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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.

PORTS

TRENDS IN WORLD CONTAINER PORTS



Cybersecurity



Consolidation and concentration



Mega-ships

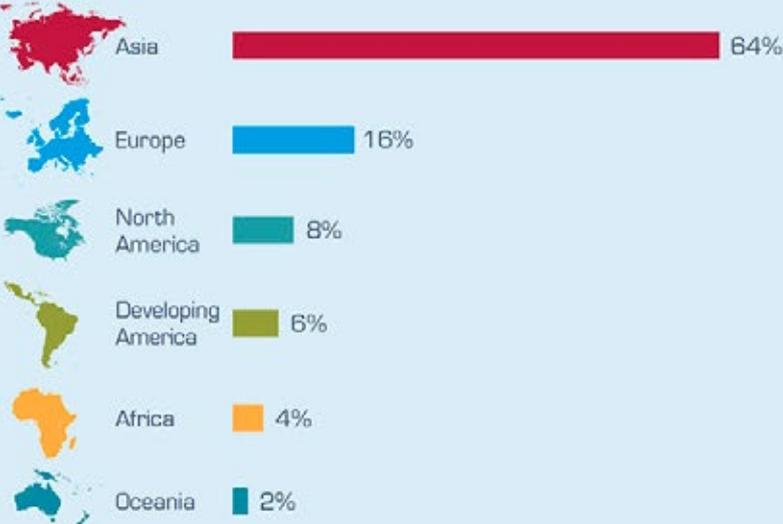
Mega-alliances

"The" Alliance Ocean Alliance 2M

secondary routes



WORLD CONTAINER PORT VOLUMES BY REGION

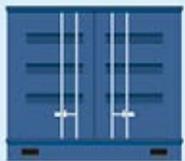


TYPE OF TRAFFIC

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

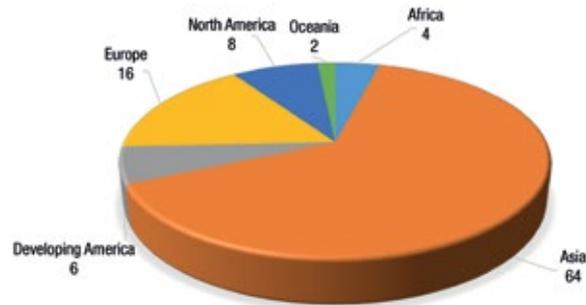
As shown in table 4.1, UNCTAD estimates that world container port throughput increased by 1.7 per cent in 2015, with total volumes reaching 686.8 million TEUs. This is less than half the growth recorded in 2014, reflecting the difficulties experienced by world containerized trade flows in 2015.

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).

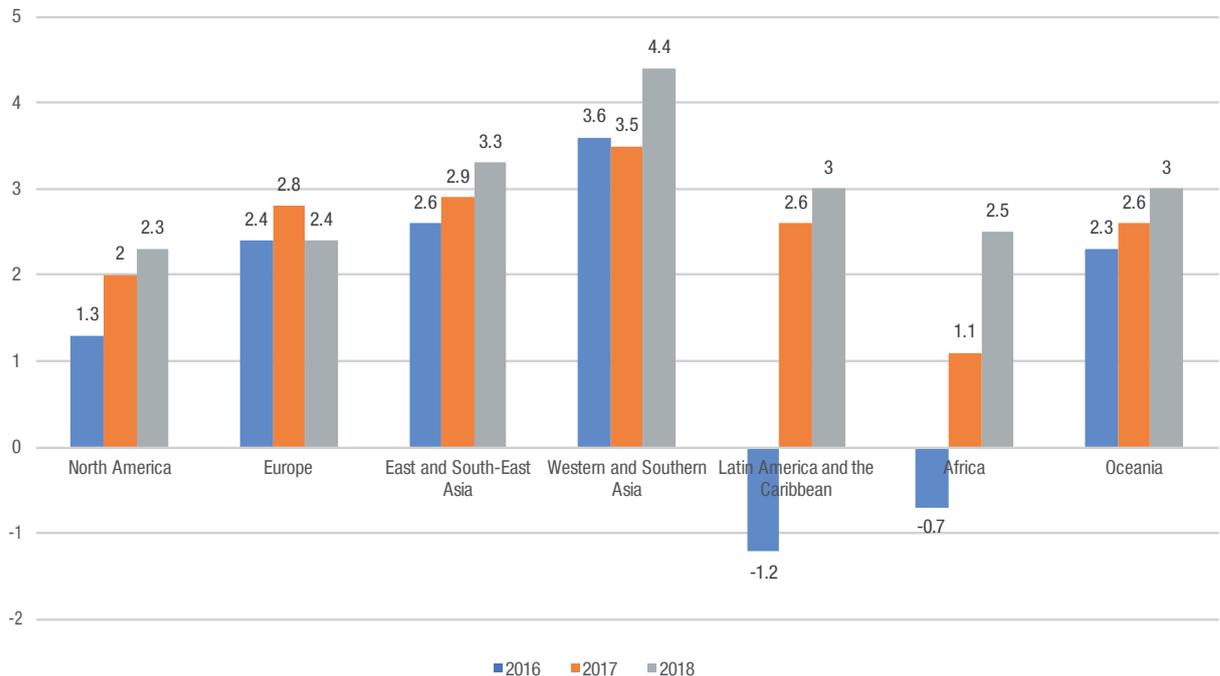
Table 4.1. World container port throughput by region, 2014 and 2015 (Twenty-foot equivalent units and annual percentage change)

	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		Million 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 up sizing

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 be 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.

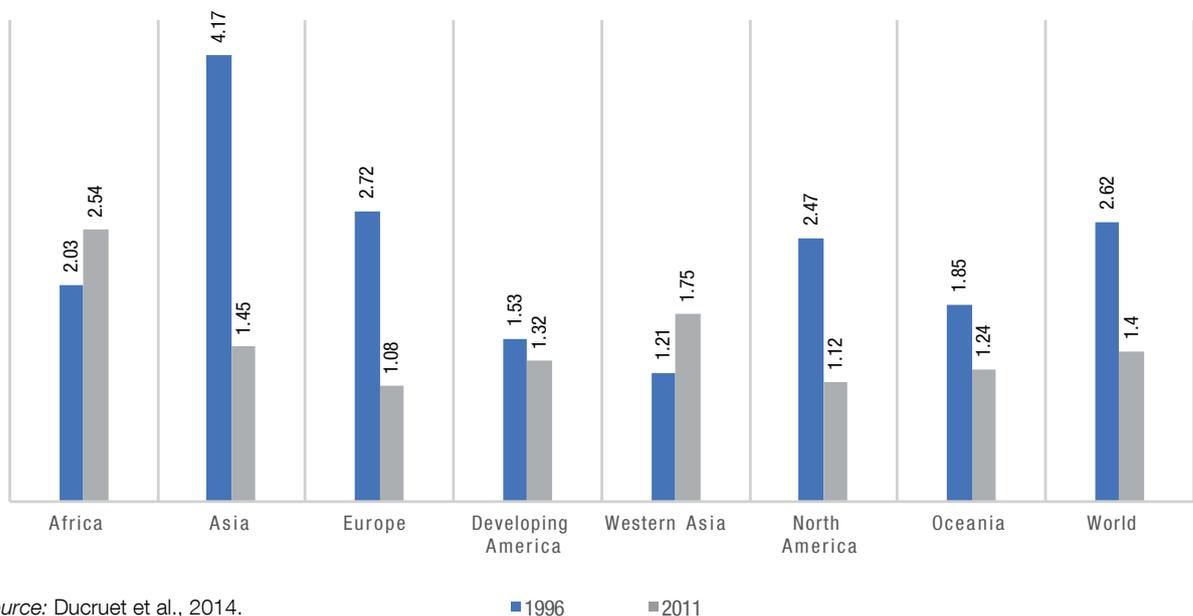
Table 4.8. Average time in port: Gas carriers, 2016

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)



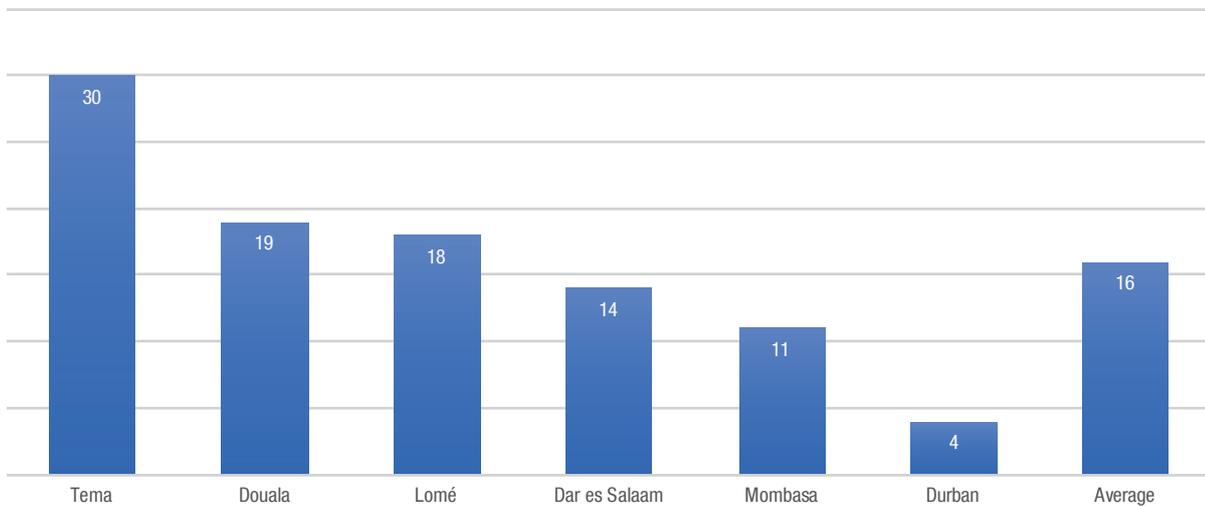
Source: Ducruet et al., 2014.

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 responsibilities.

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

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

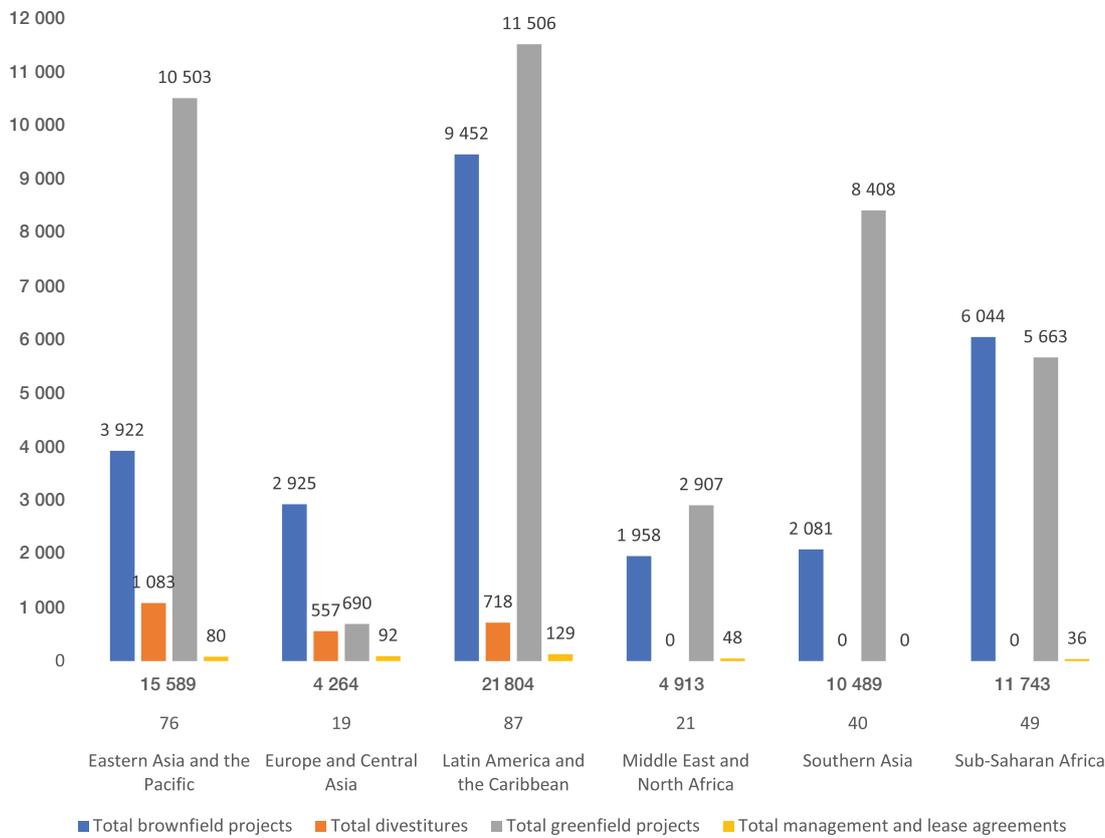
Number of countries with private participation	63
Projects reaching financial closure	292 projects, total investment \$68.8 billion
Region with largest investment share	Latin America and the Caribbean (31%)
Type of project with largest share in investment	Greenfield project (58%)
Type of project with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

Source: World Bank, 2017a.

Asia (40 projects). The Middle East and North Africa had 21 projects, and Europe and Central Asia 19 projects.

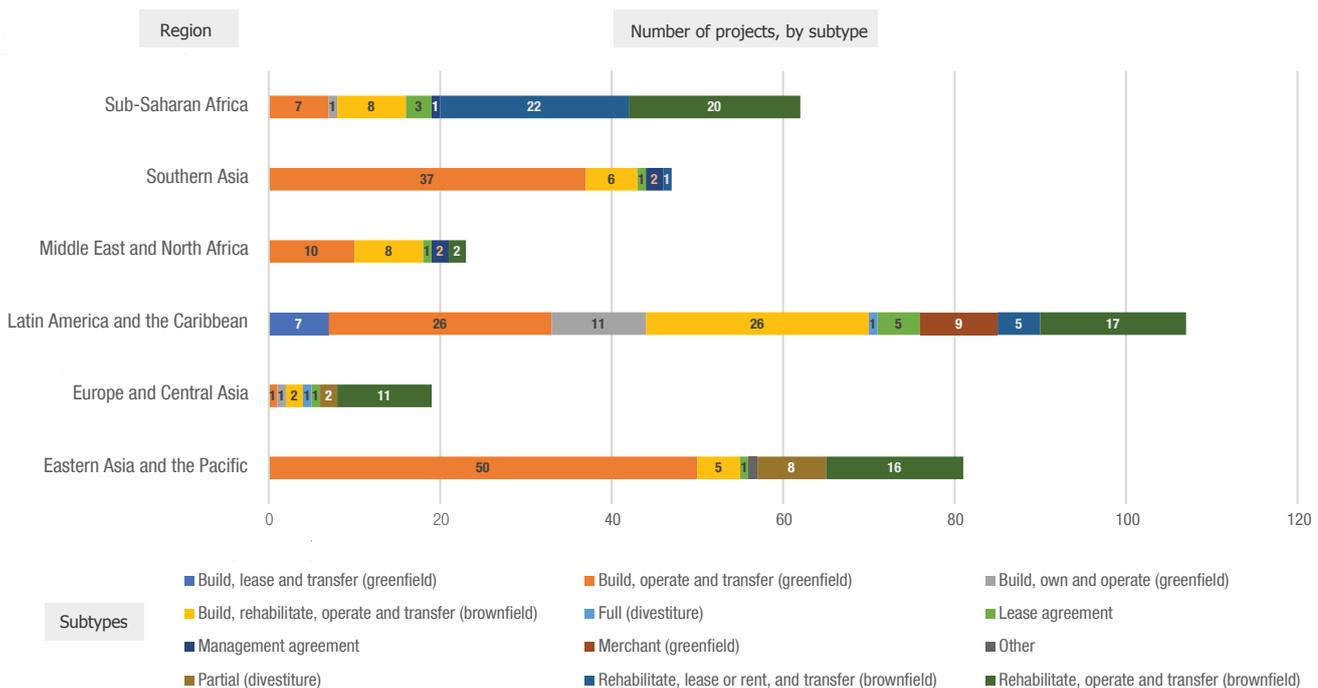
The majority of port projects are based on build–operate–transfer concession agreements. Under such an agreement, a private consortium or company builds a facility, operates it for a specified period of time and returns it to the public sector at the end of that period. Contract duration is usually determined 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 Yildirim 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
Bolloré 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%), Agrovía (25%)	Greenfield project (build, operate, and transfer)
Ghana	Tema Port Expansion	1 500.0	AP Moller–Maersk Group (35%), Bolloré 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 feeder 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.