilitation measures that could enhance maritime connectivity (section C). Concluding section D presents policy options and recommendations, building upon the six chapters of the Review.

MARITIME CONNECTIONS

Country pairs that add a direct route tend to see a reduction in trade costs of 9 percentage points

BEST CONNECTED COUNTRIES PER REGION

Cabotage can enhance operational efficiency along the supply chain, address concerns related to carbon dioxide emissions and energy efficiency and trade prospects through trans-shipment

The potential of cabotage is higher in countries with longer coasts or in countries with islands, where the alternative road transport is costlier or not available

A. CONTAINER SHIP DEPLOYMENT AND LINER SHIPPING CONNECTIVITY

Most manufactured goods are transported by containerized liner shipping services. Container ships have a fixed schedule and call at several ports during a journey. Containers with goods belonging to different shippers are loaded, trans-shipped or unloaded in each port. This type of service is comparable to a city's metro network, where metro stations are connected to one or more lines. Passengers will look at timetables and options to change from one line to another to arrive at a destination. For liner shipping services, the "connectivity" of different countries can be compared by consulting ship schedules and considering options to connect to overseas markets through the liner shipping network.[1]

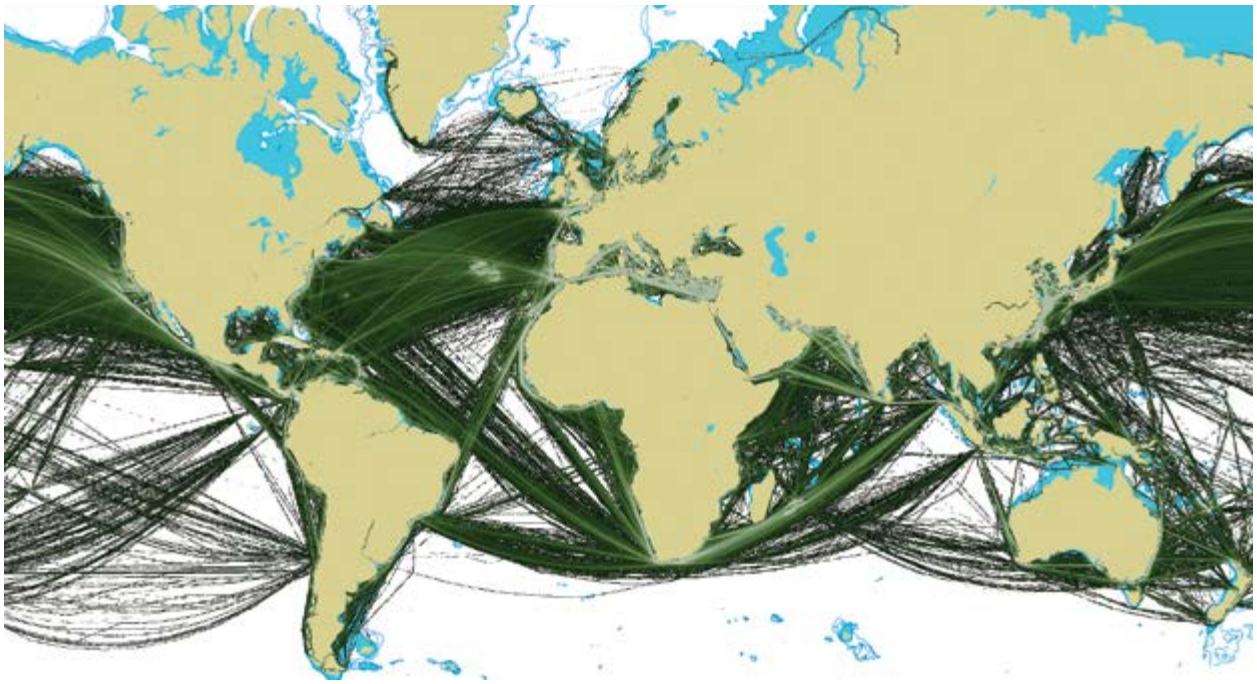
Figure 6.1 depicts the density map of container ships in 2016. The key nodes of the network are Malacca, Panama, the Strait of Gibraltar and Suez, and traffic is denser in general in the northern hemisphere than in the southern hemisphere, with exceptions, for example around Santos (Brazil), South Africa and Mauritius. Some locations are better connected than others, and it is worthwhile to understand the reasons for these differences and options for improvement.

1. Country-level liner shipping connectivity

To compare and analyse countries' positions within the global liner shipping network, UNCTAD in 2004 developed the liner shipping connectivity index. The index, generated from the schedules of the world's container shipping fleet, uses five components: the number of ships deployed to and from each country's seaports, their combined container-carrying capacity, the number of companies that provide regular services, the number of services and the size of the largest ship.[2] The methodology has remained constant since 2004 and is not dependent on samples, surveys or perceptions. Figure 6.2, panels (a) – (h), illustrates index trends in selected regions.

On the west coast of South America, Panama is the best-connected country of the subregion (figure 6.2(a)). Panama benefits from the Panama Canal, which has encouraged the establishment of trans-shipment ports. Chile and Peru have largely the same level of connectivity, as both countries are served by the same companies and ships. Ecuador is still lagging behind; initially, its main seaport, Guayaquil, was among the last to invest in ship-to-shore container gantry cranes and is hindered by draft restrictions in comparison with the other main ports on the west coast of South America. This example shows that ports along a same route also depend on investments made in other ports served by the same lines. If – for example – only one port invests in container-handling equipment while other ports on the same route do not, ships will need to bring their own gear, and potential savings on the seaside are not achieved. On the west coast of South America, Chile was among the first to invest in ship-to-shore container cranes, and for many years, many ships calling at San Antonio or Valparaiso, Chile continued to sail with

Figure 6.1. Density map of container ship movements



Source: Prepared for UNCTAD by Marine Traffic.
Note: Data depict container ship movements in 2016.

their own cranes, because they needed them in Callao, Peru; Guayaquil, Ecuador or Buenaventura, Colombia. Today, such differences have prompted a trend towards hub-and-spoke networks, and ports like Guayaquil are often served by feeder services with trans-shipment, principally in Panama.

On the east coast of South America (figure 6.2 (b)), Argentina, Brazil and Uruguay are served by the same lines. Although Uruguay is a much smaller economy, it accommodates the same services, not only for its own imports and exports, but also for transit cargo from Paraguay and trans-shipment services into Argentina and Brazil, where cabotage restrictions limit the trans-shipment potential of domestic ports.

In Africa, the best-connected countries are Egypt, Morocco and South Africa (figure 6.2 (c)). Morocco has seen a sharp increase of its liner shipping connectivity index because of the trans-shipment hub Tanger–Mediterranean. In Eastern Africa, Djibouti has significantly improved its connectivity, benefiting from its geographical position and private investments in the trans-shipment hub (figure 6.2 (d)).

On the Arabian Peninsula, the United Arab Emirates, with its hub port in Dubai, has maintained the highest liner shipping connectivity index of the subregion (figure 6.2 (e)). Several countries have benefited from their geographic position, linking East–West services between Europe and Asia to North–South and feedering services that connect their ports to Africa and Southern Asia.

In Southern Asia, Sri Lanka has bypassed its neighbours. Colombo accommodates large container ships that are deployed on services between Asia and Europe, as well as some services to Africa and South America (figure 6.2 (f)). Feedering from Colombo to ports in India can be done with ships under any flag, as these services are not affected by the Indian cabotage restrictions.

In South-East Asia, Singapore and Malaysia are largely served by the same lines in their Asia–Europe services, and their liner shipping connectivity index moves mostly in parallel (figure 6.2 (g)). In some years, however, the index reflects competition for trans-shipment services. For example, in 2007, Maersk left Singapore for Malaysia for most trans-shipment operations. The other countries in the subregion have not seen improvements in their index, as they continue to connect to overseas markets largely through trans-shipment services via Singapore and Malaysia.

In Eastern Asia, China boasts the highest liner shipping connectivity index, as its ports are the world's major loading locations (figure 6.2 (h)). For many years, Hong Kong (China) and the Republic of Korea benefited from connecting Chinese and Japanese services to the global liner network through their trans-shipment hubs. With growing trade volumes and revised cabotage regulations for trans-shipment in Shanghai, ships increasingly call directly at ports in China, and the need for trans-shipment in Hong Kong (China) and the Republic of Korea has decreased.

Small island developing States in all regions are characterized by low levels of connectivity. Examples from table 6.1 include Antigua and Barbuda in the Caribbean (four ships on two services), Sao Tome and Principe in the Atlantic (five ships on two services), Maldives in the Indian Ocean (two ships on two services), and Nauru and Tuvalu in the Pacific (one ship on one service). Mauritius, on the other hand, has attracted ships of more than 10,000 TEUs, with 16 ship operators deploying 75 ships on 13 services to and from the island.

The largest container ships of up to 18,506 TEU capacity are deployed on services between Europe and Eastern Asia, calling also at ports in Southern and South-East Asia and in Northern Africa (Morocco). The largest ships deployed on services to North America carry up to 13,950 TEUs.

The liner shipping connectivity index illustrates trends in different countries. For a more detailed analysis, it is also useful to look at the components of the index. Table 6.1 provides data relating to the five components for selected countries (May 2017). Annual deployed container-carrying capacity varies between 6,156 TEUs for Tuvalu and more than 85 million TEUs for China; there were 1,996 container ships scheduled on liner services to and from Chinese ports, compared with just one ship for Tuvalu. Small island developing States in all regions must deal with low levels of connectivity.

Container ship deployment to seaports in Egypt and Panama is similar overall, even though the maximum ship size that can pass through the Suez Canal is far larger than what is allowed through the Panama Canal, even after the latter's expansion. The larger ships that pass through the Suez Canal do not make use of Egyptian seaports. In Africa, Togo is served by ships of up to 10,309 TEU capacity, connecting Western and Southern Africa (including Mauritius) to Eastern Asia. Ships calling at ports in Ghana, Kenya, or Nigeria have less than half of that capacity. Steps policymakers can take to attract more companies, ships and services are discussed later in this chapter; further details about the structure of the global liner shipping network and country-pair (bilateral) connectivity are provided below.

2. Bilateral liner shipping connectivity

Less than 20 per cent of coastal country pairs have a direct maritime connection between them, meaning that containerized goods can be transported

Figure 6.2. Liner shipping connectivity index, 2004–2017: (a) West Coast, South America; (b) East Coast, South America; (c) African hubs; (d) Eastern Africa; (e) Western Asia; (f) Southern Asia; (g) South-East Asia; and (h) Eastern Asia

Source: UNCTAD secretariat calculations. For the liner shipping connectivity index of each country, see http://stats.unctad.org/LSCI; for the calculation, see endnote 2.

Table 6.1. Country-level container ship deployment, selected countries, May 2017

Country	Deployed annual capacity (TEUs)	Number of ships scheduled on services	Number of services	Maximum ship capacity (TEUs)
Antigua and Barbuda	78 832	4	2	1 116
Chile	4 187 451	129	21	11 629
China	85 347 681	1 996	463	18 506
Democratic Republic of the Congo	173 662	15	7	1 005
Egypt	12 110 793	293	71	14 167
Germany	26 427 472	621	143	18 350
Ghana	1 866 259	111	18	4 596
Kenya	1 815 648	71	17	4 013
Malaysia	36 663 697	906	196	18 506
Maldives	64 256	2	2	1 118
Mauritius	2 339 459	75	13	10 409
Micronesia	9 360	3	1	624
Morocco	12 053 640	312	68	18 350
Myanmar	809 958	43	17	1 468
Nauru	16 276	1	1	626
Nigeria	3 262 826	179	27	4 535
Panama	11 943 496	357	62	12 041
Republic of Korea	40 924 768	1 017	245	18 506
Sao Tome and Principe	41 145	5	2	2 006
Sri Lanka	13 719 661	327	59	18 350
Togo	2 302 871	90	15	10 409
Tuvalu	6 156	1	1	513
United Arab Emirates	20 468 669	393	94	17 387
United States	36 154 504	990	200	13 950
Venezuela (Bolivarian Republic of)	555 826	30	16	2 139

Source: UNCTAD secretariat calculations based on data provided by MDS Transmodal.
Note: The container ship-carrying capacity indicated in this table is not fully comparable to the capacity indicated in chapter 2. For the purposes of chapter 6, only the capacity to transport full containers is considered – reported vessel sizes in TEUs in this table are slightly smaller than those in chapter 2.

between a country of origin and a destination without the need for trans-shipment. The average number of direct maritime connections is half as high in developing countries compared to developed ones.

Table 6.2 provides examples of bilateral fleet deployment to illustrate the different aspects of bilateral connectivity. The highest direct bilateral connectivity is between China and the Republic of Korea. In general, there are high levels of connectivity between neighbouring countries. For instance, ships may call at the ports of two neighbouring countries; some transport bilateral trade between the two countries or call at trans-shipment ports as feeder vessels, and the same ships may transport exports from the two neighbouring countries to third countries.

More than 80 per cent of country pairs do not have a direct connection. This includes large trading nations that lie across the same ocean, for example, Brazil and Nigeria. An interesting question for trade and transport analysts is whether there are no direct connections between the two countries because there is not enough demand, or whether there is not much trade between them because the two trading partners are not well connected. As discussed below, there is evidence for both.

Because of containerization and trans-shipment, any country can effectively trade with another country, even if there is no direct service connecting the two. To capture the level of bilateral connectivity for those cases where there is no direct service, UNCTAD developed the bilateral liner shipping connectivity index (Fugazza and Hoffmann, 2016; Hoffmann et al., 2014). Unlike the country-level index, which provides an index value per country, the bilateral liner shipping connectivity index provides 160 values per country, namely a coastal country's connectivity with other coastal countries.

The bilateral liner shipping connectivity index is generated from five components. For a pair of countries A and B, the index is based on the following factors: the number of trans-shipments required to get from country A to country B, where a lower number leads to a higher index; the number of direct connections common to both countries; the geometric mean of the number of direct connections of countries A and B; the level of competition on services that connect country A to country B; and the size of the largest ships on the weakest route connecting country A to country B.[3] The index is symmetrical; in other words, what characterizes liner services from country A to country B also characterizes services from country B to country A.

Table 6.2. Bilateral container ship deployment, selected country pairs, May 2017

Country pairs	Deployed annual capacity (TEUs)	Number of ships scheduled on services	Number of services	Maximum ship capacity (TEUs)
Antigua and Barbuda–Saint Kitts and Nevis	78 832	4	2	1 116
Argentina–Brazil	4 358 270	115	19	9 635
Australia–Singapore	2 650 466	91	17	6 380
Bangladesh–Malaysia	1 612 738	40	16	2 457
Brazil–India	-	-	-	-
Cambodia–Thailand	693 801	34	9	2 181
Cameroon–Gabon	211 154	19	4	3 149
Chile–Peru	3 877 925	119	17	11 629
Chile–Singapore	-	-	-	-
China–Netherlands	11 456 912	156	14	18 506
China–Republic of Korea	38 356 591	911	180	18 506
China–United States	19 331 964	427	57	13 950
Colombia–Panama	6 527 459	203	29	11 629
Djibouti–Saudi Arabia	1 988 139	57	9	8 966
Ecuador–Panama	1 625 393	74	12	9 227
Egypt–Italy	6 090 427	152	30	14 167
Gabon–Namibia	4 260	1	1	710
Germany–Netherlands	19 879 996	409	62	18 350
India–Sri Lanka	6 982 551	150	37	11 569
Kenya–United States	-	-	-	-
Madagascar–France	720	2	1	60
Marshall Islands–Fiji	61 994	7	3	1 617
Mauritius–South Africa	1 451 832	36	4	10 409
Nigeria–Brazil	-	-	-	-
Togo–China	1 201 361	44	4	10 409

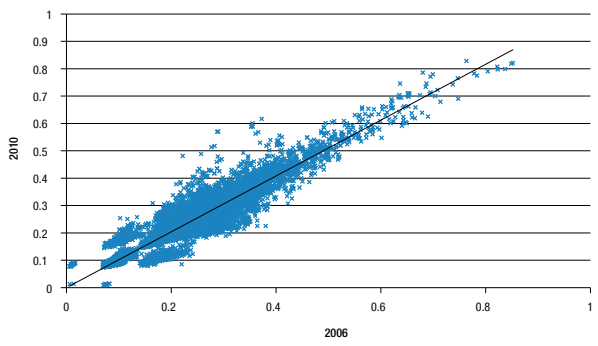
Source: UNCTAD secretariat calculations based on data provided by MDS Transmodal.
Note: Country pairs with no information provided (on this table) do not have a direct liner connection.

Figure 6.3 compares the bilateral liner shipping connectivity index over two periods: panel (a) compares 2010 values with those of 2006, and panel (b) compares 2016 values with those of 2010. Points above (below) the 45-degree line represent country pairs whose index has increased (decreased). Between 2006 and 2010, 61 per cent of country pairs saw an improvement of their index. The figure increases to 68 per cent between 2010 and 2016. The index stagnated for most country pairs in the immediate aftermath of the 2008 economic and financial crisis and began increasing only after 2010.

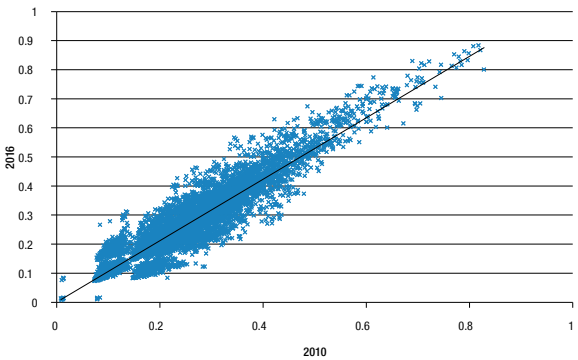
An analysis of the components of the bilateral liner shipping connectivity index reveals that the average number of trans-shipments required to transport a container from one country to another has grown over the years. This is in line with industry trends. As ships become larger and alliances make more and more use of hub ports from where ships with the most appropriate vessel size for each leg of the total route are assigned, the number of direct services decreases. This reflects the continued need for an optimization of shipping line networks (MDS Transmodal, 2017).

Figure 6.3. Bilateral liner shipping connectivity index trends, (a) 2006–2010 and (b) 2010–2016

(a)



(b)



Source: UNCTAD secretariat calculations, based on data from the UNCTAD liner shipping connectivity matrix (internal database).

Table 6.3. Top 25 country pairs ranked according to the bilateral liner shipping connectivity index, 2006, 2010 and 2016

Country pairs		Rank in 2006	Rank in 2010	Rank in 2016
Netherlands	United Kingdom	2	2	1
Netherlands	Belgium	5	4	2
United Kingdom	Belgium	1	3	3
Netherlands	Germany	6	7	4
Germany	Belgium	3	6	5
Republic of Korea	China	17	10	6
Singapore	Malaysia	16	5	7
United Kingdom	Germany	4	9	8
United Kingdom	France	8	11	9
France	Spain	10	35	10
United Kingdom	Spain	14	18	11
Netherlands	Spain	19	20	12
Malaysia	China	46	15	13
Spain	Belgium	18	19	14
Singapore	China	23	8	15
Netherlands	France	11	13	16
France	Belgium	7	12	17
Spain	Germany	25	22	18
Hong Kong (China)	China	9	1	19
France	Germany	12	17	20
Singapore	Republic of Korea	55	26	21
Italy	Spain	15	21	22
Malaysia	Republic of Korea	89	71	23
China	Belgium	36	25	24
Spain	China	57	32	25

Source: UNCTAD secretariat calculations, based on data from the UNCTAD liner shipping connectivity matrix (internal database).

In addition to European countries, five Asian countries are found among the top 25 country pairs (table 6.3). Their presence is more marked in 2016 and 2010 than in 2006. A deeper analysis shows that the top 50 bilateral liner shipping connectivity indices are only found on connections between 15 countries and that the top 250 indices are for connections between 40 countries. Bottom country pairs essentially include small and remote islands such as the Cook Islands, Montserrat and Nauru, and the least developed countries.

The definition and construction of the bilateral liner shipping connectivity index, based on hard fleet deployment data, rather than perceptions or surveys, is clearly of empirical interest. The index and its components have a direct bearing on trade costs, and liner shipping connectivity plays a crucial role in determining a country's trade performance. All other factors remaining equal, an increase by one unit (equivalent to a variation of 0.01) of the index is associated with an increase of the value of exports of containerizable goods by 3 per cent. Lacking a direct maritime connection with a trade partner is associated with lower export values; any additional trans-shipment is associated with a 40 per cent lower bilateral export value. An additional common direct destination is associated with about a 5 per cent higher bilateral export value. An increase by 1,000 TEUs of the largest ship operating on any leg of a maritime route is associated with an increase in bilateral export values of 1 per cent (Fugazza and Hoffmann, 2017; Fugazza, 2015).[4] Building on data from the UNCTAD liner shipping connectivity matrix, Shepherd (forthcoming) estimates that a reduction in trade costs of 9.09 percentage points can be achieved when country pairs add a direct maritime connection.

The construction and use of the UNCTAD indices on liner shipping connectivity go beyond empirical considerations. The possibility to monitor changes in the indices and their components over time can also help frame practical policy orientations. The data set offers a unique view of the liner shipping network, offering the possibility to understand and take into consideration the position in that network of a specific country or country pair. The indices can therefore be useful monitoring instruments and benchmarks for policymaking.

The next two sections discuss in detail two policy areas where a country's maritime transport connectivity can be improved. Section B looks at maritime cabotage – domestic shipping services – which could be linked to international shipping services, thus potentially improving a country's international connectivity. Second, section C focuses on trade and transport facilitation, through which a country's seaports can be made more attractive to its clients, that is to say, shipping lines and shippers.

B. MARITIME CABOTAGE: INTRACOUNTRY CONNECTIVITY AND GLOBAL SHIPPING NETWORKS

For any country with more than one seaport, in principle domestic and feedering traffic could be transported by sea. The potential for cabotage operations is higher in countries with longer coast lines or in countries with islands, where the alternative of trucking or rail transport is costlier or not available.

1. Domestic liner shipping connectivity

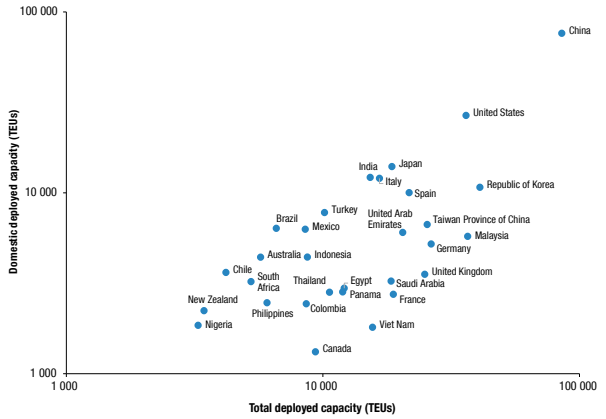
To provide an indication of potential containerized cabotage transport, table 6.4 shows the fleet deployment of liner shipping companies on services to and from a country's seaports. Figures 6.4 and 6.5 portray the relationship between total container shipping connectivity and domestic, or intracountry connectivity.

Table 6.4. Container ship deployment on domestic services, top 30 countries, May 2017

Rank (domestic deployed TEUs)	Country	Total vessel deployment					Domestic vessel deployment									
		Deployed annual capacity (TEUs)	Number of ships scheduled on services	Number of operators	Number of services	Maximum ship capacity (TEUs)	Deployed annual capacity (TEUs)	Percentage of total	Number of ships scheduled on services	Percentage of total	Number of operators	Percentage of total	Number of services	Percentage of total	Maximum ship capacity (TEUs)	Percentage of total
1	China	85 347 681	1 996	907	463	18 506	76 210 452	89	1 738	87	757	83	348	75	18 506	100
2	United States	36 154 504	990	437	200	13 950	26 758 518	74	755	76	315	72	124	62	13 950	100
3	Japan	18 584 569	594	291	204	12 939	13 960 932	75	462	78	252	87	181	89	9 041	70
4	India	15 291 675	371	164	90	11 569	12 158 250	80	290	78	117	71	62	69	11 569	100
5	Italy	16 614 787	454	162	103	14 167	12 017 710	72	318	70	114	70	72	70	14 167	100
6	Republic of Korea	40 924 768	1 017	465	245	18 506	10 725 845	26	286	28	160	34	99	40	18 348	99
7	Spain	21 685 890	605	213	151	18 506	10 016 158	46	269	44	107	50	73	48	14 167	77
8	Turkey	10 147 068	285	117	89	13 336	7 776 117	77	205	72	84	72	59	66	13 336	100
9	Taiwan Province of China	25 504 073	601	291	146	14 000	6 676 775	26	180	30	95	33	68	47	13 840	99
10	Brazil	6 581 330	175	55	31	9 635	6 359 090	97	168	96	49	89	25	81	9 635	100
11	Mexico	8 535 960	259	85	47	11 629	6 287 321	74	172	66	56	66	27	57	11 629	100
12	United Arab Emirates	20 468 669	393	158	94	17 387	6 036 511	29	118	30	52	33	31	33	12 183	70
13	Malaysia	36 663 697	906	365	196	18 506	5 739 593	16	156	17	79	22	53	27	13 908	75
14	Germany	26 427 472	621	253	143	18 350	5 213 249	20	125	20	39	15	35	24	18 341	100
15	Indonesia	8 700 671	290	146	117	8 704	4 412 786	51	184	63	85	58	77	66	4 400	51
16	Australia	5 717 420	206	91	49	6 380	4 406 863	77	157	76	63	69	32	65	6 380	100
17	Chile	4 187 451	129	40	21	11 629	3 629 957	87	113	88	32	80	18	86	11 629	100
18	United Kingdom	24 946 063	594	235	139	18 506	3 544 693	14	75	13	38	16	30	22	18 350	99
19	Saudi Arabia	18 444 508	354	137	59	14 159	3 248 576	18	60	17	29	21	13	22	11 421	81
20	South Africa	5 247 559	192	57	32	10 409	3 230 349	62	104	54	31	54	17	53	10 409	100
21	Egypt	12 110 793	293	107	71	14 167	2 968 621	25	65	22	32	30	21	30	6 571	46
22	Panama	11 943 496	357	114	62	12 041	2 829 557	24	89	25	24	21	14	23	9 040	75
23	Thailand	10 615 263	338	172	90	8 750	2 821 477	27	112	33	66	38	36	40	1 867	21
24	France	18 823 473	466	176	87	17 387	2 746 237	15	86	18	22	13	14	16	16 277	94
25	Philippines	6 056 224	195	92	76	4 818	2 468 508	41	98	50	46	50	43	57	3 477	72
26	Colombia	8 617 348	298	89	52	11 629	2 434 631	28	84	28	28	31	20	38	9 863	85
27	New Zealand	3 441 670	136	51	32	9 890	2 229 011	65	98	72	42	82	24	75	4 614	47
28	Nigeria	3 262 826	179	41	27	4 535	1 851 505	57	86	48	20	49	12	44	4 508	99
29	Viet Nam	15 616 632	487	230	128	13 504	1 804 686	12	61	13	28	12	25	20	2 550	19
30	Canada	9 351 366	259	113	45	11 293	1 320 349	14	41	16	15	13	9	20	8 500	75

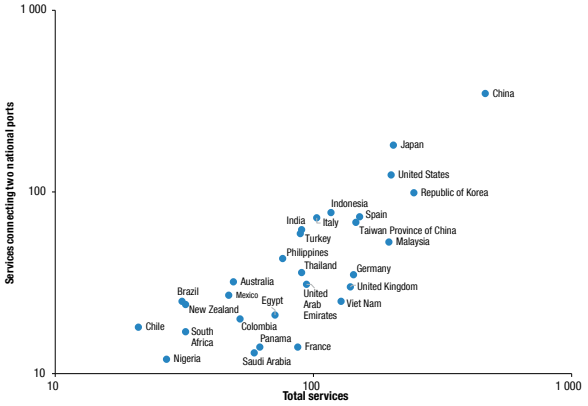
Source: UNCTAD secretariat calculations, based on data provided by MDS Transmodal.

Figure 6.4. Domestic and total 20-foot equivalent unit capacity deployed, May 2017



Source: UNCTAD secretariat calculations, based on data provided by MDS Transmodal.

Figure 6.5. Domestic and total number of container shipping services, May 2017



Source: UNCTAD secretariat calculations, based on data provided by MDS Transmodal.

As previously highlighted, many countries impose restrictions on international operators to transport domestic trade or to provide feedering services. This leads to situations where a ship may call at two ports within the same country, but is not allowed to transport cargo between the two ports. The data in table 6.4 and figures 6.4 and 6.5 give an indication of potential maritime transport of domestic trade. However, in view of the aforementioned restrictions, the data are not necessarily an indication that such transport is taking place.

Countries with long coast lines or islands often count on container shipping services that call at more than one domestic port. A comparison of Brazil and Germany, for example, reveals that Germany has a higher liner shipping connectivity than Brazil, with more companies providing services to German seaports than to ports in Brazil. However, most of these companies only call at either the ports of Hamburg or Bremerhaven but not both, while in Brazil, with its longer coast line, many operators call at the port of Santos and a second port. Hence, the intracountry container shipping connectivity is higher for Brazil than for Germany. Other countries for which domestic vessel deployment represents a high share of overall vessel deployment are Chile, China, India and Turkey.

A common feature of most countries in this situation is that the maximum TEU ship capacity deployed on intracountry services is the same as the maximum overall TEU ship capacity. This is an indication that intracountry connections form part of an international service. If in such a case an international operator is not allowed to carry domestic cargo between two ports of call in a given country, this restricts the potential supply of transport services, and thus represents a missed opportunity for maritime cabotage transport. It will also discourage the modal shift from land to sea transport.

2. Trans-shipment and feedering services

Countries with large cabotage potential may find themselves in a situation where ports in neighbouring countries become the hub ports for their own cabotage or feedering services. Montevideo, Uruguay, for example, acts as a relay port for services that connect ports in Argentina or Brazil (Brooks et al., 2014). Colombo, Sri Lanka benefits from cabotage restrictions in India, as global liner operators call at the port of Colombo, and from there international feedering services can connect to seaports in India.

Increased seaborne trade resulting from the recent Chinese economic boom had prompted several countries in Asia to compete for trans-shipment. Since 2013, China has gradually relaxed cabotage restrictions within the Shanghai free trade area in a bid to promote the area and boost the trans-shipment volumes of Shanghai. As a result, foreign registered vessels may now carry containers between Shanghai and other Chinese ports – although vessels must still have Chinese owners. Previously the formal position was that this could only be done by Chinese-owned and -flagged vessels, thereby preventing the use of, among others, foreign flagged ships of the China Ocean Shipping (Group) Company and China Shipping Container Lines. This recent change has raised concerns about Hong Kong (China), owing to its decreasing throughput and connectivity (see also the declining liner shipping connectivity index in 2016, figure 6.2(h)). Protecting the role of Hong Kong (China) as a trans-shipment hub had been one of the reasons for the mainland's restrictions on cabotage, in addition to protecting the domestic shipping lines and security concerns of China.

In India, cabotage regime changes were recently introduced in the context of broader reforms related to improving logistics for trade and competitiveness, reducing costs. The Government has relaxed cabotage restrictions for specialized vessels, which are short in supply. In this case, enabling the trans-shipment of containers through foreign flagged vessels would encourage a modal shift from road and rail to coastal shipping (MDS Transmodal, 2016).

In Malaysia, the modification of the cabotage policy is partly due to the rising cost of consumer goods. Goods exported from Eastern Malaysia are left in transit for prolonged periods of time because vessels travelling out of Eastern Malaysia are unable to carry a full load. Consequently, manufacturers in Eastern Malaysia lose their ability to compete in the market because by the time their goods arrive at the port of discharge, the prices of those goods are no longer competitive. The delay and issue of vessel frequency has also resulted in increased port charges and a risk of cargo theft. Additionally, goods transported from peninsular Malaysia to Eastern Malaysia pass through a long supply chain before being discharged, resulting in increased freight costs. The lack of transport options and a monopolized shipping industry has led to consumers having to pay the price of a cabotage policy that from the onset sought only to benefit the domestic shipping industry. Lifting cabotage laws could make Eastern Malaysian ports more accessible, increase trading activities and gain prominence attracting container traffic routes going through the Straits of Malacca.

New Zealand is also an interesting case. The country's regulation of coastal shipping has been allowing foreign registered vessels to go from one local port to another since 1994. The regulation foresees that access to coastal trade is restricted to New Zealand flagged ships or foreign ships on bareboat charter to a New Zealand-based operator. The regulation also allows for cabotage transport if a foreign ship that is passing through New Zealand waters is on a continuous journey from a foreign port to another foreign port and is stopping in New Zealand to load or unload international cargo. This exception has benefited the country from the perspective of reduced freight rates and thus improved trade competitiveness. As a result, thousands of empty containers have been repositioned in the South for loading and returning north, or heading for export markets (Thompson and Cockrell, 2015; Graham, 2003).

Current trends in shipping networks suggest that potential benefits from connecting cabotage services to international services will increase. First, there is continued growth in the average size of ships, which require deeper ports and larger areas for handling ships and containers. Such infrastructure investments are costly. Second, the difference in size between the largest and the smallest ships will also increase, making it more economical to trans-ship containers in order to benefit from the optimum vessel size for different legs of the total route. Third, there is continued pressure to reduce costs and increase efficiency along the entire supply chain. Not making use of potential cost savings will be more and more difficult to justify. Furthermore, there is a growing awareness and mainstreaming of sustainability criteria in public policies; the promotion of short sea shipping is one way to reduce carbon dioxide emissions, as shipping is more energy efficient than other modes of transport.

C. TRADE AND MARITIME TRANSPORT FACILITATION

Many international agreements are in place to support trade and transport facilitation. They include the revised International Convention on the Simplification and Harmonization of the World Customs Organization and United Nations transport facilitation conventions, managed, among others, by the Economic Commission for Europe. One such example is the Convention on International Transport of Goods under Cover of TIR [international road transport] Carnets. In addition, many international standards and guidelines cover international trade procedures, such as recommendations of the Economic Commission for Europe and the United Nations Centre for Trade Facilitation and Electronic Business. These conventions and standards contribute to facilitating elements of the trade transaction chain. This section focuses on trade and transport facilitation measures included in the Agreement on Trade Facilitation of the World Trade Organization, as well as the IMO Convention on Facilitation of International Maritime Traffic, which focuses on maritime shipping.

1. Agreement on Trade Facilitation

The Agreement on Trade Facilitation entered into force on 22 February 2017. The Agreement underlines that efficient movement of goods across borders is a priority of the global trade agenda, both for the trading community and individual countries. It also shows a shift in the focus and operation of the multilateral trading system, previously driven essentially by market access negotiations. Instead of negotiating the legal aspects of market access, the focus has shifted to improving physical market access through improved procedures and connectivity.

The Agreement sets forth procedures for expediting the movement, release and clearance of goods across borders with a view to reducing related costs, while at the same time ensuring safety and security of trade goods through efficient compliance controls. Such procedures tend to be less advanced in developing countries compared with developed countries. The Agreement contains ground-breaking rules on special and differential treatment, linking the implementation by

developing countries and the least developed countries to the attainment of technical capacity.

Against this background, the Agreement on Trade Facilitation has the potential to significantly reduce trade costs for import, export and transit procedures if the procedures contained in the Agreement are implemented in full. According to OECD estimates, the reduction of total trade costs following full implementation of the Agreement is 16.5 per cent for low-income countries, 17.4 per cent for lower middle-income countries, 14.6 per cent for upper middle-income countries, and 11.8 per cent for OECD countries (Moïsé and Sorescu, 2013). Fully implementing the Agreement would have a greater global impact on trade costs than eliminating all tariffs (World Trade Organization, 2015). OECD and UNCTAD (2017) estimate that full implementation of the Agreement would boost trade flows by 0.6 per cent and increase GDP by between 0.04 and 0.41 per cent, depending on a country's level of development. UNCTAD (2016) discusses the close statistical correlation not only between specific measures of the Agreement and trade competitiveness, but also between trade facilitation reforms and the achievement of the Sustainable Development Goals on strengthening governance and formalizing the informal sector.

Reliability and speed of maritime trade transactions

Article 7 of the Agreement on Trade Facilitation sets forth measures for the timely release and clearance of goods. At the same time, this measure encourages investment in the electronic processing of trade clearance procedures, including payment and electronic submissions of declarations and pre-arrival processing, thus reducing the time goods spend at borders. Similarly, article 10 on formalities relating to importation, exportation and transit provides incentives for the integration of informal trade into the formal economy. Indeed, the implementation of both articles have a stronger positive bearing on a country's Doing Business Index indicator for trading across borders, as suggested by the data obtained from a country-by-country analysis of the number of notifications on the date of the entry into force of the Agreement. Measures enhancing predictability have the greatest influence on imports and exports of value added goods. In this respect, advance ruling measures affect imports, while measures relating to the availability of trade-related information affect exports (OECD and UNCTAD, 2017).

Stakeholder collaboration

The entry into force of the Agreement also promotes public–private partnerships. Under article 23.2, Members of World Trade Organization are required to have in place national trade facilitation committees, which are platforms where representatives from the public and private sectors, including the port community, consult, inform, coordinate and engage in strategies towards the successful implementation of the Agreement and trade facilitation in general. Such a mechanism is crucial for ensuring political buy-in from relevant stakeholders, including users and providers of trade and transport-supporting services.

Strengthening the port community system

Implementation of the Agreement can also strengthen the port community system by enabling neutral and open electronic platforms, such as the single window, where stakeholders from the public and private sectors exchange information for the clearance of goods to improve the efficiency and competitive position of maritime communities.

Article 10.4 of the Agreement requiring countries to establish and maintain single windows plays a key role in this endeavour. The single electronic submission of data optimizes and automates the performance of ports and logistics processes. Connecting transport and logistics chains also reduces the duplication of data and the number of steps in trade procedures. Other measures of the Agreement, such as electronic payment (article 7.2), can complement a single window environment. Many ports around the world have electronic port community systems for the exchange of data between port stakeholders. By linking or converting such systems to electronic single window systems, the entire transport and trade chain can be connected, thus linking or combining the logistics and commercial data information systems with the government clearance systems of customs and other border agencies, which in turn will speed up and streamline the trade process, making it more efficient.

Experience with the Automated System for Customs Data of UNCTAD suggests that single windows can have a strong, positive impact on the speed, reliability and transparency of trade procedures. Rwanda is a case in point. Remote offices of the Rwanda electronic single window based on the Automated System for Customs Data World platform located in ports of neighbouring countries of Kenya (Mombasa) and the United Republic of Tanzania (Dar es Salaam) helped reduce clearance times from 11 days in 2010 to 34 hours in 2014. Volumes of cargo inspected increased from 14 per cent in 2012 to 42 per cent in 2014 and reduced the cost of clearance from FR 30,000 to FR 4,000 in a one-year period, 2013–2014 (Trade Mark East Africa, 2015).

Connecting landlocked countries

Landlocked developing countries face additional challenges insofar as their trade flows and costs largely depend on the efficiency of customs and other border agencies, not only in their own countries but also of those in neighbouring transit countries. Against this background, article 11 seeks to improve the efficiency of transit operations requiring close coordination among a multitude of agencies on either side of a border. Landlocked developing countries and coastal transit developing countries benefit from the reduction of

bureaucratic tasks related to transit. Furthermore, the Agreement on Trade Facilitation offers a comprehensive treatment to transit issues by considering and dealing with transit in other provisions of the Agreement. For instance, the obligation to publish relevant information (article 1) and provide traders with an opportunity to comment on proposed new regulations before they enter into force (article 2) also includes transit.

Enhancement of regional connectivity

Facilitation of cross-border transit and trade is closely linked to regional integration and cooperation between neighbouring countries. The Agreement on Trade Facilitation encourages and contributes to regional connectivity. The benefits of domestic trade facilitation reforms are multiplied when such reforms are achieved with neighbouring countries and in a regional context with trading partners. In addition, intraregional connectivity helps eliminate geographical constraints, which can benefit small economies and landlocked countries. OECD and UNCTAD (2017) describe a strong, positive association between improvements in infrastructure and trade facilitation in neighbouring countries, on the one hand, and greater value chain connectivity at home, on the other. The Agreement includes articles on inter-agency collaboration and customs cooperation at the national and bilateral levels and allows for regional collaboration in setting up enquiry points, enhancing cooperation between neighbouring countries. Moreover, the Agreement attains this objective without requiring a multitude of regional trade agreements, making it unnecessary to process additional paperwork related to certificates of origin (UNCTAD, 2016).

2. Convention on Facilitation of International Maritime Traffic

The Convention on Facilitation of International Maritime Traffic is important for the maritime and ports sectors and contributes to improving connectivity in this field. The Convention is aimed at facilitating maritime transport by simplifying and minimizing formalities, data requirements and procedures associated with the arrival, stay and departure of ships engaged in international voyage. To this end, the annex to the Convention contains standards and recommended practices on formalities, documentary requirements and procedures that should be applied to ships, their crews, passengers, cargo and baggage on arrival, during their stay and on departure.

The Convention reduces to nine the number of declarations that can be required by public authorities. These standardized IMO forms include, inter alia, the general declaration, cargo declaration, crew and passenger lists, and dangerous goods manifest (IMO, 2017). IMO is currently working on a revision of the explanatory manual of the Convention with a view to updating the information.

D. OUTLOOK AND POLICY CONSIDERATIONS

Low transport connectivity remains a major hurdle for developing countries to connect to global markets. In particular, landlocked developing countries, small island developing States and other smaller and weak economies face considerable challenges in benefiting from trade opportunities, as they have access to fewer, less frequent, less reliable, more costly transport connections. As maritime transport continues to be the main mode of transport for the imports and exports of most developing countries, it is important to identify policies that help improve maritime transport connectivity. Based on the analysis provided in this issue of the Review, a number of conclusions and recommendations for policymakers, the international community and future work of UNCTAD can be drawn, as follows.

Data and research

Include maritime connectivity in planning and trade models. When negotiating trade deals, preparing trade policies or planning transport infrastructure investments, research and forecasts can be significantly improved if data on maritime transport networks are included. "Successful connectivity combines planning for scale economies, development of sustainable infrastructure capacity, efficient use of such capacity and economic inclusion aspects" (Global Infrastructure Connectivity Alliance, 2017). To this end, UNCTAD publishes two annual indices on maritime transport connectivity. It is recommended that further research be conducted on the specific components of shipping connectivity, as well as linkages to other dimensions of transport and trade connectivity.

Explore digital and other forms of connectivity. Better transport connectivity leads to lower trade costs and higher trade flows. At the same time, e-commerce, global value chains and advances in technology trigger further demand for better digital and other forms of connectivity. There are opportunities from modern network technologies, such as cargo and vessel tracking and numerous other digital developments, that can help enhance maritime connectivity. Researchers and policymakers need to consider maritime connectivity as a component of the broader dimensions of connectivity.

Shipping networks

Promote linkages between domestic, regional and intercontinental shipping services. Limitations to domestic or regional cabotage markets can lead to unnecessary inefficiencies and loss of maritime connectivity. Allowing international lines to also carry domestic trade and feedering cargo can enhance both the competitiveness of a country's seaports and the access of importers and exporters to international shipping services.

Ensure regional coordination. Most seaports can serve more than one country, be it through inland connections or via trans-shipment operations. Not every country can be host to the region's main hub port. For ports along the same route, it makes sense to plan port investments jointly to accommodate the vessels that are expected to serve this route in future. Regional organizations and international development partners can play an important role when planning port investments in countries within the same region.

Seaports and the hinterland

Investments in seaports and intermodal connections should be made. Important determinants of a country's maritime connectivity are beyond the control of policymakers. Notably, a country's geographical position and trade volumes are difficult to change. Investments can make a difference in domestic seaports. These investments may take the form of public–private partnerships, as most common user ports such as container terminals have in recent decades been concessioned or have involved the private sector in some other form.

Inter-port competition should be encouraged. Competitive pressures will encourage port operators to maximize their efficiency and pass on those efficiency gains to their clients, shippers and shipping lines. Inter-port competition should not be limited to domestic seaports, but to neighbouring countries' ports as well. Efficient trucking markets, rail and road infrastructure, and transit regimes are effective instruments for enhancing inter-port competition.

Trade and transport facilitation

Collaborative platforms should be built or strengthened. Under the Agreement on Trade Facilitation and Convention on Facilitation of International Maritime Traffic, members should establish committees in which stakeholders coordinate and cooperate in the implementation of trade and transport facilitation reforms. Ideally, such collaborative platforms should go beyond compliance issues, aiming instead at all necessary reforms to facilitate international trade and its transport.

International transit and cross-border trade should be facilitated. Maritime connectivity benefits from a larger hinterland for seaports to capture additional cargo from neighbouring countries. Transit can be facilitated in line with international standards and recommendations, including those of the United Nations, the World Customs Organization and the World Trade Organization. Regional and subregional transit regimes may also help and are often more ambitious than the minimum requirements of multilateral regimes.

Trade and its transport

Policy objectives should be clearly defined. Connectivity is not everything. Pressure from shipping lines to invest in seaports to accommodate ever larger ships, especially for trans-shipment operations, may not be worth the extra cost. Without additional volumes, increasing the ship size will reduce the effective capacity of a seaport, as larger yards would be necessary to handle the same total volume. Policy objectives need to be clearly defined. Furthermore, improved maritime connectivity is not an end in itself – it should serve predefined purposes, such as enhancing trade competitiveness and employment.

Transport and trade policies should be realistic. In view of current industry developments in liner shipping, including mergers, global alliances and ever larger gearless ships, it will be difficult and costly for some remote and small markets to maintain frequent and cost-effective liner shipping connections. Trade policies will need to realistically consider what type of goods and services a country can import and export. These may include digital goods and services, or goods that are competitive by air transport in order to complement the goods traded by sea.

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ENDNOTES

1. International shipping services can be divided into two basic groups. In addition to liner shipping services for containerized trade, there are charter or tramp shipping services, used mostly for liquid and dry bulk commodities, such as oil, coal or iron ore. The cargo on a ship belongs to one owner, and the ship is chartered for a point-to-point operation. This type of service is comparable to a taxi service or a charter bus contract. There are no networks of such services, and the concept of connectivity cannot be applied.
2. The liner shipping connectivity index can be downloaded at http://stats.unctad.org/LSCI (accessed 24 September 2017). The calculation is as follows: For each of the five components, a country's value is divided by the maximum value of that component in 2004, and the average of the five components is calculated for each country. This average is then divided by the maximum average for 2004 and multiplied by 100. In this way, the index generates the value 100 for the country with the highest average index of the five components in 2004, which was China. The source of data on container ship schedules in past years until 2015 was *Containerization International*. For 2016 and later years, the data are provided by MDS Transmodal (http://www.mdst.co.uk, accessed 24 September 2017).
3. The bilateral liner shipping connectivity index can be downloaded at http://stats.unctad.org/LSBCI (accessed 24 September 2017). The calculation is as follows: All components are normalized using the standard formula: Normalized_Value = (Raw - Min(Raw)) / (Max(Raw) - Min(Raw)). This formula rather than the Raw/Max(Raw) formula has been chosen mainly because of the existence of minimum values that differ from zero. If all minimum values for all components were zero, both formulas would be equivalent and would generate identical normalized values. The index is computed by taking the simple average of the five normalized components. As a result, the index can only take values between 0 (minimum) and 1 (maximum). As to the first component, its complement to unity (1-Normalized_Value) is taken to respect the correspondence between higher values and stronger connectivity.
4. The statistical correlations presented here are indicative approximations and do not necessarily imply a causality, as higher connectivity may lead to more trade, and vice versa. Furthermore, not all correlations are likely to be linear, as there may be thresholds and combinations of components that will have different impacts together. For example, the level of competition on a route may be more meaningful for a direct connection than for cases involving trans-shipment.

For further information on UNCTAD work on trade logistics, please visit **http://unctad.org/tlb**

and for the *Review of Maritime Transport 2017* **http://unctad.org/rmt**

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