2

Maritime transport and infrastructure

This chapter reviews the supply of maritime transport, covering the world fleet, shipping companies, and port services, and then adding insights from the UNCTAD TrainForTrade Port Management Programme.

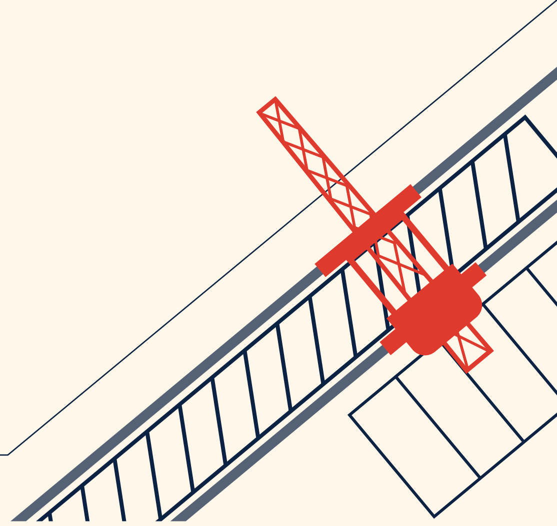
A. The world fleet – This section examines the growth of the world fleet and changes to its structure and age. It also covers parts of the maritime supply chain, such as shipbuilding, ship recycling, ship ownership and ship registration. It finds that at the beginning of 2021 the demand for shipping services was exceeding supply, resulting in a surge in orders for new ships and more activity in the second-hand market.

B. Regulation of shipping – This section examines regulatory changes, in particular decarbonization targets. It explores the implications for the shipping industry and for shipping-related operations, fuel usage and technology. Adapting to these changes will require significant investment at a time of great uncertainty.

C. Port services – This section explains how the pandemic has induced a rethink of business resilience for ports. It also covers their strategies for capitalizing on emerging opportunities, notably ecommerce and greener industrial activities.

D. The impact of COVID-19 – Using data from the UNCTAD TrainForTrade port network, this section examines the impact of the pandemic on financial performance and on vessel and cargo operations.

Maritime transport services and infrastructure supply



THE WORLD FLEET

In early 2021, the world fleet totalled
99,800 ships
of 100 gross tons and above, equivalent to **2,134,639,907** dwt of capacity

The global shipping fleet grew by
+3%
in the 12 months prior to 1 January 2021

Ships between
5–9 years old
represented the highest proportion of the fleet carrying capacity

Ship deliveries declined by
-12 %
in 2020

SHIPPING COMPANIES AND OPERATIONS

Adapting maritime transport supply

Trade growth

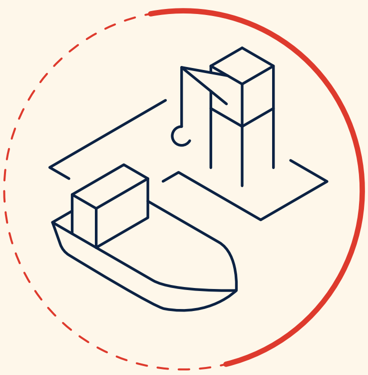
Decarbonization targets

Scaling up investment to expand the fleet

Retrofitting or replacing the existing fleet

Potential changes from the Green Transition

PORT SERVICES AND INFRASTRUCTURE SUPPLY



Since 2020, ports resilience and adaptive capacity have been tested:

- Financial performance
- Congestion
- Equipment shortages
- Supply chain disruption

New opportunities from the COVID-19 crisis

E-commerce, smart logistic hubs and intermodal connections

Greener industrial port activities

A. THE WORLD FLEET

1. Fleet structure, age, and vessel size

Ships are getting bigger, though with fewer new ships the fleet is ageing

In the 12 months to 1 January 2021, the global commercial shipping fleet grew by 3 per cent – to 99,800 ships of 100 gross tons and above, equivalent to 2,134,639,907 dwt of capacity (table 2.1). But as indicated in figure 2.1, from a peak of 11 per cent in 2011 this growth rate has slowed.

An increasingly important concern is the ageing of the fleet, since older ships are generally less efficient and generate higher emissions. At the beginning of 2021, around 30 per cent of the carrying capacity of the global fleet was in ships of between five and nine years old (table 2.2). As indicated in figure 2.2, since 2017 this age cohort has represented the highest proportion of capacity, but its proportion and that for younger vessels has been falling, while that for vessels of 10 to 14 years old has steadily been rising.

The age distribution varies, however, between different economies (figure 2.3). The oldest ships are generally those in the least developed countries (LDCs), where close to 30 per cent are more than 20 years old. Compared to the developing group, or the developed countries, the LDCs also have a higher proportion of ships of 15 to 19 years old.

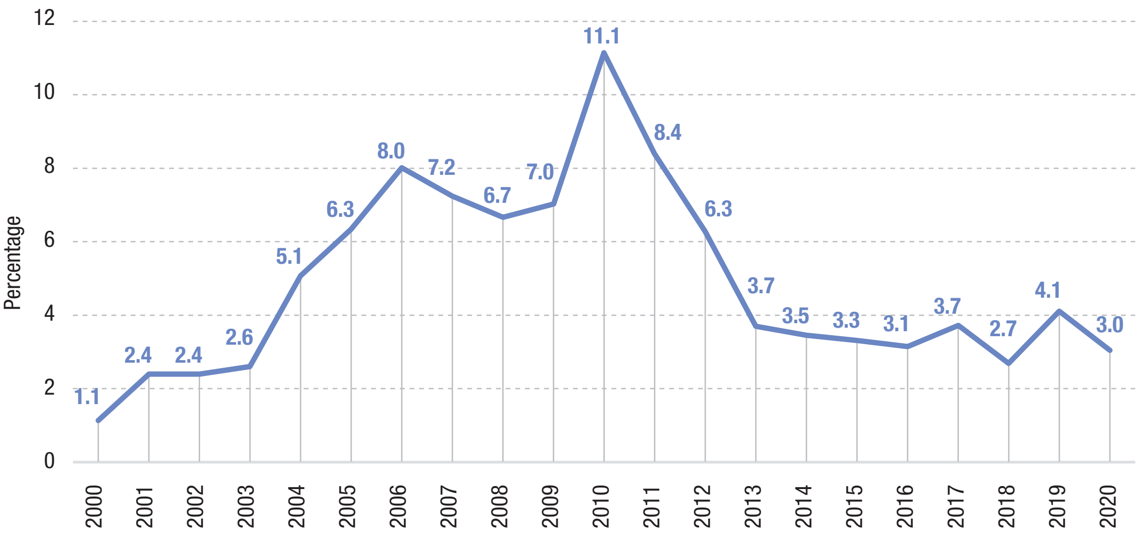
Table 2.1 World fleet by principal vessel type, 2020–2021 (thousand dead-weight tons and percentage change)

Principal types	2020	2021	Percentage change 2021 over 2020
Bulk carriers	879 725	913 032	3.79%
	42.47%	*42.77%*	
Oil tankers	601 342	619 148	2.96%
	29.03%	*29.00%*	
Container ships	274 973	281 784	2.48%
	13.27%	*13.20%*	
Other types of ship:	238 705	243 922	2.19%
	11.52%	*11.43%*	
Offshore supply	84 049	84 094	0.05%
	4.06%	*3.94%*	
Gas carriers	73 685	77 455	5.12%
	3.56%	*3.63%*	
Chemical tankers	47 480	48 858	2.90%
	2.29%	*2.29%*	
Other/not available	25 500	25 407	-0.36%
	1.23%	*1.19%*	
Ferries and passenger ships	7 992	8 109	1.46%
	0.39%	*0.38%*	
General cargo ships	76 893	76 754	-0.18%
	3.71%	*3.60%*	
World total	**2 071 638**	**2 134 640**	**3.04%**

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

Notes: Propelled seagoing merchant vessels of 100 gross tons and above, at 1 January.
Dead-weight tons for individual vessels have been estimated.

Figure 2.1 Annual growth rate of world fleet, dead-weight tonnage, 2000–2020 (percentage)



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

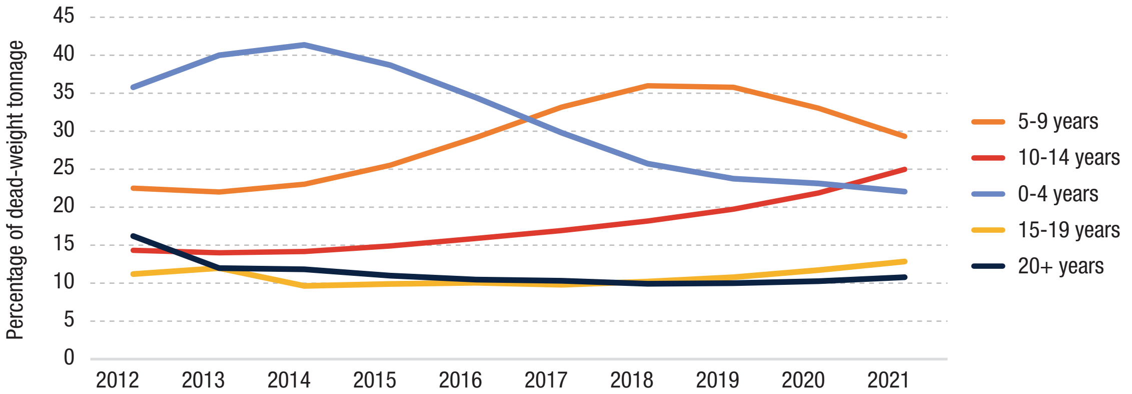
Table 2.2 Age distribution of world merchant fleet by vessel type, 2021 and average age 2020–2021
(percentage and average vessel size)

Vessel type, country grouping by flag of registration and indicator		Years					Average age	
		0–4	5–9	10–14	15–19	More than 20	2021	2020
World								
Bulk carriers	Percentage of total ships	18	37	24	10	10	10.6	10.2
	Percentage of dead-weight tonnage	22	40	23	9	6	9.5	9.3
	Average vessel size (dead-weight tonnage)	90 447	78 409	68 583	68 087	46 623	NA	NA
Container ships	Percentage of total ships	14	19.21	32	17	17	13.2	12.7
	Percentage of dead-weight tonnage	20	29	29	14	7	10.4	9.9
	Average vessel size (dead-weight tonnage)	74 632	78 802	46 897	42 345	21 975	NA	NA
General cargo	Percentage of total ships	5	10	16	9	59	27.1	26.3
	Percentage of dead-weight tonnage	8	20	23	10	40	19.9	19.3
	Average vessel size (dead-weight tonnage)	5 992	7 493	5 494	4 372	2 660	NA	NA
Oil tankers	Percentage of total ships	14	17	21	13	35	19.5	19
	Percentage of dead-weight tonnage	25	21	28	19	8.	10.9	10.4
	Average vessel size (dead-weight tonnage)	96 122	65 148	72 208	80 802	12 346	NA	NA
Other types of ships	Percentage of total ships	10	17	17	9	47	23.6	23.0
	Percentage of dead-weight tonnage	20	16	23	11	30	16.1	15.8
	Average vessel size (dead-weight tonnage)	9 236	4 562	6 524	5 953	3 014	NA	NA
All ships	Percentage of total ships	11	18	19	10	42	21.6	21.1
	Percentage of dead-weight tonnage	22	29	25	13	11	11.2	10.80
	Average vessel size (dead-weight tonnage)	43 364	34 175	28 112	27 809	5 505	NA	NA
Developing economies (all ships)								
	Percentage of total ships	10	20	19	10	41	20.8	20.2
	Percentage of dead-weight tonnage	21	29	22	13	15	11.9	11.6
	Average vessel size (dead-weight tonnage)	33 788	24 295	18 871	21 144	6 190	NA	NA
Developed economies (all ships)								
	Percentage of total ships	12	17	20	10	40	21.3	20.8
	Percentage of dead-weight tonnage	23	30	28	13	7	10.5	10.2
	Average vessel size (dead-weight tonnage)	54 908	50 000	39 696	35 466	5 132	NA	NA
Small Islands Developing States (all ships)								
	Percentage of total ships	6	8	10	8	68	30.9	30.3
	Percentage of dead-weight tonnage	3	30	18	20	30	17.5	17.8
	Average vessel size (dead-weight tonnage)	2 009	16 865	8 077	11 326	2 036	NA	NA
Least developed countries (all ships)								
	Percentage of total ships	12	13	8	6	61	28.6	28.6
	Percentage of dead-weight tonnage	9	19	25	18	29	17.0	16.5
	Average vessel size (dead-weight tonnage)	7 551	15 032	33 414	31 782	4 956	NA	NA

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

Notes: Propelled seagoing vessels of 100 gross tons and above, as at 1 January.
Dead-weight tons for individual vessels have been estimated.
The LDC and SIDS country grouping are based on the definitions of the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UNOHRLLS). For more information see: https://www.un.org/ohrlls/content/ldc-category and https://www.un.org/ohrlls/content/list-sids.

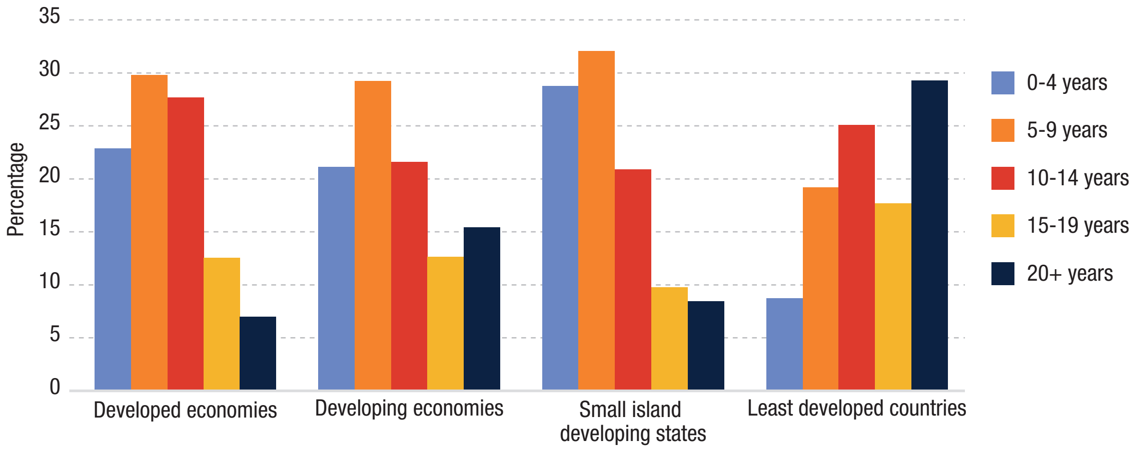
Figure 2.2 Age distribution of the global fleet, share of the global carrying capacity, 2012–2021



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

Notes: Propelled seagoing merchant vessels of 100 gross tons and above; beginning-of-year figures.

Figure 2.3 Age distribution of the fleet, as at beginning of 2021, per development status groups



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

Note: The LDC and SIDS country grouping are based on the definition by UNOHRLLS. For more information see: https://www.un.org/ohrlls/content/ldc-category and https://www.un.org/ohrlls/content/list-sids.

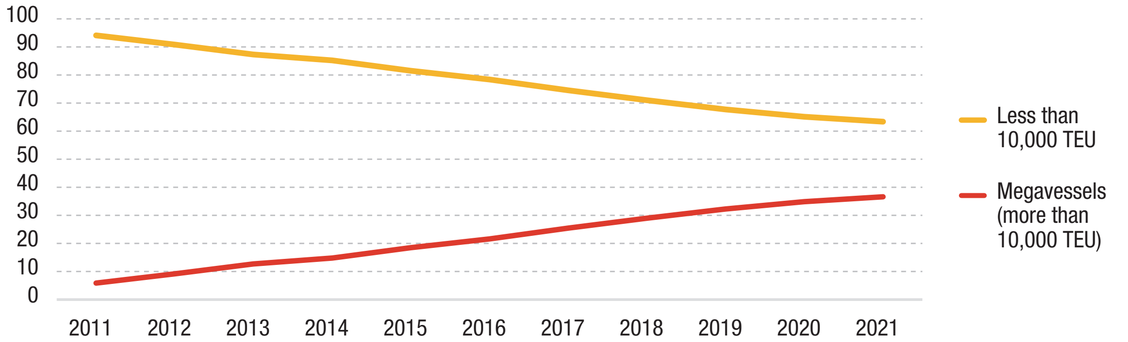
Increasing ship sizes: what we have learnt from the Ever Given incident

Since the early 2000s, more of the world's cargo has been carried in mega-container ships – those with a container capacity greater than 10,000 twenty-foot equivalent units (TEU): between 2011 and 2021 their proportion of carrying capacity rose from 6 to almost 40 per cent (figure 2.4). In the last 10 years, there have been 97 new ships of between 15,000 and 19,990 TEU, and since 2018 74 ships of 20,000 TEU and above (figure 2.5). These larger ships, facilitated by technological advances, have been part of broader corporate strategies to pursue economies of scale (Sanchez, 2021). However, this has resulted in excess supply – 'over-tonnaging' – in the world's major liner routes, with greater pressure on infrastructure and on logistics at ports.

This pressure on infrastructure was dramatically illustrated from 23 to 29 March 2021 when the Suez Canal was blocked by the Ever Given, a container ship with a carrying capacity of 20,000 TEU. Larger ships are more difficult to steer, and harder and more costly to rescue in cases of collisions and groundings. In addition to safety and salvage issues, the higher risks entail higher insurance costs. (Hayden, 2015; Lockton, 2019; Allianz, 2019; and Boulougouris, 2021).

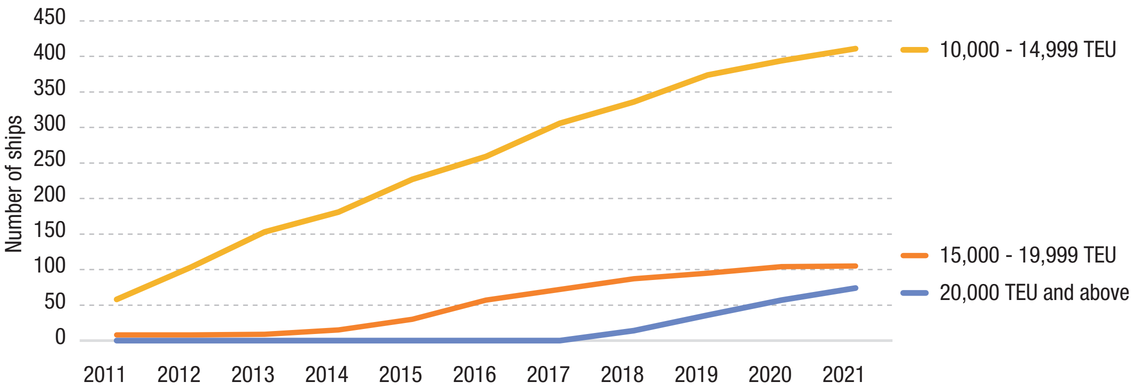
This is a critical issue for key nodes of the global maritime transport network such as the Suez and Panama canals, which have constrained capacities and where any disruption sends shockwaves through global supply chains. The Ever Given incident delayed the passage of hundreds of vessels through the canal, disrupted global trade, and exacerbated the shortage of shipping containers, leading to congestion in many ports and an increase in container freight rates (Hellenic Shipping News, 2021). As indicated in figure 2.6, since 2012 these mega-vessels have been making more journeys through the Panama and Suez canals.

Figure 2.4 **Share of mega-vessels in the global container ship fleet carrying capacity by TEU, 2011–2021**
(percentage)



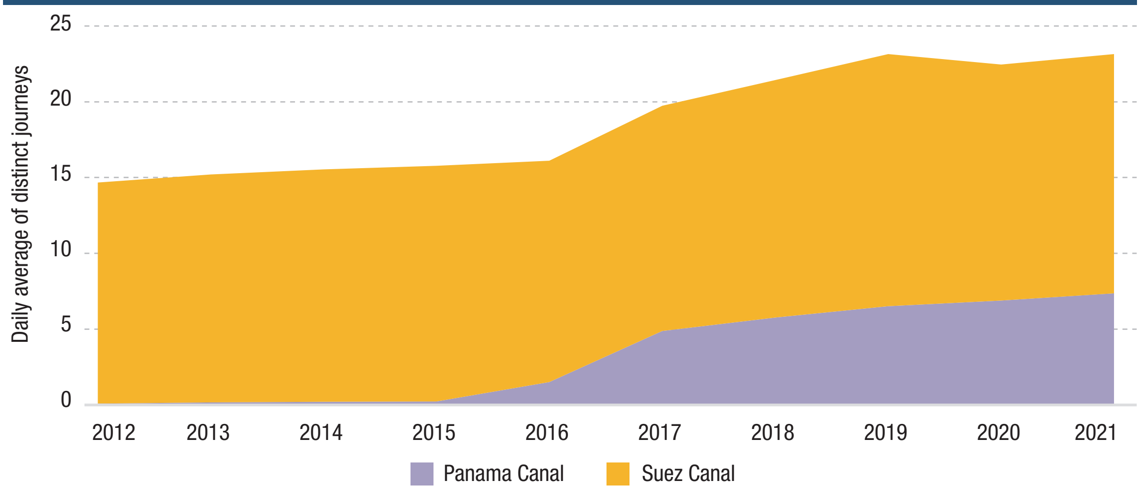
Source: UNCTAD calculations, based on data from Clarksons Research.

Figure 2.5 **Number of mega-containerships**



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

Figure 2.6 **Mega-vessel distinct journeys through the Panama and Suez canals, daily averages, from 2012 until 4 June 2021**



Source: UNCTAD calculations, based on data from VesselsValue.

Notes: In the case of the Panama Canal the mega-vessel category includes bulk carriers (Capesize), containerships (Neo-Panamax and Post Panamax), gas carriers (Q Flex and VLGC) and oil tankers (VLCC). In the case of the Suez Canal, in addition to the ship types mentioned before, the mega-vessel category includes an additional type of gas carrier (Q-Max) and containership (ULCV).

2. Ship ownership and registration

The principal ship-owning countries mostly flag their ships abroad

As of 1 January 2021, the top three ship-owning countries, in terms of both dead-weight tons and the commercial value of their fleets, were Greece, China, and Japan (table 2.3) (table 2.4). Over the previous year, among the top 35 shipowners, the greatest increases in shares of carrying capacity were in the United Arab Emirates, from 1.01 to 1.18 per cent, and Viet Nam from 0.52 to 0.59 per cent. In terms of value, the highest increases in shares of the world merchant fleet value were in Taiwan Province of China, from 1.49 to 1.86 per cent, and the Republic of Korea, from 2.77 to 3.08 per cent.

Table 2.3 Top 25 ship-owning economies, as of 1 January 2021
(millions of United States dollars)

	Country or Territory of Ownership	Bulk Carriers	Container Ships	Offshore vessels	Oil Tankers	Ferries and Passenger Ships	Gas Carriers	General Cargo Ships	Chemical Tankers	Other/ not available	Total
1	Japan	39 564	15 101	4 746	9 529	3 236	15 436	3 130	5 203	7 888	103 833
2	Greece	39 853	11 670	197	32 602	2 512	14 572	182	977	402	102 968
3	China	34 735	20 632	9 967	12 838	4 979	4 115	5 120	3 344	3 207	98 936
4	United States	3 734	1 938	15 494	5 117	51 259	1 454	1 320	1 098	791	82 206
5	Singapore	14 564	9 274	4 304	12 569	32	4 377	870	4 778	534	51 301
6	Norway	4 384	2 514	21 748	5 570	3 208	7 620	900	2 433	2 719	51 096
7	Germany	6 207	24 166	687	1 767	9 460	1 627	2 789	704	347	47 754
8	United Kingdom	4 001	7 123	10 064	3 829	5 661	5 816	791	1 354	2 239	40 878
9	China, Hong Kong SAR	11 117	12 982	73	6 288	2 387	1 114	918	269	886	36 032
10	Republic of Korea	9 123	5 363	240	5 558	433	4 791	680	1 480	2 673	30 340
11	Bermuda	5 863	2 301	5 198	5 919		8 107		297	51	27 736
12	Denmark	1 526	12 847	1 701	3 416	1 032	2 049	751	1 032	108	24 462
13	Switzerland	822	9 012	3 056	596	9 521	213	183	169	12	23 584
14	Netherlands	704	412	13 273	441	526	686	2 969	1 892	2 046	22 949
15	Taiwan Province of China	8 145	7 372	48	1 483	74	363	563	148	107	18 304
16	Italy	1 116	6	2 441	1 866	9 475	256	1 801	418	621	18 000
17	Brazil	179	465	14 312	810	64	116	30	77	2	16 054
18	Monaco	3 390	2 004		6 381	29	3 300		26	24	15 153
19	France	374	5 325	5 183	112	1 860	476	155	132	144	13 761
20	Russian Federation	256	110	1 346	3 320	76	1 740	1 449	637	1 828	10 762
21	Turkey	3 406	1 011	677	1 269	353	131	1 793	1 156	51	9 847
22	Indonesia	1 110	1 103	1 137	2 131	2 020	565	1 174	369	51	9 659
23	Malaysia	142	110	6 748	219	19	1 811	189	150	159	9 548
24	Belgium	1 747	491	134	3 305		860	761	210	2 018	9 526
25	United Arab Emirates	1 959	469	2 858	2 361	57	544	90	621	179	9 138
	Others	14 436	4 971	23 462	18 470	12 008	13 971	7 863	4 050	2 297	101 529
	World total	**212 455**	**158 771**	**149 093**	**147 764**	**120 282**	**96 110**	**36 470**	**33 026**	**31 384**	**985 356**

Source: UNCTAD calculations, based on data from Clarksons Research, as of 1 January 2021 (estimated current value).
Note: Value is estimated for all commercial ships of 1,000 gross tons and above.

Table 2.4 Ownership of the world fleet, ranked by carrying capacity in dead-weight tons, 2021

	Country or territory of ownership	Number of vessels			Deadweight tonnage				
		National flag	Foreign flag	Total	National flag	Foreign flag	Total	Foreign flag as a percentage of total	Total as a percentage of world
1	Greece	642	4 063	4 705	58 067 003	315 350 152	373 417 155	84.45%	17.64%
2	China	4 887	2 431	7 318	105 657 323	138 898 420	244 555 743	56.80%	11.56%
3	Japan	914	3 115	4 029	35 107 223	206 741 103	241 848 326	85.48%	11.43%
4	Singapore	1 459	1 384	2 843	73 258 302	65 805 758	139 064 059	47.32%	6.57%
5	China, Hong Kong SAR	886	878	1 764	72 367 151	31 851 549	104 218 700	30.56%	4.92%
6	Germany	198	2 197	2 395	7 437 473	78 759 307	86 196 779	91.37%	4.07%
7	Republic of Korea	787	854	1 641	15 096 916	70 995 920	86 092 836	82.46%	4.07%
8	Norway	387	1 655	2 042	1 899 017	62 144 480	64 043 497	97.03%	3.03%
9	Bermuda	13	540	553	300 925	63 733 226	64 034 151	99.53%	3.03%
10	United Kingdom (excl. Channel Islands)	309	1 014	1 323	7 160 493	46 524 174	53 684 667	86.66%	2.54%
11	United States of America (incl. Puerto Rico but excluding Virgin Islands)	790	1 020	1 810	10 395 172	44 576 019	54 971 191	81.09%	2.60%
12	Taiwan Province of China	147	867	1 014	6 998 235	46 284 542	53 282 777	86.87%	2.52%
13	Monaco	0	478	478	0	43 426 478	43 426 478	100.00%	2.05%
14	Denmark	26	902	928	47 415	42 185 673	42 233 088	99.89%	2.00%
15	Belgium	108	249	357	8 974 783	21 969 171	30 943 954	71.00%	1.46%
16	Turkey	429	1 112	1 541	5 994 812	21 970 706	27 965 518	78.56%	1.32%
17	Indonesia	2 232	89	2 321	24 139 035	2 704 715	26 843 751	10.08%	1.27%
18	Switzerland	18	396	414	928 432	25 794 797	26 723 229	96.53%	1.26%
19	India	875	195	1 070	16 396 087	10 013 434	26 409 521	37.92%	1.25%
20	United Arab Emirates	119	941	1 060	525 959	24 431 420	24 957 380	97.89%	1.18%
21	Russian Federation	1 464	322	1 786	9 184 626	14 682 694	23 867 320	61.52%	1.13%
22	Iran (Islamic Republic of)	246	8	254	18 898 257	352 889	19 251 146	1.83%	0.91%
23	Netherlands	692	515	1 207	5 577 088	13 185 003	18 762 090	70.27%	0.89%
24	Saudi Arabia	151	111	262	13 397 363	3 422 203	16 819 566	20.35%	0.79%
25	Italy	481	170	651	10 296 714	5 900 509	16 197 223	36.43%	0.77%
26	Brazil	292	91	383	4 735 593	9 120 015	13 855 608	65.82%	0.65%
27	France, metropolitan	98	327	425	1 592 919	12 004 098	13 597 017	88.28%	0.64%
28	Viet Nam	929	166	1 095	9 491 311	3 043 458	12 534 769	24.28%	0.59%
29	Cyprus	134	177	311	5 166 089	7 174 723	12 340 812	58.14%	0.58%
30	Canada	210	164	374	2 569 373	7 212 024	9 781 397	73.73%	0.46%
31	Oman	5	58	63	5 704	8 926 419	8 932 123	99.94%	0.42%
32	Malaysia	456	163	619	6 587 734	2 158 859	8 746 592	24.68%	0.41%
33	Qatar	57	69	126	1 123 717	6 145 431	7 269 149	84.54%	0.34%
34	Nigeria	198	73	271	3 517 645	3 429 887	6 947 532	49.37%	0.33%
35	Sweden	90	208	298	1 004 333	5 448 524	6 452 857	84.44%	0.30%
Subtotal, top 35 shipowners		**20 729**	**27 002**	**47 731**	**543 900 223**	**1 466 373 485**	**2 010 273 707**	**72.94%**	**94.99%**
Rest of the world unknown		*3 096*	*3 146*	*6 242*	*37 011 088*	*69 116 093*	*106 127 181*	*65.13%*	*5.01%*
World		**23 825**	**30 148**	**53 973**	**580 911 310**	**1 535 489 578**	**2 116 400 888**	**72.55%**	**100.00%**

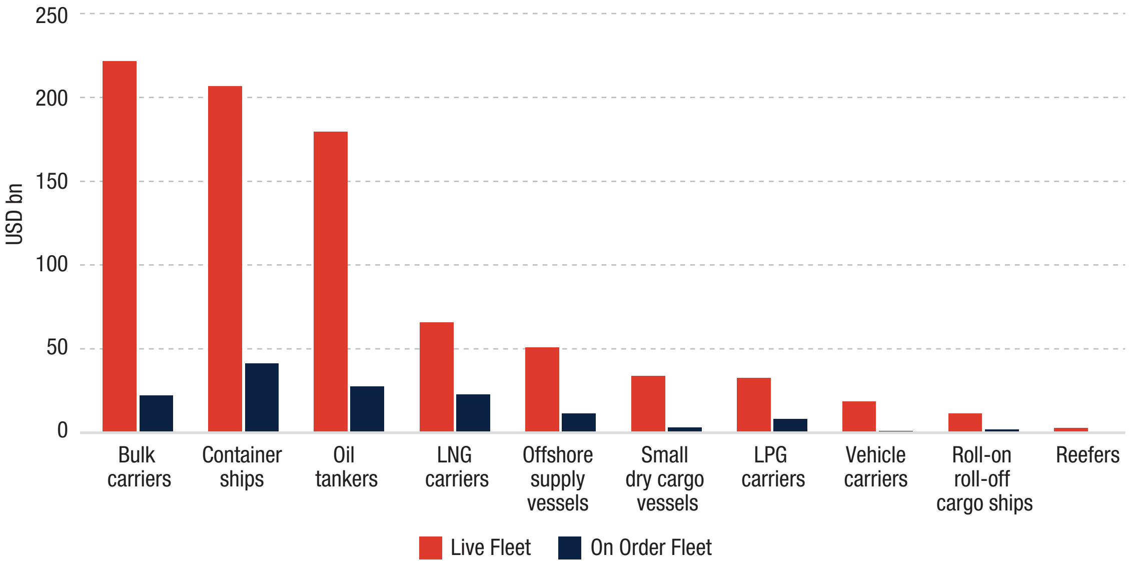
Source: UNCTAD calculations, based on data from Clarksons Research.

Notes: Propelled seagoing vessels of 1,000 gross tons and above, as of 1 January 2021. For the purposes of this table, second and international registries are recorded as foreign or international registries, whereby, for example, ships belonging to owners in the United Kingdom but registered in Gibraltar or on the Isle of Man are recorded as being under a foreign or international flag. In addition, ships belonging to owners in Denmark and registered in the Danish International Ship Register account for 48 per cent of the Denmark-owned fleet in dead-weight tonnage, and ships belonging to owners in Norway registered in the Norwegian International Ship Register account for 28 per cent of the Norway-owned fleet in dead-weight tonnage.
For a complete listing of nationally owned fleets, see http://stats.unctad.org/fleetownership.

Rising value of the fleet: a sign of confidence?

The commercial value of a vessels depends on many considerations, including: size, type, builder, age, classification status, certifications, ship condition and maintenance, added technology, and engine and fuel efficiency. Values are also influenced by prevailing conditions in shipping and financial markets. As of 1 June 2021, the highest value was in bulk carriers at 27 per cent, followed by container ships at 25 per cent, and tankers at 22 per cent (figure 2.7). For ships on order, the highest value was in container ships 30 per cent, followed by tankers at 20 per cent and LNG carriers at 16 per cent.

Figure 2.7 Live and on-order global fleet by ship type
(billions of United States dollars)



Source: UNCTAD, based on data from VesselsValue, as of 1 June 2021.
Note: Includes all vessels above 1,000 GT.

Second-hand ship prices can be quite volatile. Since the last quarter of 2020, there have, for example, been significant increases in the value of container ships. Between end-2020 and mid-June 2021 the Containership Secondhand Price Index increased by 71 per cent. Sales were at their highest since 2013, reflecting the demand for smaller container ships of between 5 and 15 years old (Clarksons Research, 2021a).

There have also been significant increases in the prices for second-hand bulk carriers. Since October 2020, the Bulk Carrier Secondhand Price Index has been steadily increasing – during the first half of 2021 prices of various vessel sizes aged between 5 and 10 years rose by between 25 and 50 per cent (Miller, 2021). Higher prices reflect strong short-term market confidence, based on rising commodity prices, high earnings for bulk carriers and projections for increasing global seaborne bulk trade (Clarksons Research, 2021b). Since the beginning of 2021, sales have been at their highest for the past five years (Roussanoglou, 2021a).

To a great extent, selling and purchasing decisions are driven by expected future profitability (Haralambides et al. 2005). In times of tight vessel supply, higher freight rates drive up the prices of ships (see chapter 3). The stronger market for used vessels may also signal a return in investor confidence. By buying second-hand ships, companies can expand rapidly by acquiring almost instantly available tonnage (Sancricca, 2016).

Developing economies remain the main providers of ship registration

As of 1 January 2021, in terms of both carrying capacity (table 2.5) and commercial value of the fleet, the top three flags of registration remained those of Panama, Liberia and Marshall Islands (table 2.6). Among the top 35 flags of registration, the greatest increases were in Viet Nam by 12.1 per cent, from 9,868 to 10,269 thousand dwt, and in the Russian Federation, by 10.4 per cent, from 9,164 to 10,899 thousand dwt. In terms of value, the greatest increase was in Nigeria whose share of the world merchant fleet value increased from 0.50 to a 0.78 per cent.

Table 2.5 Leading flags of registration by dead-weight tonnage, 2021

	Flag of registration	Number of vessels	Share of world vessel total (percentage)	Dead-weight tonnage (thousands dead-weight tons)	Share of total world dead-weight tonnage (percentage)	Cumulative share of dead-weight tonnage (percentage)	Average vessel size (dead-weight tonnage)	Growth in dead-weight tonnage 2020 to 2021
1	Panama	7 980	8	344 200	16.1	16.1	43 133	4.6
2	Liberia	3 942	4	300 088	14.1	30.2	76 126	8.9
3	Marshall Islands	3 817	4	274 041	12.8	43.0	71 795	4.7
4	Hong Kong, China	2 718	3	205 092	9.6	52.6	75 457	1.8
5	Singapore	3 321	3	136 400	6.4	59.0	41 072	-2.6
6	Malta	2 137	2	116 407	5.5	64.5	54 472	0.5
7	China	6 653	7	107 583	5.0	69.5	16 171	5.0
8	Bahamas	1 323	1	74 289	3.5	73.0	56 152	-4.3
9	Greece	1 236	1	64 850	3.0	76.0	52 468	-6.0
10	Japan	5 201	5	39 091	1.8	77.9	7 516	-3.6
11	Cyprus	1 051	1	33 976	1.6	79.5	32 328	-1.6
12	Indonesia	10 427	10	28 750	1.3	80.8	2 757	6.0
13	Danish International Register	602	1	24 735	1.2	82.0	41 089	6.9
14	Madeira	578	1	22 726	1.1	83.0	39 318	9.7
15	Norwegian Int'l Register	671	1	22 093	1.0	84.1	32 926	5.7
16	Isle of Man	319	0	22 011	1.0	85.1	68 999	-8.7
17	Iran (Islamic Republic of)	893	1	20 417	1.0	86.0	22 863	3.1
18	India	1 801	2	17 054	0.8	86.8	9 469	-2.1
19	Republic of Korea	1 904	2	15 723	0.7	87.6	8 258	4.9
20	Saudi Arabia	392	0	13 662	0.6	88.2	34 853	-1.7
21	United States	3 625	4	12 456	0.6	88.8	3 436	-0.4
22	United Kingdom	927	1	12 063	0.6	89.4	13 013	-0.2
23	Italy	1 296	1	11 255	0.5	89.9	8 685	-6.1
24	Russian Federation	2 873	3	10 899	0.5	90.4	3 794	10.4
25	Viet Nam	1 926	2	10 269	0.5	90.9	5 332	12.1
26	Malaysia	1 769	2	10 231	0.5	91.4	5 783	-1.6
27	Belgium	201	0	9 603	0.4	91.8	47 774	-4.5
28	Bermuda	147	0	8 053	0.4	92.2	54 781	3.0
29	Germany	598	1	7 618	0.4	92.6	12 740	-10.7
30	Taiwan Province of China	429	0	7 136	0.3	92.9	16 635	5.3
31	Netherlands	1 199	1	6 807	0.3	93.2	5 677	-3.4
32	Cayman Islands	160	0	6 725	0.3	93.5	42 032	0.1
33	Turkey	1 217	1	6 425	0.3	93.8	5 279	-9.2
34	Antigua and Barbuda	677	1	6 402	0.3	94.1	9 456	-3.5
35	Philippines	1 805	2	6 240	0.3	94.4	3 457	-5.3
	Top 35	**75 815**	**76**	**2 015 370**	**94.4**	**94.4**	**26 583**	**2.7**
	World total	**99 800**	**100**	**2 134 640**	**100.0**	**100.0**	**21 389**	**3.0**

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

Notes: Propelled seagoing merchant vessels of 100 gross tons and above, as of 1 January 2021. For a complete listing of countries, see http://stats.unctad.org/fleet.
Dead-weight tons for individual vessels have been estimated.

Table 2.6 Leading flags of registration, ranked by value of total tonnage, 2021 (million US dollars) and principal vessel types

	Flag of Registration	Bulk carriers	Container ships	Offshore vessels	Oil tankers	Ferries and passenger ships	Gas carriers	General cargo ships	Chemical tankers	Other/ not applicable	Total
1	Panama	46 903	23 289	14 056	12 065	12 786	10 108	3 768	5 260	6 314	134 550
2	Marshall Islands	32 671	8 217	12 787	26 845	1 513	14 537	430	4 470	1 917	103 388
3	Liberia	29 781	26 351	10 520	20 941	430	5 977	796	2 862	1 439	99 097
4	Bahamas	5 177	706	22 781	6 521	28 250	12 000	65	74	2 303	77 878
5	Hong Kong, China	25 050	25 442	260	10 404	42	6 439	1 318	1 687	105	70 747
6	Malta	10 205	14 925	4 240	9 448	15 166	6 407	1 740	1 661	834	64 626
7	Singapore	13 509	16 531	7 589	11 445		7 947	803	3 560	1 189	62 571
8	China	16 555	5 609	7 728	8 023	4 159	731	2 885	1 668	3 079	50 436
9	Italy	650	196	284	852	15 027	200	1 826	327	621	19 985
10	Greece	3 305	245	1	8 375	1 338	5 388	52	82	22	18 808
	Subtotal top 10	**183 806**	**121 512**	**80 246**	**114 918**	**78 711**	**69 735**	**13 684**	**21 651**	**17 823**	**702 087**
	Other	***28 649***	***37 260***	***68 847***	***32 846***	***41 571***	***26 375***	***22 785***	***11 375***	***13 561***	***283 269***
	World total	**212 455**	**158 771**	**149 093**	**147 764**	**120 282**	**96 110**	**36 470**	**33 026**	**31 384**	**985 356**

Source: UNCTAD calculations, based on data from Clarksons Research, as at 1 January 2019 (estimated current value).
Note: Value is estimated for all commercial ships of 1,000 gross tons and above.

3. Shipbuilding, new orders and ship recycling

Two-thirds of world ship building was of dry bulk carriers and tankers

In 2020, ship deliveries declined by 12 per cent, mainly due to lockdown-induced labour shortages during the first half of the year that disrupted marine-industrial activity. As in 2018 and 2019, the ships delivered were mostly bulk carriers, followed by oil tankers and container ships (table 2.7). Since 2015, an increasing proportion of shipbuilding has taken place in just four countries – China, the Republic of Korea, Japan, and the Philippines. In 2020, their combined market share rose to 96 per cent.

Table 2.7 Deliveries of newbuildings by major vessel types and countries of construction, 2020
(thousand gross tons)

Vessel type	China	Republic of Korea	Japan	Philippines	Rest of the world	Total	Percentage
Bulk carriers	15 051	1 442	9 383	551	311	**26 738**	46
Oil tankers	2 702	7 071	1 901	1	478	**12 152**	21
Container ships	2 665	5 357	394	56	200	**8 671**	15
Gas carriers	869	4 046	353		7	**5 275**	9
Ferries and passenger ships	251	64	76		1 208	**1 600**	3
Chemical tankers	488	88	465		55	**1 095**	2
General cargo	390	1	142		360	**893**	2
Offshore	340	101	7		118	**566**	1
Other	501	4	107		162	**775**	1
Total	**23 257**	**18 174**	**12 827**	**608**	**2 898**	**57 765**	**100**
Percentage	*40*	*31*	*22*	*1*	*5*	***100***	

Source: UNCTAD calculations, based on data from Clarksons Research.
Notes: Propelled seagoing merchant vessels of 100 gross tons and above. For more data on other shipbuilding countries, see http://stats.unctad.org/shipbuilding.

China has the largest share at around 40 per cent. Since the 1980s, based on cost advantages and with strong government policy support, China's shipbuilding industry has sought to improve its capabilities and expand capacity. In 1982, the shipbuilding ministry was 'corporatized' as the China State Shipbuilding Corporation (CSSC) which now administers most commercial and military shipbuilding. This prioritized development in prosperous coastal regions through decentralized organization of diverse related industries. Focussing on international demand, the industry also had greater access to foreign capital, and in the last two decades Chinese companies have entered into technology-sharing agreements with foreign shipbuilders giving them access to foreign equipment, materials and technical expertise. R&D institutes and academic organizations in China have also enhanced their research, development and design capabilities (Market and Research News, 2021 and Medeiros et al. 2021). As a result, over recent years China has improved its building techniques and efficiency and increased its market share not just for bulk carriers and container ships but also for segments where it has previously not operated, such as passenger ships and LNG carriers (Hellenic Shipping News, 2021).

New orders

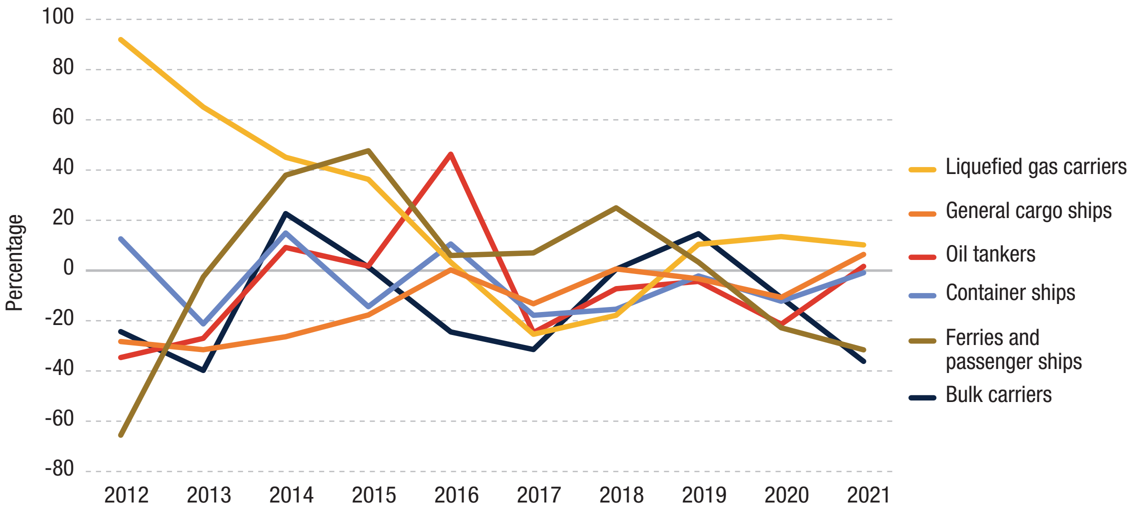
Between January 2020 and January 2021, the global orderbook declined by 16 per cent. The sharpest reductions were for bulk carriers, down 36 per cent, followed by ferries and passenger ships, down 32 per cent. By contrast, other segments grew: liquefied gas carriers, up 10 per cent, and general cargo ships, up 6 per cent (figure 2.8).

From a longer-term perspective, the fleet orderbook has been shrinking since 2011, reaching 165,520,744 dwt in January 2021, the lowest level for the last decade. This is largely the result of constraints on finance combined with uncertainty over future choices of energy sources, and compounded from 2020 by the impacts of COVID-19 on trade volumes and economic activity. At the beginning of 2021, order levels for container ships were similar to those in 2018, for bulk carriers to those in 2004–2006, and for oil tankers to those in 2001, 2003 and 2020 (figure 2.9).

Since early 2021, however, there has been a surge of new orders. As world trade gradually recovered during the second half of 2020 and the first half of 2021, demand for ships increased – responding to severe fleet capacity constraints and the uptick in freight rates. In the first half of 2021, newbuild investment was at its highest since the first half of 2014 (Bak, 2021), with record-breaking orders for container ships – almost eight times those in the first half of 2020. New building orders were spearheaded by those for Panamax container ships (ShipInsights, 2021). There has also been an increase for LNG carriers (Roussanoglou, 2021b).

The largest increases in orders during this period were for Chinese and Korean shipbuilders (Maritime Executive, 2021). However, these orders appear to be concentrated in a few shipyards – which could increase average contract lead times and hinder fleet growth (Springer, 2021, and Walia, 2021).

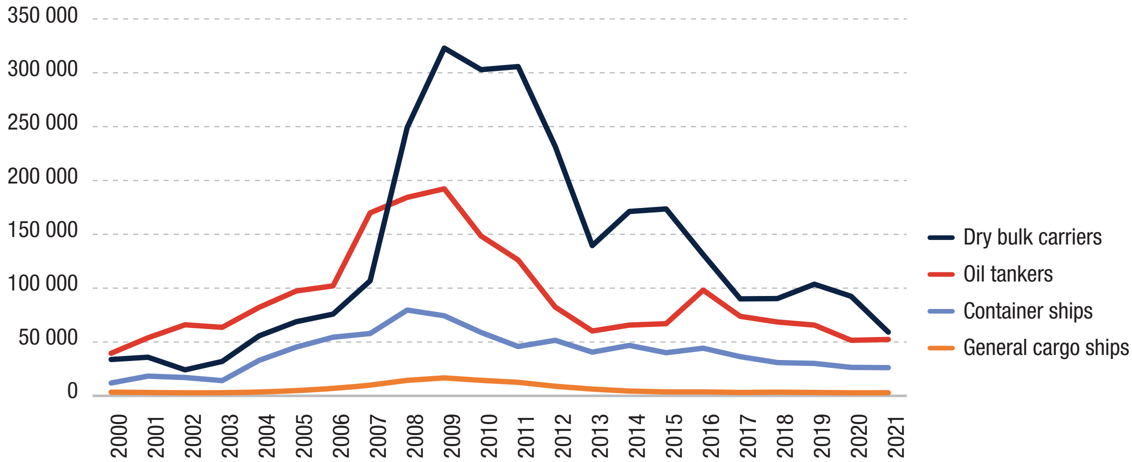
Figure 2.8 Growth of world fleet orderbook, 2012–2021, percentage change in dead-weight tonnage



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

Notes: Propelled seagoing merchant vessels of 100 gross tons and above; beginning-of-year figures.

Figure 2.9 World tonnage on order, selected ship types, 2000–2021 (thousand dead-weight tons)



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

Notes: Propelled seagoing merchant vessels of 100 gross tons and above; beginning-of-year figures.

Ship recycling

Even through the COVID-19 disruption, the tonnage of ships sold for recycling increased by 44 per cent in 2020, reaching 17,400,564 GT. Nevertheless, recycling levels remain lower than in the 2014–2017 period. Despite high scrap metal prices, ship owners believe they can continue to earn high incomes by continuing to operate older vessels.

In 2020, almost half of the recycling was of bulk carriers, reflecting declining charter rates and following the trend of recycling ageing tonnage (Jiang, 2021 and Clarksons Research, 2021c). Around two-thirds of reported tonnage sold for recycling in 2020 was in Bangladesh and India. With the addition of Pakistan and Turkey, the share of the top four countries reached 93 per cent (table 2.8). The highest increases in shares were for Pakistan, by 14.7 percentage points, and for India by 3.2 percentage points.

In contrast, there were noticeable reductions in Bangladesh, by 15 percentage points, and in China by 2 percentage points. In China, this follows a ban on receiving international vessels for recycling, which

Table 2.8 Reported tonnage sold for ship recycling by major vessel type and country of ship recycling, 2020 (thousand gross tons)

Vessel type	Bangladesh	India	Pakistan	Turkey	China	Rest of the world	World total	Percentage
Bulk carriers	5 254	1 317	1 718	34	125	61	**8 509**	48.9
Container ships	160	1 428	282	206		68	**2 143**	12.3
Oil tankers	616	410	617	159	10	226	**2 038**	11.7
Offshore supply	125	257	4	308	3	273	**969**	5.6
Ferries and passenger ships	26	279		545	3	26	**879**	5.1
General cargo ships	176	219	175	203	47	29	**848**	4.9
Liquefied gas carriers	169	241		8		176	**594**	3.4
Chemical tankers	12	125	94	1		10	**241**	1.4
Other/ n.a.	157	786		135	9	93	**1 180**	6.8
Total	**6 694**	**5 061**	**2 890**	**1 598**	**195**	**962**	**17 401**	**100.0**
Percentage	*38.5*	*29.1*	*16.6*	*9.2*	*1.1*	*5.5*	***100.0***	

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

Notes: Propelled seagoing vessels of 100 gross tons and above. Estimates for all countries available at http://stats.unctad.org/shiprecycling.

entered into force in 2018. Between 2017 and 2020, China's share of global recycling tonnage fell from 16 to 1 per cent.

The extent of ship recycling depends on a number of factors, including vessel age, freight markets, and trade patterns (OECD, 2019). In addition, ship owners have to take into account new environment-related regulations, such as IMO limits on the sulphur content of ship fuel oil, the IMO Ballast Water Management Convention, and emerging IMO regulations on decarbonization. When capital expenditures for retro-fitting older ships to comply with new regulations exceed the return on investment, owners are likely to favour recycling.

B. SHIPPING COMPANIES AND OPERATIONS: ADAPTING MARITIME TRANSPORT SUPPLY IN AN UNCERTAIN ENVIRONMENT

1. Expanding and renewing the global fleet

Until recently, there was a structural oversupply of maritime transport and, especially from the onset of the pandemic, ship owners had been cutting capacity. Since 2021, however, supply has lagged behind demand, leading to higher freight rates (UNCTAD, 2021a).

This situation poses fundamental questions about the future of maritime transport. Owners now have to decide what ships they require to expand and renew their fleets, and must do so in an uncertain environment. This also means taking into account significant regulatory changes, particularly those related to decarbonization and the aim of zero emissions (Shell and Deloitte, 2020). To achieve this, the industry needs to consider measures and technologies that can improve ship efficiency. These include:

- Lightweight materials
- Slender hull design
- Propulsion improvement
- Bulbous bows
- Air lubrication systems
- Advanced hull coating
- Ballast water-system design
- Engine and auxiliary systems improvement
- Higher efficiency standards

Some of these options are being incorporated in newbuilds or in the orderbook but, as indicated in table 2.9, they have yet to be widely deployed in the global fleet. Others are not yet economically viable (Balcombe et al. 2019).

Table 2.9 Status of uptake of selected technologies in global shipping, as of 14 June 2021

Equipment type	Energy-saving technologies	Ballast water management systems	(Modern) eco-engine
Fleet, number of ships	3 929	18 925	6 698
Percent of fleet (Percent of GT capacity)	*3.9% (19.0%)*	*18.8% (59.5%)*	*6.7% (25.7%)*
Orderbook	254	2 078	
Percent of orderbook (Percent of GT capacity)	*6.8% (13.2%)*	*55.3% (91.6%)*	

Source: Clarksons Research (2021). Tracking "Green" Technology Uptake - June 2021 and Eco-fleet dashboard. *Shipping Intelligence Network*.

Notes: As of 14th June 2021, the global fleet (vessels above 100GT) stood at 100,500 ships, as per Clarksons data. Energy-saving technologies encompass waste heat recovery systems, exhaust gas economizers, propeller ducts, pre-Swirl or stator fins, rudder bulbs, rigid sails, air lubrication system, bow enhancement and solar panels. Modern eco-engine refers to a vessel with an electronic injection main engine contracted after 1st January 2012.
Data based on reported equipment in merchant fleet, which may underestimate total uptake.

Responding to this challenge will require significant investment. Expanding the fleet to cater for trade growth over the coming three decades could cost around $0.2 trillion while retrofitting or replacing the existing fleet over the next 30 years, could cost an additional $2.19 trillion (Ovcina, 2021).[1] Since it is impossible to renew the whole fleet by 2050, innovation and new technologies will also need to be applied to existing vessels.

2. Decarbonization without a crystal ball

Uncertain decarbonization scenarios

In 2018, the IMO adopted a sector reduction pathway consistent with the Paris Agreement. The aim is by 2050 to reduce total annual greenhouse gas emissions by at least 50 per cent of 2008 levels, while reducing carbon intensity by at least 40 per cent by 2030, and 70 per cent by 2050. These objectives are to be achieved through a combination of short-, mid- and long-term measures, with quantitative targets until 2050. Table 2.10 summarizes some proposed measures.

Table 2.10 Some proposed IMO measures to reduce greenhouse gas emissions

Category	Subcategories	Examples of measures
Short-term measures, to be agreed upon between 2018 and 2023	• Technical and operational energy-efficiency measures • Use of alternative low-carbon or zero-carbon fuels for marine propulsion and other technologies	• New operational energy-efficiency standards for new and existing ships (EEXI) • Consider and analyse the use of speed optimization and reduction • Developments of port infrastructure to support alternative fuels • Progressive tightening of standards on minimum energy efficiency levels and emissions, based on ship design and engine performance data (CII) • R&D efforts on marine propulsion with alternative fuels • Encourage the development of national action plans to develop policies and strategies to address greenhouse gas emissions from international shipping
Mid-term measures, to be agreed upon between 2023 and 2030	• Market-based measures – carbon pricing mechanisms to give firms economic incentives to emit less • Operational energy efficiency measures for new and existing ships	• Market-based measures could include an offsetting scheme, a maritime emissions trading scheme, or a carbon levy • Specify in the national action plan measures to increase the uptake of low- and zero-carbon fuels
Long-term measures (to be agreed beyond 2030)	• Measures to ensure zero-carbon and fossil-free fuels	

Sources: IMO (2018), Kachi et al. (2019).

Note: Some measures mentioned in this table have been agreed at the IMO (short-term measures including EEXI and CII) whereas others have not.

At present, the regulatory outlook is uncertain. The IMO has yet to agree on a number of issues, such as the market-based mechanism, and the outcome is likely to be combination of measures. Moreover, the IMO regulations will be accompanied by those from other bodies such as the EU. On 14 July 2021 the EU announced a series of measures:

- Including ships of 5,000 GT and above in its Emissions Trading System for all intra-EEA voyages and for 50 per cent of voyages starting and ending in the bloc.
- Establishing greenhouse gas intensity standards for ship fuels.
- Introducing taxes on bunkers sold in the European Economic Area.

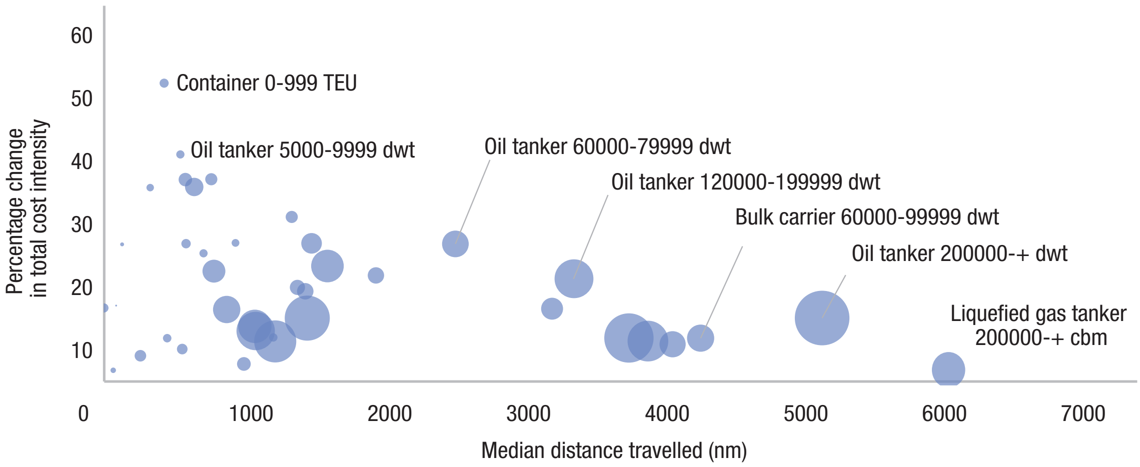
The interplay between different regulatory regimes, combined with volatility in carbon prices is generating considerable uncertainty – which is compounded by the difficulty in modelling the outcome of each measure (ING, 2021). Total emissions will depend on ship type, size and engine, as well as on sea routes

[1] These projections exclude fuel transition-related investments, such as storage and transport of alternative fuels.

and navigation conditions – information which may not be easily accessible (Sanchez et al, 2020 and Plevrakis, 2020).

Since 2020, UNCTAD has been collaborating with IMO on assessing the impact of short-term measures. In a report published in 2021, UNCTAD looks at the combined impact of two measures: a new energy standard, the energy efficiency existing ship index; and a new operational requirement, the carbon intensity indicator (UNCTAD, 2021b). The report considers their potential impacts on ship costs, travel distances, fleet distribution, routing patterns, and the use of different types of vessels as well as on maritime logistics costs. The report concludes that the greatest impact will be on smaller vessels plying shorter routes and on container ships and tanker vessels (figure 2.10).

Figure 2.10 Percentage change in cost intensity by ship segment, average size and median distance travelled



Source: UNCTAD compiled from DNV and MarineTraffic data.

Notes: Size of the bubbles stands for the average ship size per DWT. This figure represents the percentage change in total cost intensity between (i) the most ambitious greenhouse gas reduction scenario (regulatory scenario including both EEXI and CII requirements, with an average CII reduction requirement of 21.5 per cent between 2019 and 2030) and (ii) the 2030 "current regulations scenario (with only adopted EEDI requirements, including those entering into force in 2022)".

The easiest and cheapest way to reduce emissions is to reduce ship speed. Operating at less than full power cuts fuel consumption, and thus carbon emissions, while reducing operating costs. However, transporting the same cargo volumes at slower speeds will also require more ships. The report estimates that the IMO short-term measures will require 13 per cent more vessel capacity. This will entail considerable capital expenditure and have important implications for shipbuilders. Drewry estimates that global shipbuilding capacity is equivalent to 7 per cent of the global fleet and that, while maintaining also normal fleet replacement and growth, increasing vessel capacity by 13 per cent would require a ramp-up period of around five years (UNCTAD, 2021b).

The study points out that reducing speeds will also mean reconfiguring services – especially for Pacific and Caribbean SIDS where the maritime trade typically depends on smaller cargo ships on shorter routes. Smaller ships will also be needed, when a deep-sea liner that is going slower now needs to skip a port – which would require more transhipment, thereby increasing costs.

Uncertain energy transition pathways

The path towards shipping decarbonization involves not just ship design and improvements in technology but also the use of alternative fuels. As indicated in table 2.11, the shipping industry uses a range of fuels, though the predominant ones are traditional liquid ones, such as very-low-sulphur intermediate fuel oil (VLS IFO) and intermediate fuel oil with a maximum viscosity of 380 centistokes (IFO380), along with VLS marine diesel oil.

There is certainly significant scope for moving the existing fleet to alternative fuels but there are many areas of uncertainty, and the shift to net-zero fuels has barely begun. For alternative fuels it is important to ensure their safety and consider upstream emissions from their production (see box 2.1).

Table 2.11 World fleet by fuel type as of 1 January 2021

Fuel type	Ships	GT	TEU	dwt	Ships %	GT %	TEU %	Dwt %	Ships % of known fuel type	GT % of known fuel type	TEU % of known fuel type	Dwt % of known fuel type
Very Low-Sulphur (VLS) Intermediate Fuel Oil (IFO)	36 188	993 715 259	18 384 210	1 534 083 046	36.26	69.08	70.97	72.11	47.12	72.26	71.29	74.54
VLS Marine Diesel Oil (MDO)	33 118	29 698 675	149 929	27 886 341	33.18	2.06	0.58	1.31	43.12	2.16	0.58	1.36
IFO 380*	3 635	283 299 533	6 949 482	437 386 040	3.64	19.69	26.83	20.56	4.73	20.60	26.95	21.25
VLS Marine Gasoil (MGO)	2 539	7 441 142	34 467	6 769 951	2.54	0.52	0.13	0.32	3.31	0.54	0.13	0.33
Ultra-Low Sulphur (ULS) MDO	381	697 587	7 000	661 627	0.38	0.05	0.03	0.03	0.50	0.05	0.03	0.03
LNG, VLS IFO	373	36 964 811	144 014	30 159 817	0.37	2.57	0.56	1.42	0.49	2.69	0.56	1.47
LNG, VLS MDO	168	10 814 060	12 703	8 190 743	0.17	0.75	0.05	0.39	0.22	0.79	0.05	0.40
IFO 180	166	7 351 589	75 955	9 536 173	0.17	0.51	0.29	0.45	0.22	0.53	0.29	0.46
ULS IFO	43	352 580	15 617	438 639	0.04	0.02	0.06	0.02	0.06	0.03	0.06	0.02
LNG, VLS MGO	37	424 846	10	430 662	0.04	0.03	0.00	0.02	0.05	0.03	0.00	0.02
LNG	32	459 380	260	139 039	0.03	0.03	0.00	0.01	0.04	0.03	0.00	0.01
MDO	22	652 797	1 629	188 652	0.02	0.05	0.01	0.01	0.03	0.05	0.01	0.01
ULS MGO	22	26 594		16 571	0.02	0.00		0.00	0.03	0.00		0.00
Biofuel	18	360 677	11 684	386 434	0.02	0.03	0.05	0.02	0.02	0.03	0.05	0.02
MGO	12	880 222		122 003	0.01	0.06		0.01	0.02	0.06		0.01
Methanol, VLS IFO	11	336 377		552 044	0.01	0.02		0.03	0.01	0.02		0.03
Ethane, VLS IFO	7	292 595		264 750	0.01	0.02		0.01	0.01	0.02		0.01
Nuclear	6	144 573	1 324	50 079	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00
LPG, VLS IFO	5	236 752		272 690	0.01	0.02		0.01	0.01	0.02		0.01
Biofuel, LNG	4	43 851		3 907	0.00	0.00		0.00	0.01	0.00		0.00
Compressed Natural Gas (CNG), VLS MDO	3	111 058		105 325	0.00	0.01		0.00	0.00	0.01		0.01
IFO 380, LNG	2	251 144		18 400	0.00	0.02		0.00	0.00	0.02		0.00
MDO, MGO	2	183 254		16 030	0.00	0.01		0.00	0.00	0.01		0.00
Biofuel, VLS MGO	2	6 810		9 876	0.00	0.00		0.00	0.00	0.00		0.00
VLS IFO, Well Fuel	1	86 952		166 546	0.00	0.01		0.01	0.00	0.01		0.01
CNG, VLS MGO	1	30 742		31 473	0.00	0.00		0.00	0.00	0.00		0.00
LNG, MDO	1	65 314	600	22 437	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IFO 380*, MGO	1	149 215		19 189	0.00	0.01		0.00	0.00	0.01		0.00
Methanol	1	51 837		10 670	0.00	0.00		0.00	0.00	0.00		0.00
Nuclear, VLS MDO	1	33 500		9 000	0.00	0.00	-	0.00	0.00	0.00	-	0.00
Unknown fuel type	*22 998*	*63 435 988*	*115 238*	*69 356 421*	*23.04*	*4.41*	*0.44*	*3.26*				
Grand Total	**99 800**	**1 438 599 714**	**25 904 122**	**2 127 304 575**	**100.00**	**100.00**	**100.00**	**100.00**				
World total known fuel type	***76 802***	***1 375 163 726***	***25 788 884***	***2 057 948 154***					***100.00***	***100.00***	***100.00***	***100.00***

Source: UNCTAD, based on data provided by Clarksons Research.

Notes: * Intermediate fuel oil with a maximum viscosity of 380 centistokes (<3.5 per cent sulphur).

All variations of MGO, MDO and IFO are traditional fuel types.

Alternative fuels encompass: LNG, LPG, methanol, biofuels, hydrogen, ammonia; synthetic methane and nuclear - highlighted in green.

Fuels that mention a traditional fuel type, along with an alternative fuel (for example: “Ethane, VLS IFO”; “Biofuel, VLS MGO” or “Nuclear, VLS MDO” refer to dual-fuel ships highlighted in light orange.

Box 2.1 Divided views on whether oil should be replaced by LNG

An alternative fuel already widely in use is liquefied natural gas. This is the greenest fossil energy source, which compared to heavy fuel oil (HFO), could reduce sulphur emissions by 99 per cent, nitrogen oxides by 80 per cent, and CO2 emissions by up to 20 per cent, along with most particulate matters. The 2020 Sphera report demonstrated that LNG/dual-fuel engines emit fewer grams of CO2 equivalent per kw than diesel engines. Dual-fuel engines can use existing technology, enabling ships to be operated on different types of fuel and comply with regulations while remaining competitive.

In January 2021 the IMO sulphur cap entered into force, prompting greater investment in bunkering port infrastructure and in LNG-fuelled ships. Currently, these represent a small share of the fleet and of the orderbook. But their numbers are expected to grow significantly in the 2021–2022 period.

The major disadvantage of LNG is that it consists primarily of methane which is a far more potent greenhouse gas than CO2. Even small escapes during production or use could result in a net increase in GHG emissions. In April 2021, the World Bank published a report that considered holistic lifecycle emissions and highlighted the impact of LNG on climate change. It recommended countries to avoid supporting LNG as a bunker fuel and advocated for regulation of methane emissions.

Shipping industry voices, such as Maersk and Euronav, have also questioned the suitability of LNG as a transition fuel and point to the high costs of investing in new ships and infrastructure while not reducing lifecycle greenhouse gas emissions – with the danger of technological lock-in since new infrastructure with be in operation for 20 years. They also perceive such investment as extending the use of carbon in the maritime energy supply chain and delaying the energy transition.

Sources: Gaztransport Technigaz (GTT). LNG as a marine fuel. Gilbert, P., Walsh C., Traut M., Kesieme U., Pazouki K. and Murphy A. (2018). Assessment of full life-cycle air emissions of alternative shipping fuels, *Journal of Cleaner Production*, Volume 172, 20 January 2018. Clayton, R. (2019). LNG will be transitional fuel for 2030, Nor-Shipping hears. Lloyds List News, 03 Jun 2019. Ovcina, J. (2020). Clarksons: 27 per cent of the order book to run on alternative fuels. *Offshore Energy*, 1/12/2020. Lloyd's Register (2021). The complexities of the fuel supply chain as we move towards zero-carbon. 20/01/2021. World Bank (2021). The role of LNG in the transition toward low-and zero carbon shipping. Lloyds List (2021). Is LNG really borderline greenwashing? *Lloyds' List Shipping Podcast*, 14/05/2021.

C. PORT SERVICES AND INFRASTRUCTURE SUPPLY

The past year has been very testing for port operations. The impacts of COVID-19, compounded by the Ever Given incident in the Suez Canal, have resulted in congestion and equipment shortages and have disrupted supply chains. Nevertheless, ports have remained operational and continued to serve diverse flows of trade. Their experience has confirmed the importance of preparing for the unexpected and of building resilience (box 2.2). But the COVID-19 crisis has also opened up new opportunities to diversify and to create better links between maritime and other modes of transport.

Box 2.2 Building port resilience UNCTAD experience

The UNCTAD TrainForTrade Port Management Programme helps ports in developing countries become more efficient and competitive. During the pandemic, the programme worked with other United Nations entities on a joint project to keep transport networks and borders operational – by implementing standards, guidelines, metrics, tools and methodologies to facilitate the flow of goods and services, while containing the spread of COVID-19. The project supports governments, including customs and other border agencies, port authorities, and the business community.

This work includes a course on Building Port Resilience Against Pandemics which addresses four areas: crisis protocols and communications strategy; staff management, well-being, and resilience; technology preparedness; and cargo flow continuity.

Discussions during the course indicate that building resilience requires significant changes in port operations. These would necessarily differ from country to country but this forum allows practitioners to discuss and exchange experience and ideas and explore responses and actions. They have concluded that port clients, operators and governmental entities can cooperate to improve their information systems – aiming for uniformity, consistency and predictability, while minimizing confusion and uncertainty at times of disruption.

Key to the programme's success is South-South cooperation. Local instructors deliver training supported by experts from UNCTAD and other port partners.

Source: Information provided by the UNCTAD TrainForTrade Port Management Programme.

Ecommerce, smart logistic hubs and intermodal connections

During the pandemic, consumers sought a safe way to meet their needs, leading to a boom in online retail sales – which in 2020 amounted globally to $4.28 trillion. This trend is expected to continue: in 2022 e-retail revenues are projected to grow to $5.4 trillion (Statista, 2021).

These higher volumes, combined with expectations for rapid delivery, have boosted the demand for better logistic facilities – in particular for sufficient warehouses to store products along with space to fulfil and despatch orders, while also providing value-added services.

Indeed investment decisions and port planning are increasingly being influenced by the expectations of retailers and logistic operators – who are looking to reduce costs by using seaports close to warehousing or distribution facilities and their end markets (Drewry 2021). To avoid congestion and ensure rapid replenishment, ports can offer storage and warehousing capacity and space for modern logistics.

Ports are also investing in more technology for monitoring supply chains, detecting potential disruption and generally tracking shipments to their destinations. In 2021, several Asian ports, including Sichuan and Hainan in China, launched or announced investments in smart logistics (American Journal of Transportation, 2021 and South China Morning Post, 2021).

To maximize ecommerce logistics operations, port operators need to be able to handle data efficiently (Drewry, 2021). For this purpose, port logistic are increasingly relying on digitalization – for exchanging information among customers, partners, suppliers and other actors, and for offering new services (Logmore, 2019). For example, one of the world's largest global terminal operators, DP World, has acquired Syncreon, a global provider of supply chain services (van Marle, 2021).

To take advantage of ecommerce, ports also need to be well connected to their hinterlands. Using new technology they can become smart logistic hubs that connect maritime and other modes of transport – facilitating supply chain connections, domestically, regionally and internationally. These need to operate in a more agile, intermodal fashion at times of congestion and disruption (Schwerdtfeger, 2021). Box 2.3 describes how intermodal connections can be advanced by best practices, standards and regulations.

Box 2.3 Guidance and standards for intermodal operations

The UN Economic Commission for Europe (ECE) promotes best practices and standards for sustainable transport while also developing, and overseeing the implementation of, legal instruments. ECE aims to support inland freight transport, by improving traffic safety, environmental performance, energy efficiency, security and efficient service provision.

A recent ECE report, the *Handbook for National Masterplans for Freight Transport and Logistics*, provides guidance to governments on how transport and logistic services can, in post-pandemic times, contribute to economic development and recovery. The report highlights the critical importance for intermodal operations of intelligent transport systems (ITS) and telematics that enable operators to shift freight seamlessly across transport modes and networks – to plan routes and deliveries, and optimize cargo flows and the use of infrastructure.

Maximizing the benefits of ITS to transport operations will mean training the workforce for increased specialization and technological innovation, and supporting ITS research and development in cost-efficient solutions. At the same time, there needs to be significant investment, partly through public-private partnerships, in high-performance digital infrastructure, while ensuring efficient data exchange and interoperability.

It is also important to agree on legal instruments and standards. An example is the 1991 European Agreement on Important International Combined Transport Lines and related installations (AGTC). This agreement aims to make international combined transport in the ECE region more efficient and attractive to customers, by developing a common infrastructure quality standard for combined transport on the main European corridors. The framework's important nodal points include transport terminals, border crossing points, stations for exchanging wagon groups, gauge-interchange stations, and ferry links and ports. Facilitating modal shifts enables international freight movements while reducing the damaging environmental impacts from transporting international freight by road.

Implementing AGTC minimum standards is expected to strengthen critical Euro-Asian railway routes that can connect Central Asian landlocked ECE members to international markets. To avoid temporary closure of borders as a result of pandemics, ECE is also considering an agreement for uninterrupted operation of designated core lines of the network.

Box 2.3 Guidance and standards for intermodal operations *(cont.)*

At present, digital exchange between different modes of transport, sectors and countries is quite fragmented, so ECE is working on digital standards for harmonizing digital exchange of data and documents based on existing UN/CEFACT semantic standards and reference data models. These will allow for interoperability along multimodal supply chains, using a common foundation for converting data between modes of transport, sectors and authorities.

Tests to prove the concept are taking place. For example, UN/CEFACT and FIATA experts have prepared a digital version of the FIATA multimodal Bill of Lading, aligned to the MMT RDM. Another test has focused on exports of wood and cellulose from Belarus to Central Europe via Ukraine, the Black Sea and the Danube, combining rail, road, river and maritime transport information exchanges. These tests demonstrate the benefits of seamless data exchange between different modal consignment notes and maritime bills of lading. Experts are also currently working on IMO/FAL forms in Ukraine with a view to using them along multimodal transport routes.

Source: Inputs provided by the ECE Secretariat and ECE (2021) *Handbook for National Masterplans for Freight Transport and Logistics*.

Greener industrial port activities

The world is now embarking on the transition to greener energy. This will be costly. Halving shipping emissions by 2050 is estimated to require an annual average investment of between $40 to $60 billion between 2030 and 2050. Most of this is for producing alternative fuels such as ammonia, hydrogen, and methanol among others, while also developing new land-based infrastructure for storage and bunkering (Krantz et al, 2020).

The energy transition has major implications for ports. Less trade in oil will reduce revenue from storing and distributing fossil fuels. Preparing for a future without carbon fuels, ports are therefore aiming to develop new markets and value-added services (The Conversation, 2021 and Manners-Bell, 2021). And despite the pressures faced in 2020, many have maintained their plans for investing in environmental sustainability (IAPH-WPSP, 2021). These include production of alternative energy, infrastructure to import alternative fuels, and for bunkering and storage to facilitate onward distribution (table 2.12). Some ports have benefitted from infrastructure green recovery plans and others from incentives for foreign investment.

Table 2.12 Industrial port projects capitalizing on green opportunities to generate new revenue streams

Alternative energy	Bunkering infrastructure	Facilitating import of alternative energy and storage infrastructure
• Project to develop hydrogen-based exports from the Port of Fujairah (United Arab Emirates) • Project to develop offshore wind energy to generate hydrogen at North Sea Port (Belgium)	• Pilot hydrogen filling stations in the port of Antwerp • Proposed hydrogen infrastructure at Kobe, Chita, Yokkaichi and Hibikinada ports (Japan), capitalizing on existing hydrogen pipeline	• Project to develop a terminal in Germany for import and onward distribution of LNG, encompassing storage and ancillary services (Brunsbüttel Ports, Germany)

Sources: Argus Media (2021): Japan studies options to cut coastal shipping emissions. ArgusMedia, 2/7/2021. OffshoreWind. Biz (2021) Equinor, Ørsted, Boskalis Join AquaVentus Offshore Wind-to-Hydrogen Project 4/5/2021. Savvides; Nick (2021). Antwerp and CMB team up to launch multimodal hydrogen filling station. The Loadstar, 10/6/2021. Liebig; L. (2021). The United Arab Emirates is well placed to capitalise on the pivot to hydrogen 13/4/2021. Pekic, Sanja (2021). North Sea Port to get hydrogen pipeline network. *Offshore Energy*, 3/6/2021.

There is also now greater interest in smarter and greener ports. Beyond transforming ports into carbon-neutral ecosystems this means using new data environments and artificial intelligence to enhance competitiveness and sustainability. Some factors affecting the development of such ports are indicated in table 2.13.

Table 2.13 Factors affecting the development of smart green ports

Dimension	Influencing factors	Indicators of success
Greenness	Energy-saving and emission-reducing capability	Port's capability in saving energy and controlling pollutant discharges
	Pollution treatment capability	Responsiveness and degree in treating pollutants
	Efficient utilization of resources	Whether a port has the capability to utilize resources effectively to reduce resource waste
	Environmental protection concept and policy system	Knowledge and practices of port management personnel and policymakers in green concepts
Agility	Agile production capability	Port's capability in fully utilizing the limited resources and responding quickly to orders
	Comprehensive logistic capability. Levels of a port's comprehensive logistic services and supply	Whether a port adopts refined operation modes and has JIT capabilities
Personalization	Port-differentiated service levels	Levels of a port's services that are different from those at other ports
	Personalized service levels for customers	Levels of personalized services provided by the port to customers
	Emergency and quick response capabilities	Port's response capabilities to multiple emergencies and adjustability to changes
Cooperation	International port-shipping cooperation	Degree and model of international port-shipping cooperation
	Port-city integration	Port-city cooperation
	Cooperation between subsidiary and parent ports	Cooperation between subsidiary and parent ports (international dry ports, feeder ports and inland port areas)
Intelligence*	Intelligent production infrastructure and operation	Intelligence degree of port infrastructure operation and production
	Intelligent administration	Intelligence degree of port administration
	Intelligent facility security	Intelligence degree of port facility security
	Innovative R&D and technology application	Port's technical innovation R&D capability and degree of application
Liberalization	Liberalization of trade and economic policies	Port's liberalization degree in domestic and foreign trade
	Facilitation of logistics and customs clearance	Port's coordination with the Customs and quarantine departments and degree of cargo transportation facilitation
	Openness of investment and financing	Openness of a port in market investment and financing

Source: Chen, J.; Huang, Tiancun, Xie, X; Lee, P. and Hua, C. (2019). Constructing the Governance Framework of a Green and Smart Port. Journal of Marine Science and Engineering.

* Defined as “more modern intelligent technologies integrated into port working environments to improve port operations”.

D. THE IMPACT OF COVID-19 ON PORTS: LESSONS FROM THE UNCTAD TRAINFORTRADE PORT MANAGEMENT PROGRAMME

The TrainForTrade Port Management Programme brings together a strong network of ports across several continents, for which the programme has continued to upgrade its Port Performance Scorecard (PPS). Each April member ports complete a survey on their performance in the previous calendar year. This provides valuable data for strategic planning within ports and for evidence-based policy analysis at regional and state levels.

The data are collected through 82 questions from which the PPS derives 26 agreed indicators under the following categories: finance, human resources, gender, vessel operations, cargo operations, and environment (table 2.14). The same approach has been used each year since the inception of the PPS in 2012 thus ensuring consistency and comparability over time.

For the current scorecard for the five-year period 2016–2020, 51 port entities provided 3,301 data points – an average of 98 data points per indicator. Around half of the ports were small, less than five million tons, or medium, between five million and 10 million tons. The annual volume throughput for the largest port in the sample was 80.9 million tons and for the smallest was 1.5 million tons. Two-thirds were landlord ports – owning the basic infrastructure and leasing it out to operators – or used a mixed model.

Table 2.14 Port Performance Scorecard indicators, 2016–2020

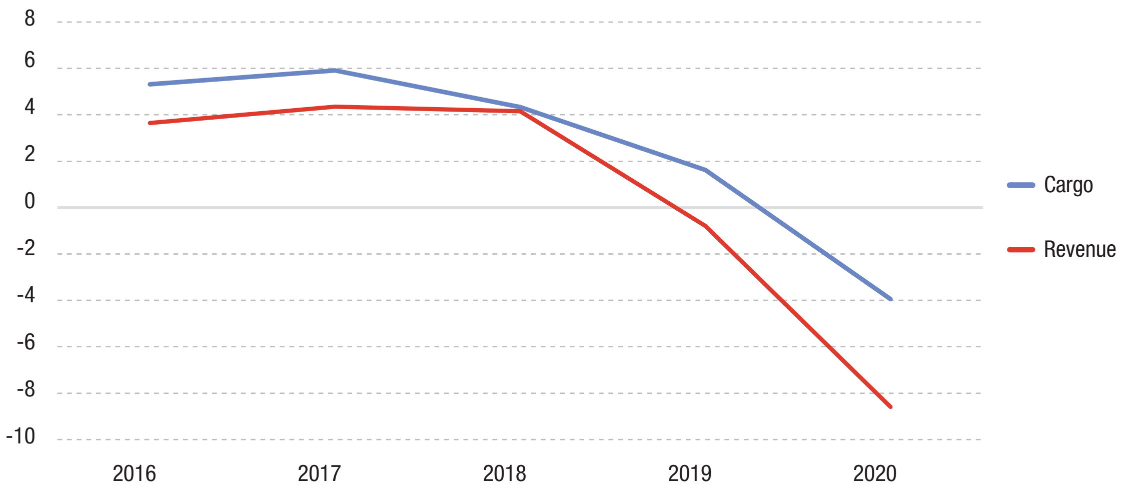
Category	Indicator number	Indicator	Number of values	Mean
Finance	1	EBITDA / revenue (operating margin)	98	33.1%
	2	Labour / revenue	102	22.9%
	3	Vessel dues / revenue	101	15.8%
	4	Cargo dues / revenue	101	36.7%
	5	Concession fees / revenue	91	13.7%
	6	Rents / Revenue	96	5.7%
Human resources	7	Tons / employee	108	65 054
	8	Revenue / employee	101	$189 180
	9	EBITDA / employee	97	$98 029
	10	Labour cost / employee	96	$32 985
	11	Training cost / wages	96	1.3%
Gender	12	Female participation rate – all categories	108	17.5%
	12.1	Female participation rate – management	108	42.0%
	12.2	Female participation rate – operations	100	16.0%
	12.3	Female participation rate – cargo handling	74	5.7%
	12.4	Female participation rate – other employees	46	29.1%
Vessel operations	13	Average waiting time (hours)	92	14
	14	Average gross tonnage per vessel	106	18 184
	15.1	Average of oil tanker arrivals	114	9.8%
	15.2	Average of bulk carrier arrivals	115	10.5%
	15.3	Average of container ship arrivals	114	30.7%
	15.4	Average of cruise ship arrivals	113	1.1%
	15.5	Average of general cargo ship arrivals	116	27.4%
	15.6	Average of other ship arrivals	114	22.5%
Cargo operations	16	Average tonnage per arrival (all)	117	8 162 t
	17	Tons per working hour, dry or solid bulk	77	317 t
	18	Tons per hour, liquid bulk	55	367 t
	19	Boxes per ship hour at berth	70	27
	20	Twenty-foot equivalent unit dwell time (days)	63	6
	21	Tons per hectare (all)	107	141 704 t
	22	Tons per berth meter (all)	113	6 482 t
	23	Total passengers on ferries	89	959 899
	24	Total passengers on cruise ships	92	91 068
Environment	25	Investment in environmental projects / Total CAPEX	54	6.3%
	26	Environmental expenditure/revenue	77	1.8%

Source: UNCTAD, based on data provided by selected member ports of the TrainForTrade network.
Abbreviations: CAPEX, capital expenditure; EBITDA, earnings before interest, taxes, depreciation and amortization.

1. Impact of COVID-19 pandemic across the TFT port network

In 2020, the COVID-19 pandemic had a significant impact on ports worldwide. As well as creating health risks for port workers and seafarers in all regions it also substantially reduced the volume of trade. Between 2016 and 2018 cargoes had been growing at a median value of five per cent per year and revenues by six per cent. In 2020, however, volumes fell by 4 per cent and revenues by 9 per cent (figure 2.11). The impacts on individual ports are illustrated in box 2.4, by the experience of the Port of Gijon in Spain, and in box 2.5, by the port system in Peru.

Figure 2.11 Cargo and revenue, 2016–2020
(percentage change)



Source: UNCTAD, based on data provided by selected member ports of the TrainForTrade network.

Box 2.4 Port performance analysis of the Port of Gijon in 2020

Although 2020 was a tough year for ports in general, and for Europeans in particular, for the port of Gijon it was what we could call the ‘perfect storm’.

On the one hand, COVID-19 hit. On the other hand, the fight for a more sustainable world caused the closure of the five thermal power plants that the port served; consequently causing a loss of five million tons of coal. In addition, the shutdown of an Arcelor Mittal blast furnace caused a loss of almost four million tons.

Other traffic, such as the import, mix and export of coals from Russia to the Maghreb helped offset the large losses mentioned above. And despite the ‘three storms’, the Port of Gijon has firmly held the wheel while at the same time helping its clients, allowing them to delay payments for a year and rewarding companies affected by COVID-19.

Losses meant a 7 per cent drop over the previous year (2019). The total tons handled, amounted to 16 million tons. Traffic was broken down into 80 per cent solid bulks, 12 per cent general merchandise and 8 per cent made up of liquid bulks.

Iron ore, steel coal and cement made the port the first in solid bulk in the Spanish port system. Other solid bulks, like cereals and fertilizers, contributed to its leadership.

As for general merchandise, 75 per cent was containerized, with 85,000 TEU moved. This represented 75 per cent of the port’s hinterland and is expected to expand in the coming years following a new rail connection with the centre of the country. The remaining 25 per cent of the total, 1.5 million ton of general merchandise, was steel products.

Liquid bulks represented 8 per cent of the mix – petroleum products, gasoline, and gasoil, intended for final consumption.

Despite the wind and seas from the bow, financial results have been positive and increased by a little over two million euros. The year 2021 is born full of new projects and hopes that will undoubtedly help turn the page of these challenging times.

Source: Port Authority of Gijon.

Box 2.5 Port performance analysis of the national port system in Peru in 2020

In Peru, in 2020 there was a 10.9 per cent fall in volumes to 97.4 million tons while the number of containers (in TEU) handled remained stable nationally. However, there was a drop in container traffic at the larger international terminals of 3 per cent compared to 2019 due to the impact of the COVID-19 health emergency (see table).

The main types of goods, containers, solid bulk, and break-bulk cargo, decreased by 0.3 per cent, 3.7 per cent and 4.9 per cent, respectively, as shown in the table, which illustrates the movement of cargo at public and private port terminals for 2019/2020.

Type of Merchandise	Unit of measure	Year 2019	Year 2020	Change (%) 2020/2019
LoLo containers	TEU	2 678 258	2 654 289	-0.9%
	units	1 618 433	1 592 256	-1.6%
	tons	25 905 625	25 832 736	-0.3%
Break Bulk	tons	4 057 174	3 858 419	-4.9%
Bulk Solids	tons	12 165 301	11 714 440	-3.7%
Bulk Solid Minerals	tons	33 122 675	27 978 125	-15.5%
Liquid Bulks	tons	33 756 658	27 883 897	-17.4%
RoRo	tons	333 213	207 063	-37.9%
Total Load	**tons**	**109 340 647**	**97 474 680**	**-10.9%**

However, these reductions are moderate compared to those for bulk minerals, liquid, and roro cargo, which decreased by 15.5 per cent, 17.4 per cent, and 37.9 per cent, respectively.

During the year 2020, the National port system handled a total of 2.6 million TEUs, presenting a slight drop of 0.9 per cent, compared to the year 2019.

Source: National Port Authority of Peru.

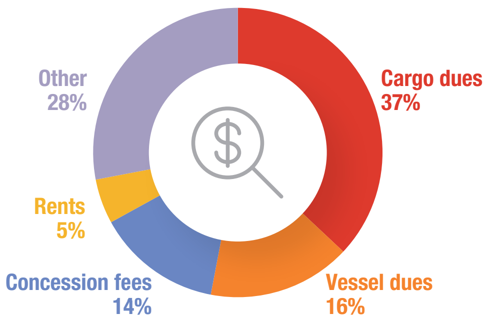
Financial performance

Financial performance of ports can be measured as the average gross revenue per ton of cargo. This ranged from $1.9 per ton in Europe, and $2.26 in Asia, to $5.31 in Africa. At the global level the sources of revenues are indicated in figure 2.12, showing the split between port dues on vessels and cargo throughput, port service charges, and income derived from land and concession rights.

Around half of revenues come from vessel and cargo charges for the use of primary port infrastructure. This proportion is likely to fall over time with the development of digitalized ports and energy hubs, using either the concession or landlord model.

Profitability is measured as earnings before interest, taxes, depreciation, and amortization (EBITDA). Businesses with high demands for infrastructure investment require elevated levels of EBITDA to be sustainable. In 2020 average profitability declined by 12 per cent in Europe, by 17 per cent in Asia and by 25 per cent in Africa. Latin America showed no change. These declines can be partly explained by the impacts of COVID-19, though in Africa there must be other major factors since volumes and revenues showed only a minor impact from the pandemic.

Figure 2.12 Average revenue mix of ports, 2016–2020



Source: UNCTAD, based on data provided by selected member ports of the TrainForTrade network.

In performance terms, the reported numbers show a falloff in 2020. While there have been profitability drops in other periods this decline can be partially explained by the COVID-19 pandemic.

Last year the scorecard covered the period 2015–2019, for which EBITDA as a proportion of revenue was 38.8 per cent (indicator 1). The 2021 scorecard covered the period 2016–2020 for which the proportion declined to 33 per cent. The impact was, however, lower in Europe where averages remained at 59 per cent and in Latin America at 41 per cent.

A high-level comparison of revenue profiles shows the mix between port dues on vessels and cargos, port service charges and incomes derived from lands and concession rights. Between 2020 and 2021 scorecards, the proportion of total capital expenditure for environmental purposes fell from 7.2 to 6.4 per cent, while the proportion of operating costs for environmental purposes fell from 2.3 to 1.8 per cent. In some countries the environmental data are difficult to extract since they can be embedded in the total capital or operating spends.

Gender equality

Sustainable Development Goal 5.5 calls for full and effective participation of women and equal opportunities for leadership at all levels of decision making in political, economic, and public life. In this respect, ports still do not perform well. Between 2020 and 2021 scorecards, the average female proportion of the port entity workforce fell slightly, from 17.6 to 17.5 per cent. The proportion in Europe is significantly higher at 24.8 per cent, though most of these women work in management or administration.

Overall, the figures are more encouraging for management and administrative roles. Between 2020 and 2021 scorecards, the proportion of women rose from 38 to 42 per cent. Asia led the way at 52 per cent, followed by Europe at 39 per cent. Female participation is however far lower for cargo handling and port operations. There is thus still a lot to be done to achieve the SDG target to “Achieve gender equality and empower all women and girls.” Box 2.6 illustrates how the Philippines Ports Authority is making the changes to meet this objective.

Box 2.6 Gender and development in the Philippine Ports Authority and its journey

The Philippine Ports Authority (PPA), under the present leadership of Atty. Jay Daniel R. Santiago, General Manager, has continued its commitment to institutionalize gender and development (GAD) in all the ports under its jurisdiction. For SDG 5: “Gender Equality” PPA now satisfies target 5.5 “Ensure women’s participation and leadership in decision-making”.

The port industry in the Philippines is undeniably male-dominated. However, in recent years, women have been making remarkable progress, within the Authority particularly at management levels and PPA continues to put a premium on women’s empowerment. In its GAD journey there have been many firsts in entrusting some of highest managerial positions to female officers: first female Assistant General Manager on Finance and Administration (executive level); first female Port Manager (managerial level in field offices); and first female Department Manager (managerial level in head office).

As of May 2021, women made up half of PPA’s workforce, amounting to 1,026 female personnel. The highest women-occupied positions are at the middle management level with two department managers, five port managers and 56 division managers. Some women employees are also taking male-dominated positions such as terminal supervisor, safety officer, civil security officer, engineer, terminal operations officer, or industrial security officer. This shows that the authority values the immense contributions of women employees in the areas of decision-making, management, operations, and even security.

To further strengthen GAD initiatives the Authority ensures compliance with statutory laws upholding the welfare and development of Filipino women. For instance, PPA strictly observes the provisions of the General Appropriations Act and Republic Act 9710, also known as the Magna Carta of Women, which directs government agencies to formulate a GAD plan, the cost of which shall be not less than 5 per cent of the annual budget. Annually, PPA appropriates 5 per cent of its corporate budget for implementing the Authority’s GAD plans and programmes. Among the GAD flagship projects and programmes are the construction of gender-neutral facilities and halfway houses, along with capacity-building to increase awareness among employees.

In recent years, PPA has been crafting and implementing gender-responsive policies, plans and programmes to advocate gender equality and women’s empowerment. This has been given an added impetus by the UNCTAD TrainForTrade port management programme in the Philippines. Many women have participated in the three cohorts of the programme and more are expected to join subsequent cycles.

Source: Philippine Ports Authority.

Vessel and cargo operations

PPS data provide interesting insights into the differences between regions. At the global level, for the 2016–2020 period, compared with the previous five-year average, the average cargo load per vessel per arrival rose from 7,865 to 8,162 tons, a 3.9 per cent increase (indicator 16). However, these average loads vary greatly between regions, reflecting different types of operations and distances to market. Asia, for example, has a high proportion of passenger ferry operations and an average load of only 2,313 tons, while Africa on average has longer journeys made by larger vessels and an average load of 15,681 tons. Globally, there was little change in average vessel size which rose from 18,124 to 18,184 Gross Tons (GT) (indicator 14) in the 2016–2020 period compared with the previous five-year average (2015–2019).

One of the most direct impacts of COVID-19 was on the number of passengers. For the 2016–2020 period, compared with the previous five-year average, passenger numbers fell by 34 per cent (indicator 23). There was similar fall in the number of cruise passengers, by 28 per cent (indicator 24). Between years 2019 and 2020 only, the number of passengers on ferries fell by 71 per cent and on cruise ships by 76 per cent.

Overall, modern ports show many similarities in their financial and operations data as well as in their declared policy profiles and corporate structures. Nonetheless, each port entity has its own unique characteristics. Some may have greater autonomy on pricing while for others this might require national-level approval. Control over major investments, however, appears to be retained at the political level.

The pandemic has accelerated digitalization and decarbonization and key theme of future data analysis will be on how performance levels are affected by such changes.

E. SUMMARY AND POLICY CONSIDERATIONS

This chapter has provided recent information in some key areas:

- *Fleet size* – Between 1 January 2020 and 1 January 2021, the world fleet grew at the historically low rate of 3 per cent, reaching 99,800 ships of 100 gross tons and above, equivalent to 2.13 billion dwt of capacity in January 2021. Ships delivered in 2020 were mostly bulk carriers, followed by oil tankers and container ships. During this period, ship deliveries declined by 12 per cent, partly due to lockdown-induced labour shortages for marine-industrial activity. The number of ships sold for recycling increased in 2020, although levels remained low by historical standards.
- *Ship orders* – During 2020, ship ordering declined by 16 per cent, continuing the downward trend observed in previous years, though newbuilding orders surged during the first half of 2021. As owners and operators tried to cope with tight vessel supply, they turned to the second-hand market, leading to higher second-hand prices. In several shipping segments, the current imbalance between supply and demand has pushed up freight rates.
- *Regulation* – Regulatory changes to align shipping operations with decarbonization targets, along with the energy transition creates an uncertain environment that will affect shipping, trade and energy use and entail significant costs. The short-term measure agreed recently at the IMO could affect ship costs, ship travel distance, fleet distribution, routing patterns, and use of different types of vessels and may increase maritime logistics costs. Slow steaming to reduce fuel consumption could result in the need to increase the number of ships.

To cater for the high demand for ships, shipping companies will need to expand their fleets and scale up investment. Meeting the decarbonization target will require retrofitting or replacement. In developing countries in particular it will be important to assess the implications of regulatory measures. For replacing older vessels with larger and more fuel-efficient ships and making the corresponding landside investments, investors will need more predictable regulatory environments, and greater certainty when trialling and scaling up alternative fuels.

While adding to the pressures, the pandemic has often accelerated necessary changes. Many ports for example, are embracing new strategies, capitalizing on ecommerce opportunities and preparing for a future without carbon fuels by embarking on greener industrial port activities – evolving into green smart ports that can become catalytic hubs for revenue generation and industrial growth. Key to all these changes is digitalization which is redefining port business success and facilitating intermodal operations. Both seaports and inland ports will need support to keep up with digitalization, so as to function efficiently and seize opportunities as they arise.

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