WORLD BANK GROUP

S&P Global
Market Intelligence

The Container Port Performance Index 2023

A Comparable Assessment of Performance Based on Vessel Time in Port

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TRANSPORT GLOBAL PRACTICE

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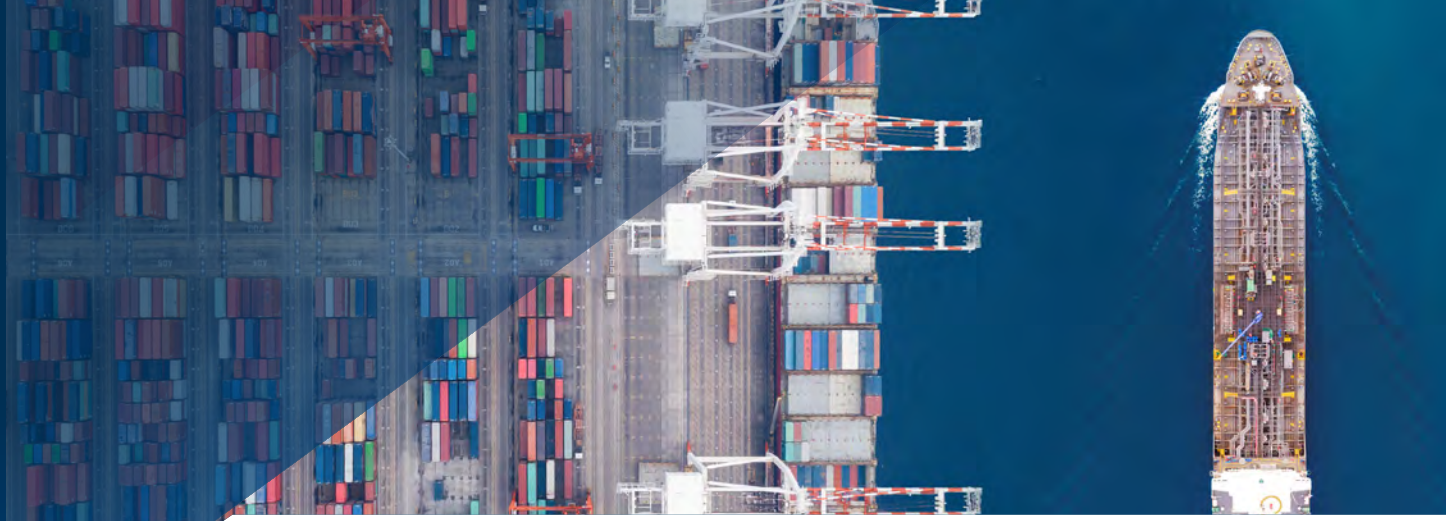

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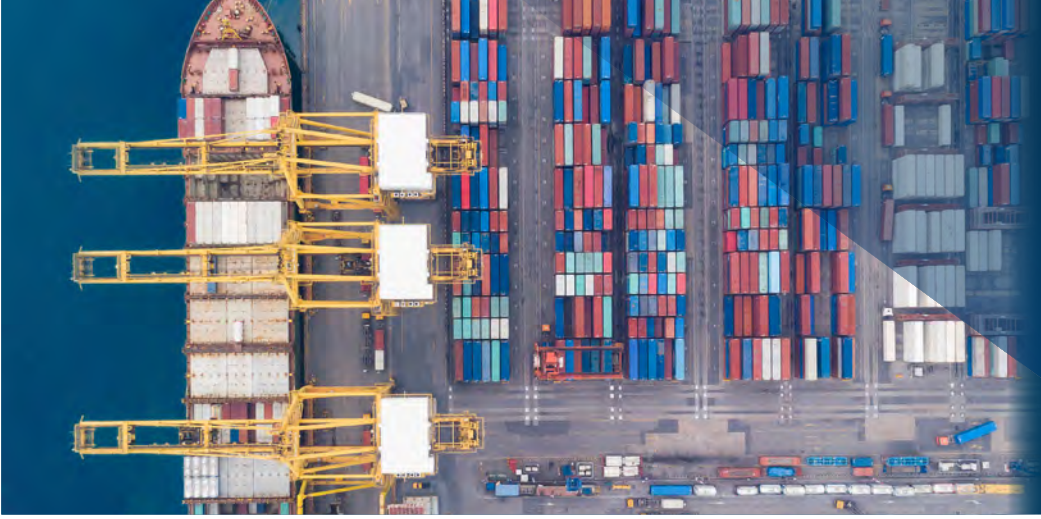

Abbreviations and Acronyms

AIS	Automatic Identification System
CI	Crane Intensity
COVID-19	Coronavirus Disease 2019
CPPI	Container Port Performance Index
EEZ	Exclusive Economic Zone
FA	Factor Analysis
GCI	Global Competitiveness Index
GCMPH	Moves per Gross Crane Hour
GDP	Gross Domestic Product
GRT	Gross Registered Tonnage
ITU	International Telecommunication Union
LLDC	Landlocked Developing Country
LPI	Logistics Performance Index
SIDS	Small Island Developing States
TEU	Twenty-foot Equivalent Unit
UNCTAD	United Nations Conference on Trade and Development

Glossary

All fast: The point when the vessel is fully secured at berth and all mooring lines are fast

Arrival time/hours: The total elapsed time between the vessel's automatic identification system (AIS) recorded arrival at the actual port limit or anchorage (whichever recorded time is the earlier) and its all lines fast at the berth

Berth hours: The time between all lines fast and all lines released

Berth idle: The time spent on berth without ongoing cargo operations. The accumulated time between all fast to first move plus last move to all lines released

Call size: The number of container moves per call, inclusive of discharge, load, and restowage

Cargo operations: When cargo is being exchanged, the time between first and last container moves

Crane intensity (CI): The quantity of cranes deployed to a ship's berth call. Calculated as total accumulated gross crane hours divided by operating (first to last move) hours

Factor analysis (FA): A statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors

Finish: Total elapsed time between last container move and all lines released

Gross crane hours: Aggregated total working time for all cranes deployed to a vessel call without any deductions. Time includes breakdowns, inclement weather, vessel inspired delays, un/lashing, gantry, boom down/up plus hatch cover and gear-box handling

Gross crane productivity (GCMPH): Call size or total moves divided by total gross crane hours.

Hub port: A port which is called at by deep-sea mainline container ships and serves as a transshipment point for smaller outlying, or feeder, ports within its geographical region. Typically, more than 35 percent of its total throughput would be hub and spoke or relay transshipment container activity

Moves: Total container moves. Discharge + restowage moves + load. Excluding hatch covers, gearboxes, and other non-container related crane work. Breakbulk cargo lifts are excluded, however empty platform (tweendeck or flat-rack) handling moves are included.

Moves per crane: Total Moves for a call divided by the crane intensity

Port call: A call to a container port/terminal by a container vessel where at least one container was discharged or loaded

Port hours: The number of hours a ship spends at/ in port, from arrival at the port limits to sailing from the berth

Port limits: Either an anchorage zone or the location where pilot embarkation or disembarkation occurs and recorded as whichever activity is the earliest

Port to berth hours: The time from when a ship first arrived at the port limits or anchorage zone (whichever activity occurs first) until it is all fast alongside the berth.

Relay transshipment: Containers transshipped between ocean going container ships

Ship size: Nominal capacity in twenty-foot equivalent units ("TEU's")

Start: The time elapsed from berthing (all lines fast) to first container move

Steam in time: The time required to steam-in from the port limits and until all fast alongside the berth

Twenty-foot equivalent unit or TEU: A standard metric for container throughput, and the physical capacity of a container terminal. A 20-foot container is equal to 1 TEU, and a 40-foot or 45-foot container is equal to 2 TEUs. Regardless of container size (10 feet, 15 feet, 20 feet, 30 feet, 40 feet, or 45 feet), each is recorded as one move when being loaded or discharged from the vessel.

Vessel capacity: Nominal capacity in twenty-foot equivalent Units ("TEU's")

Waiting time: Total elapsed time from when vessel enters anchorage zone to when vessel departs anchorage zone (vessel speed must have dropped below 0.5 knots for at least 15 mins within the zone)

Foreword

The challenges caused by the COVID-19 pandemic and its aftermath on the sector eased further in 2023. Continuing or new disruptions in the form of Russia's invasion of Ukraine, the attacks on shipping in the Gulf of Aden, and draught restrictions on the Panama Canal, all impacted container shipping. In addition, the glut of new capacity ordered by lines during the pandemic and falling demand meant that freight rates have fallen, after an initial slump, to pre-pandemic norms on most routes.

These changes impact performance and the ranking of ports. While some problems are exogenous or systemic, some are endogenous or location specific, with the result that both impact the performance and ranking of individual ports. One of the 'silver linings' of the pandemic was greater awareness and focus on the resilience and efficiency of the maritime gateways, where any friction will result in tangible impacts on consumer choice, price, and ultimately economic development. That focus is even more important now.

Traditionally, one of the major challenges to stimulating improvement in the efficiency of ports has historically been the lack of a reliable, consistent, and comparable basis on which to compare operational performance across different ports. While modern ports collect data for performance purposes, the quality, consistency, and availability of data, the definitions employed, and the capacity and willingness of the organizations to collect and transmit data to a collating body have all precluded the development of a robust comparable measure(s) to assess performance across ports and time.

The introduction of new technologies, increased digitalization, and the willingness on the part of industry stakeholders to work collectively toward systemwide improvements have now provided the opportunity to measure and compare container port performance in a robust and reliable manner. A partnership has resulted in this technical report, which is the fourth iteration of the Container Port Performance Index (CPPI), produced by the Transport Global Practice of the World Bank in collaboration with the Global Intelligence & Analytics division of S&P Global Market Intelligence.

The CPPI is intended, as in its earlier iterations, to serve as a reference point for improvement for key stakeholders in the global economy, including national governments, port authorities and operators, development agencies, supranational organizations, various maritime interests, and other public and private stakeholders in trade, logistics, and supply chain services. The performance of a port may be assessed based on a myriad of measurements, such as: terminal capacity or space utilization, cost, landside connectivity & services, or ship to shore interchange. The CPPI is based on available empirical objective data pertaining exclusively to time expended in a vessel stay in a port and should be interpreted as an indicative measure of container port performance, but not a definitive one.

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Executive summary

Maritime transport forms the foundation of global trade and the manufacturing supply chain. The maritime industry provides the most cost-effective, energy-efficient, and dependable mode of transportation for long distances. More than 80 percent of global merchandise trade (by volume) is transported via sea routes. A considerable and increasing proportion of this volume, accounting for about 35 percent of total volumes and over 60 percent of commercial value, is carried in containers.

The emergence of containerization brought about significant changes in how and where goods are manufactured and processed, a trend that is likely to continue with digitalization. Container ports are critical nodes in global supply chains and essential to the growth strategies of many emerging economies. In numerous cases, the development of high-quality container port infrastructure operating efficiently has been a prerequisite for successful export-led growth strategies. Countries that follow such a strategy will have higher levels of economic growth than those that do not. Efficient, high quality port infrastructure can facilitate investment in production and distribution systems, engender expansion of manufacturing and logistics, create employment opportunities, and raise income levels.

However, ports and terminals, especially container terminals, can cause shipment delays, disruptions in supply chain, additional expenses, and reduced competitiveness. The negative effect of poor performance in a port can extend beyond the that port's hinterland to others as container shipping services follow a fixed schedule with specific berth windows at each port of call on the route. Therefore, poor performance at one port could disrupt the entire schedule. This, in turn, increases the cost of imports and exports, reduces the competitiveness of the country and its hinterland, and hinders economic growth and poverty reduction. The consequences are particularly significant for landlocked developing countries (LLDCs) and small island developing states (SIDS).

Comparing operational performance across ports has been a major challenge for improving global value chains due to the lack of a reliable, consistent, and comparable basis. Despite the data collected by modern ports for performance purposes, the quality, consistency, and availability of data, as well as the definitions used and the capacity and willingness of organizations to transmit data to a collating body, have hindered the development of a comparable measure(s) for assessing performance across ports and time. However, new technologies, increased digitalization, and industry interests' willingness to work collectively toward systemwide improvements now provide an opportunity to measure and compare container port performance in a robust and reliable manner. The World Bank's Transport Global Practice and the Global Intelligence & Analytics division of S&P Global Market Intelligence have collaborated to produce the fourth edition of the Container Port Performance Index (CPPI), presented in this technical paper.

The aim of the CPPI is to pinpoint areas for enhancement that can ultimately benefit all parties involved, ranging from shipping lines to national governments and consumers. It is designed to act as a point of reference for important stakeholders in the global economy, including port authorities and operators, national governments, supranational organizations, development agencies, various maritime interests, and other public and private stakeholders in trade, logistics, and supply chain services. The development of the CPPI rests on total container ship in port time in the manner explained in subsequent sections of the report, and as in earlier iterations of the CPPI. This fourth iteration utilizes data for the full calendar year of 2023. It continues the change introduced last year of only including

ports that had a minimum of 24 valid port calls within the 12-month period of the study. The number of ports included in the CPPI 2023 is 405. As in earlier iterations of the CPPI, the production of the ranking employs two different methodological approaches, an administrative, or technical, approach, a pragmatic methodology reflecting expert knowledge and judgment; and a statistical approach, using factor analysis (FA), or more accurately matrix factorization. The rationale for using two approaches was to try and ensure that the ranking of container port performance reflects as closely as possible actual port performance, whilst also being statistically robust.

As there had been a marked improvement in consistency between the rankings resulting from the two approaches since the inaugural CPPI 2020, for CPPI 2023, the same two methodological approaches were used. In addition, the rank aggregation method is employed again to combine the results and return one aggregate ranking. The construction of the statistical and administrative approaches, the aggregation methodology and the resulting ranking is detailed in the report, while the respective rankings of the former are detailed in Appendix A. Table E.1 presents the resulting CPPI 2023.

The top-ranked container ports in the CPPI 2023 are Yangshan Port (China) in first place, followed by the Port of Salalah (Oman) in second place, retaining their ranking from the CPPI 2022. Third place in the CPPI 2023 is occupied by the port of Cartagena, up from 5th place in the CPPI 2022, whilst Tangier-Mediterranean retains its 4th place ranking. Tanjung Pelepas improved one position to 5th, Ningbo moved up from 12th in 2022 to 7th in 2023, and Port Said moved from 16th to 10th in 2023. Ports moving in the other direction in the top ten: Khalifa port falls from 3rd position in 2022 to 29th position in CPPI 2023. Hamad Port which fell from 8th in 2022 to 11th in 2023.

TABLE E.1 • The CPPI 2023: Global Ranking of Container Ports

Port Name	Overall Ranking	Port Name	Overall Ranking
YANGSHAN	1	VISAKHAPATNAM	19
SALALAH	2	YEOSU	20
CARTAGENA (COLOMBIA)	3	TIANJIN	21
TANGER-MEDITERRANEAN	4	YANTIAN	22
TANJUNG PELEPAS	5	TANJUNG PRIOK	23
CHIWAN	6	LIANYUNGANG	24
CAI MEP	7	SHEKOU	25
GUANGZHOU	8	CALLAO	26
YOKOHAMA	9	MUNDRA	27
ALGECIRAS	10	PORT KLANG	28
HAMAD PORT	11	KHALIFA PORT	29
NINGBO	12	KING ABDULLAH PORT	30
MAWAN	13	XIAMEN	31
DALIAN	14	BUSAN	32
HONG KONG	15	GEMLIK	33
PORT SAID	16	BARCELONA	34
SINGAPORE	17	DAMMAM	35
KAOHSIUNG	18	SAVONA-VADO	36

Port Name	Overall Ranking
POSORJA	37
FUZHOU	38
ZEEBRUGGE	39
COLOMBO	40
PIPAVAV	41
RIO DE JANEIRO	42
KHALIFA BIN SALMAN	43
BUENAVENTURA	44
LAEM CHABANG	45
SHIMIZU	46
KAMARAJAR	47
INCHEON	48
JEBEL ALI	49
LAZARO CARDENAS	50
AARHUS	51
DA CHAN BAY TERMINAL ONE	52
CHARLESTON	53
TOKYO	54
PHILADELPHIA	55
NAGOYA	56
KATTUPALLI	57
JEDDAH	58
JUBAIL	59
QINZHOU	60
KARACHI	61
KEELUNG	62
COCHIN	63
KOBE	64
PORT EVERGLADES	65
SOHAR	66
SALVADOR	67
HAZIRA	68
LONDON	69
HAIPHONG	70
KRISHNAPATNAM	71
WILHELMSHAVEN	72
BEIRUT	73
MIAMI	74
BOSTON (USA)	75
ANTWERP	76
DILISKELESI	77
ITAPOA	78

Port Name	Overall Ranking
PUERTO LIMON	79
CHENNAI	80
WILMINGTON (USA-N CAROLINA)	81
MARSAXLOKK	82
ZHOUSHAN	83
SOUTHAMPTON	84
OSAKA	85
HAIFA	86
AQABA	87
BREMERHAVEN	88
SANTA CRUZ DE TENERIFE	89
MALAGA	90
ROTTERDAM	91
NEW YORK & NEW JERSEY	92
JOHOR	93
POINTE-A-PITRE	94
YOKKAICHI	95
JAWAHARLAL NEHRU PORT	96
CORONEL	97
TRIPOLI (LEBANON)	98
JACKSONVILLE	99
ALTAMIRA	100
TANJUNG PERAK	101
COLON	102
PARANAGUA	103
PIRAEUS	104
OSLO	105
BERBERA	106
RIO GRANDE (BRAZIL)	107
HALIFAX	108
TALLINN	109
SAN ANTONIO	110
CAT LAI	111
WELLINGTON	112
SHANTOU	113
FORT-DE-FRANCE	114
DANANG	115
SHANGHAI	116
HAKATA	117
IZMIR	118
QINGDAO	119
SIAM SEAPORT	120

Port Name	Overall Ranking
HAMBURG	121
SOKHNA	122
SHARJAH	123
VERACRUZ	124
PUERTO BARRIOS	125
TAICHUNG	126
MOJI	127
VIGO	128
YARIMCA	129
NAHA	130
PORT AKDENIZ	131
SAIGON	132
BATANGAS	133
LISBON	134
SINES	135
LAS PALMAS	136
SAN JUAN	137
CHU LAI	138
KLAIPEDA	139
OMAEZAKI	140
SANTA MARTA	141
VALENCIA	142
CEBU	143
BORUSAN	144
SUAPE	145
MUHAMMAD BIN QASIM	146
RIO HAINA	147
QUANZHOU	148
CORK	149
TANJUNG EMAS	150
VALPARAISO	151
CAGAYAN DE ORO	152
BARRANQUILLA	153
MUUGA HARBOUR	154
CHIBA	155
FREDERICIA	156
LIMASSOL	157
AL DUQM	158
HIBIKINADA	159
LIRQUEN	160
SHUAIBA	161
BURGAS	162

Port Name	Overall Ranking
HELSINGBORG	163
PUERTO BOLIVAR (ECUADOR)	164
SAGUNTO	165
MOGADISCIO	166
NEW ORLEANS	167
KOMPONG SOM	168
BAR	169
SANTO TOMAS DE CASTILLA	170
DUNKIRK	171
ALEXANDRIA (EGYPT)	172
MOBILE	173
TARRAGONA	174
PUERTO PROGRESO	175
PAPEETE	176
NORRKOPING	177
PUERTO CORTES	178
PECEM	179
BASSETERRE	180
GUSTAVIA	181
FELIXSTOWE	182
GIOIA TAURO	183
PYEONG TAEK	184
ARRECIFE DE LANZAROTE	185
PANJANG	186
GENERAL SAN MARTIN	187
QUY NHON	188
BALTIMORE (USA)	189
RAUMA	190
RAVENNA	191
HUELVA	192
CAUCEDO	193
MUARA	194
LA GUAIRA	195
LATAKIA	196
CONAKRY	197
COPENHAGEN	198
SHIBUSHI	199
CIVITAVECCHIA	200
BELL BAY	201
LARVIK	202
BRIDGETOWN	203
GIJON	204

Port Name	Overall Ranking
POINT LISAS PORTS	205
PLOCE	206
TARTOUS	207
SHUWAIKH	208
CADIZ	209
TEESPORT	210
FERROL	211
PHILIPSBURG	212
CASTELLON	213
HELSINKI	214
BREST	215
KRISTIANSAND	216
BORDEAUX	217
SALERNO	218
PORT TAMPA BAY	219
PORT AU PRINCE	220
CASTRIES	221
OITA	222
HERAKLION	223
HONOLULU	224
VOLOS	225
FREETOWN	226
SUBIC BAY	227
SONGKHLA	228
PUERTO QUETZAL	229
BILBAO	230
PARAMARIBO	231
NGHI SON	232
RADES	233
APRA HARBOR	234
NEW MANGALORE	235
CRISTOBAL	236
ADEN	237
ALICANTE	238
BIG CREEK	239
VARNA	240
PALERMO	241
SYAMA PRASAD MOOKERJEE PORT	242
PAITA	243
MALABO	244
ANCONA	245
SEVILLE	246

Port Name	Overall Ranking
MARIEL	247
TRABZON	248
GOTHENBURG	249
YANGON	250
GAVLE	251
GRANGEMOUTH	252
NASSAU	253
GHAZAOUET	254
BARI	255
MANAUS	256
KOTKA	257
NOVOROSSIYSK	258
CALDERA (COSTA RICA)	259
BLUFF	260
SAINT JOHN	261
NANTES-ST NAZAIRE	262
BATUMI	263
TIMARU	264
ZARATE	265
PORT OF SPAIN	266
GENERAL SANTOS	267
NELSON	268
BUENOS AIRES	269
VENICE	270
BATA	271
GDYNIA	272
BANGKOK	273
TAKORADI	274
KUANTAN	275
AMBARLI	276
RIGA	277
HUENEME	278
DAVAO	279
NEMRUT BAY	280
KOTA KINABALU	281
UMM QASR	282
SEPETIBA	283
SAMSUN	284
NOUMEA	285
ENSENADA	286
VILA DO CONDE	287
AGADIR	288

Port Name	Overall Ranking
PORT MORESBY	289
LEIXOES	290
KUCHING	291
OTAGO HARBOUR	292
VLISSINGEN	293
SANTOS	294
PUERTO CABELLO	295
LIVERPOOL (UNITED KINGDOM)	296
CATANIA	297
GEORGETOWN (GUYANA)	298
PENANG	299
TOAMASINA	300
PORT OF VIRGINIA	301
DUBLIN	302
NAMIBE	303
PORT VICTORIA	304
ONNE	305
LIVORNO	306
MAYOTTE	307
BELAWAN	308
LAGOS (NIGERIA)	309
MANILA	310
MELBOURNE	311
HOUSTON	312
SAN VICENTE	313
BALBOA	314
GUAYAQUIL	315
ARICA	316
KHOMS	317
LOME	318
GENOA	319
PORT REUNION	320
SAN PEDRO (COTE D'IVOIRE)	321
MAZATLAN	322
TURBO	323
PORT BOTANY	324
MAPUTO	325
LAE	326
THESSALONIKI	327
MOMBASA	328
LA SPEZIA	329
CORINTO	330

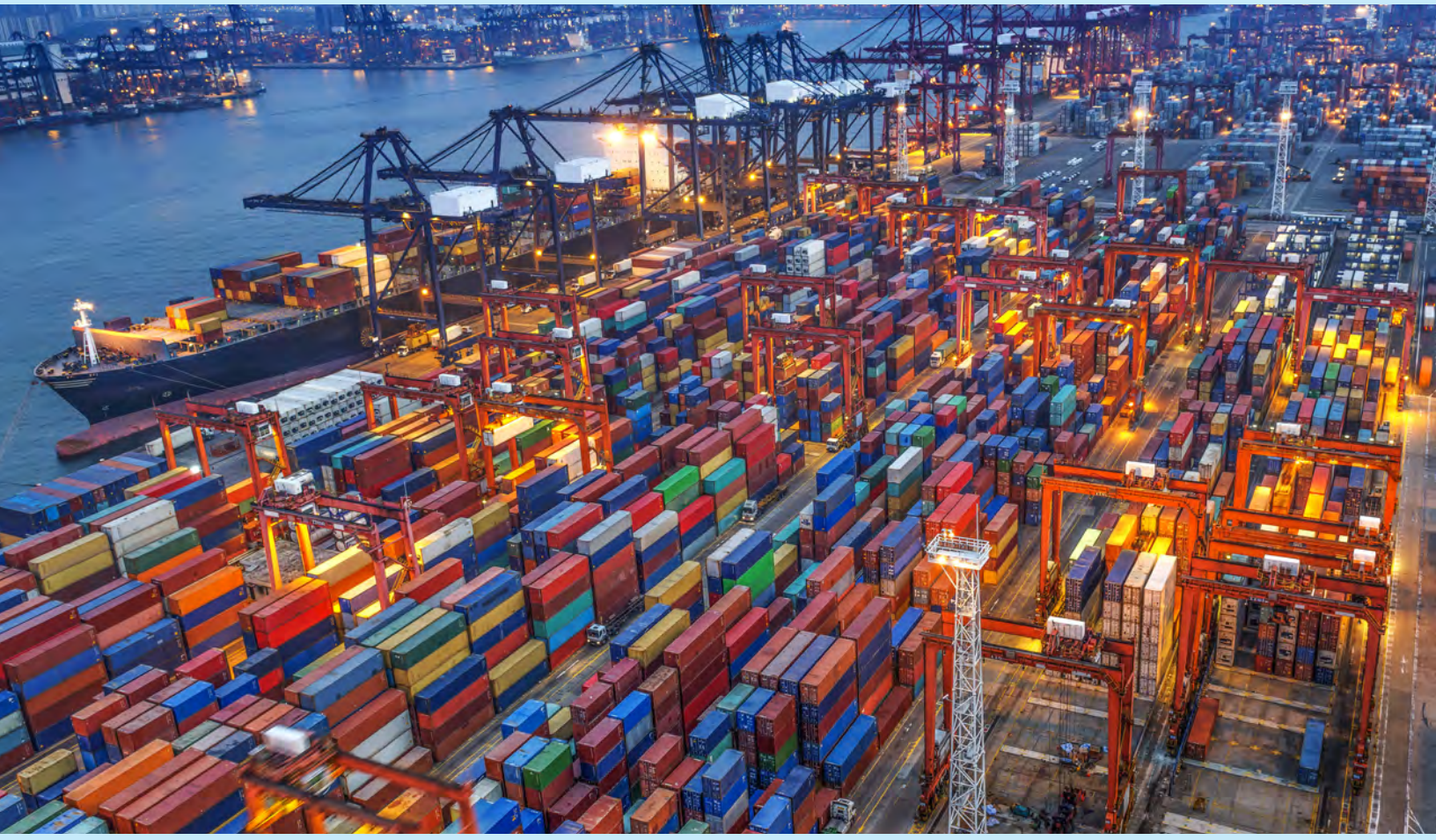
Port Name	Overall Ranking
MANZANILLO (MEXICO)	331
CASABLANCA	332
MEJILLONES	333
CHATTOGRAM	334
VITORIA	335
NAPIER	336
BRISBANE	337
GREENOCK	338
NAPLES	339
BEIRA	340
EL DEKHEILA	341
DURRES	342
GDANSK	343
MONROVIA	344
ADELAIDE	345
ALGIERS	346
TAURANGA	347
MONTREAL	348
POTI	349
AUCKLAND	350
SETUBAL	351
IQUIQUE	352
ABIDJAN	353
MARSEILLE	354
CONSTANTZA	355
VANCOUVER (CANADA)	356
OWENDO	357
NOUAKCHOTT	358
FREEPORT (BAHAMAS)	359
SEATTLE	360
BENGHAZI	361
KOPER	362
NACALA	363
TIN CAN ISLAND	364
BRISTOL	365
KRIBI DEEP SEA PORT	366
DAR ES SALAAM	367
QASR AHMED	368
PORT LOUIS	369
DOUALA	370
BINTULU	371
LE HAVRE	372

Port Name	Overall Ranking
LONG BEACH	373
FREMANTLE	374
LOS ANGELES	375
TEMA	376
IMBITUBA	377
KINGSTON (JAMAICA)	378
DJIBOUTI	379
WALVIS BAY	380
DAKAR	381
BEJAIA	382
ACAJUTLA	383
MONTEVIDEO	384
LYTTELTON	385
MATADI	386
DAMIETTA	387
PORT SUDAN	388
LUANDA	389

Port Name	Overall Ranking
ASHDOD	390
PORT ELIZABETH	391
ISKENDERUN	392
ITAJAI	393
POINTE-NOIRE	394
SAVANNAH	395
TRIESTE	396
OAKLAND	397
DURBAN	398
PRINCE RUPERT	399
RIJEKA	400
TACOMA	401
COTONOU	402
MERSIN	403
NGQURA	404
CAPE TOWN	405

Source: Original table produced for this publication, based on CPPI 2021 data.

There are 55 new entrants to the CPPI 2023, and several significant movers since the CPPI 2022. One hundred ports improved their ranking in CPPI 2023 compared to CPPI 2022, with some of the largest movers improving their ranking by more than 200 places.



1. Introduction

Since the start of maritime trade, ports have played a central role in the economic and social development of countries. The innovation of containerization by Malcom McLean in 1958 changed the course of the shipping industry and engendered significant changes to where and how goods are manufactured. Container ports remain vital nodes in global supply chains and are crucial to the growth strategies of many emerging economies. The development of high-quality port infrastructure, operated efficiently, has often been a prerequisite for successful growth strategies, particularly those driven by exports. When done correctly, it can attract investment in production and distribution systems and eventually, support the growth of manufacturing and logistics, create employment, and increase income levels.

In contrast, a poorly functioning or inefficient port can hinder trade growth, with a profound impact on LLDCs and SIDS. The port, along with the access infrastructure (inland waterways, railways, roads) to the hinterland, is a vital link to the global marketplace and needs to operate efficiently. Efficient performance encompasses several factors, such as the port's efficiency itself, the availability of sufficient draught, quay, and dock facilities, the quality of road and rail connections, the competitiveness of these services, and the effectiveness of the procedures utilized by public agencies for container clearance. Any inefficiencies or non-tariff barriers among these actors will result in higher costs, reduced competitiveness, and lower trade volumes (Kathuria 2018).

More specifically, the efficiency of port infrastructure has been identified as a key contributor to the overall port competitiveness and international trade costs. Micco et al. (2003) identified a link between port efficiency and the cost of international trade. Clark, Dollar, and Micco (2004) found a reduction

in country inefficiency, specifically transport cost, from the 25th to 75th percentile, resulting in an increase in bilateral trade of around 25 percent. Wilmsmeier, Hoffmann, and Sanchez (2006) confirmed the impact of port performance on international trade costs, finding that doubling port efficiency in a pair of ports had the same impact on trade costs as halving the physical distance between the ports. Hoffmann, Saeed, and Sødal (2020) analyzed the short- and long-term impacts of liner shipping bilateral connectivity on South Africa's trade flows, and showed that gross domestic product (GDP), the number of common direct connections, and the level of competition have a positive and significant effect on trade flows.

However, ports and terminals, particularly for containers, can often be the main sources of shipment delays, supply chain disruptions, additional costs, and reduced competitiveness. Poorly performing ports are characterized by limited spatial and operating efficiency, maritime and landside access, oversight, and coordination among the public agencies involved, which lower predictability and reliability. The result is that instead of facilitating trade, the port increases the cost of imports and exports, reduces competitiveness, and inhibits economic growth and poverty reduction. The effect on national and regional economies can be severe [see inter alia World Bank (2013)] and has driven numerous efforts to improve performance to strengthen competitiveness.

Port performance is also a key consideration for container shipping lines that operate liner services on fixed schedules, based on agreed pro-forma berth windows. Delays at any of the scheduled ports of call on the route served by the vessel would have to be made good before the vessel arrives at the next port of call, to avoid an adverse impact on the efficient operations of the service. As such, port efficiency and port turnaround time at all the ports of call are important subjects for operators, and monitoring port performance has become an increasingly important undertaking in the competitive landscape.

One of the major challenges to improving efficiency has been the lack of reliable measures to compare operational performance across different ports. The old management idiom, 'you cannot manage what you cannot measure,' is reflective of the historical challenge of both managing and overseeing the sector. While modern ports collect data for performance purposes, it is difficult to benchmark the outcomes against leading ports or ports with similar profiles due to the lack of comparative data.

Unsurprisingly, there is a long history of attempts to identify a comparative set of indicators to measure port or terminal performance. A brief review of the literature was provided in The Container Port Performance Index 2020: A Comparable Assessment of Container Port Performance (World Bank 2021), CPPI 2020, which illustrated the broad approaches identified and commented on the merits and demerits of each. The measures fell into three broad categories: Firstly, measures of operational and financial performance; secondly, measures of economic efficiency; and thirdly, measures that rely, predominately, on data from sources exogenous to the port. This review has not been replicated in CPPI 2023, and interested readers are directed to CPPI 2020 (World Bank 2021), or the extant literature. One of the general challenges of nearly all the approaches has been the quality, consistency, and availability of data; the standardization of definitions employed; and the capacity and willingness of organizations to collect and transmit the data to a collating body.

At a slightly higher level, there are several aggregate indicators that provide an indication of the comparative quality and performance of maritime gateways. The World Bank Logistics Performance Index (LPI) (Arvis et al. 2018) and the World Economic Forum's Global Competitiveness Index (GCI) 4.0 both report on the perceived efficiency of seaport services and border clearance processes and indicate the extent to which inefficiencies at a nation's sea borders can impact international trade

competitiveness. But the aggregate nature of the indicators, and the fact that they are perception based, means that they offer at best an indication of comparative performance and offer little to guide spatial or operating performance improvements at the level of the individual port. This could change if the next version of the LPPI reflects the movement of the consignment from origin to destination. The United Nations Conference on Trade and Development's (UNCTAD's) Liner Shipping Connectivity Index (LSCI) provides an indicator of a port's position within the liner shipping network, which is partly a result of the port's performance, but does not directly measure it. Like the CPPI, the LSCI is limited to container ports.

Digitalization offers an opportunity to measure and compare container port performance in a robust and reliable manner. New technologies, increased digitalization and digitization, and growing willingness on the part of industry stakeholders to work collectively toward system-wide improvements have created the capacity and opportunity to measure and compare container port performance. The data used to compile the CPPI 2023 are from S&P's Global Port Performance Program. This program commenced in 2009 to drive efficiency improvements in container port operations and supporting programs to optimize port calls.

The aim of CPPI was to utilize the existing empirical data to establish an unbiased metric for comparing container port performance among different ports, over time. The performance of container ports is most relevant in terms of customer experience, specifically the speed and efficiency with which customer assets are handled. In this fourth of CPPI, the focus remains exclusively on quayside performance, which reflects the experience of a container ship operator - the port's primary customer - and its fundamental value stream. The operational efficiency of how ports receive, and handle container ships is critically important in a carrier's decision to choose a port over other options.

The purpose of the CPPI is to help identify opportunities to improve a terminal or a port that will ultimately benefit all public and private stakeholders. The CPPI is intended to serve as a benchmark for important stakeholders in the global economy, including national governments, port authorities and operators, development agencies, supranational organizations, various maritime interests, and other public and private stakeholders engaged in trade, logistics, and supply chain services. The joint team from the World Bank and S&P Global Market Intelligence intends to continue to enhance the methodology, scope, and data in future annual iterations, reflecting refinement, stakeholder feedback, and improvements in data scope and quality.

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2. The Port Performance Program

Introduction

Container (liner) shipping services are generally highly structured service rotations. They are typically set up with weekly departure frequencies, a fixed sequence of port calls, and standard pro forma day and time-specific berthing windows. Once a service has been defined or adjusted, it will usually remain intact for many months, or even years. The berthing windows are pre-agreed with the terminal and port operators, usually based on a slightly higher than expected average quantity of container exchange moves, and ideally modest buffers in the sea legs between ports.

The clear advantages of this model are that shippers can make long-term supply decisions and ports and terminals schedule and balance their resources to meet expected demand. With a well-planned and well-executed pro forma schedule, they can achieve higher levels of reliability and predictability. This, in turn, can lead to more effective supply chain operations and planning as container ships spend around 15 percent to 20 percent of their total full rotation time in ports, with the balance being spent at sea. Reduced port time can allow ship operators to reduce vessel speed between port calls, thereby conserving fuel, reducing emissions, and lowering costs in the process.

Conversely, for every unplanned additional hour in port or at anchorage, the ships need to increase speed to maintain the schedule, resulting in increased fuel consumption, costs, and emissions.

In extreme cases, ships that fall many hours behind their pro forma schedule will start to arrive at ports outside of their agreed windows, causing berth availability challenges for ports and terminals, particularly those with high berth utilization rates. This, in turn, causes delay to shipments and disruption to supply chains. A service recovery can involve significantly higher sailing speeds, and therefore, higher fuel consumption, emissions, and costs, or the omission of a port or ports from the service rotation.

Time is valuable for stakeholders, and so it is logical to measure port performance based on the total amount of time ships are required to spend in port. The CPPI 2023 has again been developed based on the total port time in the manner explained in subsequent sections. This iteration has utilized data from the full calendar year of 2023 and has employed the same two approaches as the earlier editions, an administrative approach, and a statistical approach. The resulting ranking of container port performance reflects as closely as possible actual port performance, while being statistically robust. The data are discussed in this section, with the methodologies discussed in Chapter 3. The results are presented in Chapter 4, and in more detail in Appendix A.

The Port Performance Program

The data used to compile the CPPI is from S&P Global's Port Performance Program. The program was started in 2009 with the goal of supporting efficiency improvements in container port operations and to support projects to optimize container port calls. The program includes 10 of the world's largest liner shipping companies that collectively operate close to 80 percent of global fleet capacity.

The liner shipping companies provide the program with a series of data points comprising operational time stamps and other bits of information such as move counts for each individual port call undertaken globally. The data are provided monthly and cover the full global networks of each liner shipping company and their subsidiaries. In 2023, performance time stamp data were captured for 194,198 port calls involving 253.7 million container moves at 876 container terminals in 508 ports worldwide.

Following receipt from the shipping lines, the port call data undergoes several validation and quality checks before mapping to historical AIS vessel movement data, which enables tracking and verification of the shipping line data. The geo-fencing of port and terminal zones within the AIS system supports the creation of several of the performance metrics tracked in the program.

Most of the port performance metrics are constructed from the combined AIS and liner shipping data. The combination of empirical shipping line data and AIS movement data enables the construction of more accurate and granular metrics to measure container port performance. Many of the metrics consist of a time component cross-referenced with workload achieved in that time, either in the form of move counts or a specific task within the container port call process. Time stamps, definitions, and methods to calculate metrics are fully standardized in collaboration with the shipping line partners in the program.

The Automatic Identification System and Port Zoning

AIS technology is used to track and monitor vessels in near real time. It sends information on a vessel's movement, speed, direction, and other particulars via satellite and terrestrial stations. The system's function as a localized service, and indeed global tracking, was initially considered secondary. The AIS primarily functions as a navigational safety aid, to ensure the safety and efficiency of navigation, safety of life at sea, and maritime environmental protection.[1] AIS was designed for the avoidance of vessel collision, as outlined in the Safety of Life at Sea (SOLAS) Convention.[2]

All ships of net tonnage of at least 300 gross register tonnage (GRT) performing international voyages, all cargo ships of at least 500 GRT not performing international voyages, and all passenger ships, regardless of size, should be equipped with AIS. This allows vessels to automatically transfer data and a plethora of navigational and identification information to other nearby ships and relevant port authorities in the form of structured messages.[3] The technical requirements for AIS are specified by the International Telecommunication Union (ITU) Recommendation ITU-R M.1371-5(02/2014).[4]

For maritime domain awareness and safety purposes, the use of continuous 24/7, near-real-time online AIS data makes it possible to monitor areas, vessels, and routes; generate shore-based alerts; and provide useful positional and navigational information in general (IALA 2005). Satellite-based AIS receivers offer coverage outside the land-based antennas' range by covering the whole globe from pole to pole. Satellite AIS coverage can extend to the entire exclusive economic zone (EEZ) or globally, including remote coastal areas (IALA 2016).

In the case of ports[5], the usage of 'zones' helps in recording a vessel's navigational status and positioning. AIS zones offer different indicators activated automatically by the vessel's signal reporting its position. Every port has at least one zone created in a way that captures the arrivals and sailings of vessels at cargo-handling facilities but avoids spurious reports being recorded from passing traffic. Where a subject port is geographically spread out with terminals located remotely, it is likely that there will be more than one zone, with all zones linked by a standard port identification number.

Ports that straddle a river or another similar body of water will often have zones along opposing shorelines with a track separating them, thus avoiding the capture of AIS reports from traffic navigating through a fairway or channel. Once again, the individual zones will be linked to their common port using the port's unique identification number.

Zones also cover anchorages to record vessels arriving at a port but awaiting authority to enter, or vessels laid up awaiting orders. Additional zones cover the arrival of vessels at repair yards or those navigating locks. Anchorage zones may be created on an ad hoc basis. Not all ports have anchorage areas and among those that do, not all are shown in nautical charts. Whenever possible, S&P Global uses its own tracking and observation tools to determine where vessels anchor and create zones accordingly. Each anchorage zone is linked to the relevant port using the subject port's unique identification number.

AIS is generally reliable, but it also has limitations that can impact the transmission and quality of the data captured. Some factors that may affect the signal could be the AIS transponder being turned off deliberately, problematic reception, high traffic density areas, weather conditions, or anomalous positions.

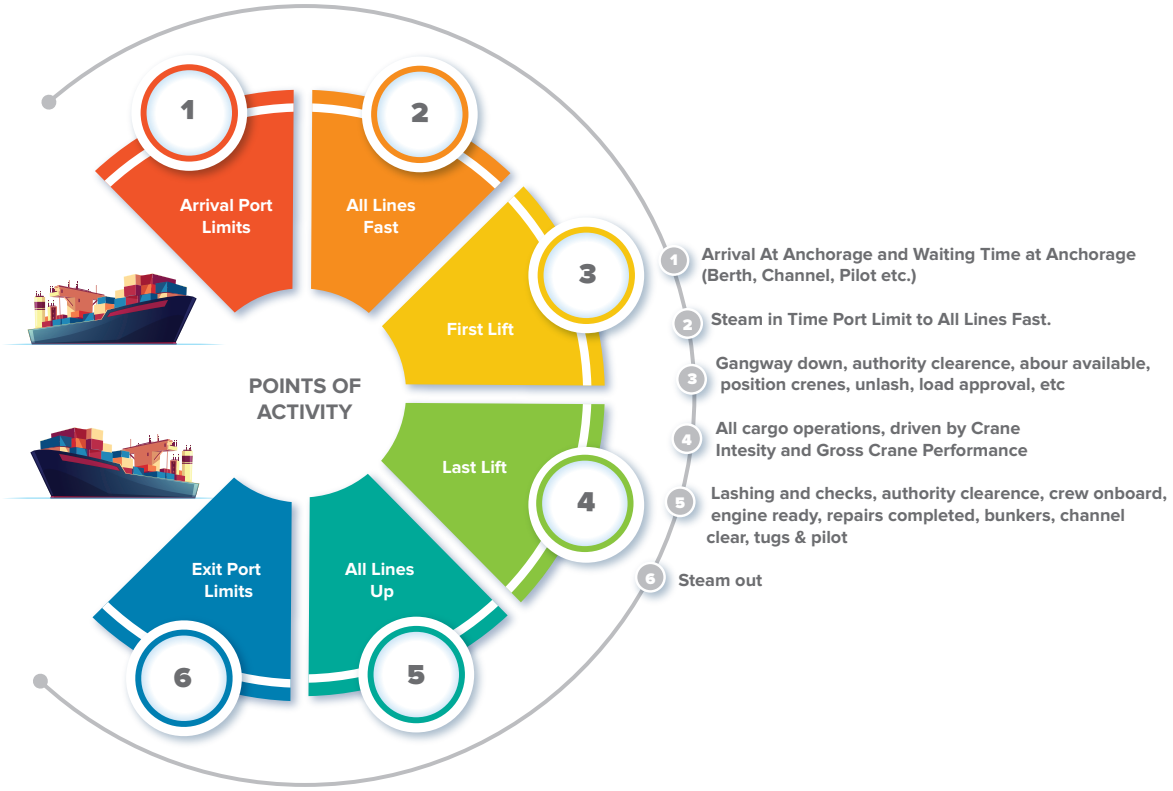
The Anatomy of a Port Call

Every container ship port call can be broken down into six distinct steps. These individual steps are illustrated in Figure 2.1. 'Total port hours' is defined as the total time elapsed between when a ship reaches a port (either port limits, pilot station, or anchorage zone, whichever event occurs first) to when it departs from the berth after having completed its cargo exchange.

The time spent from berth departure (All Lines Up) to the departure from the port limits is excluded. This is because any port performance loss that pertains to departure delays, such as pilot or tug availability, readiness of the mooring gang, channel access and water depths, forecasting completion time, communication, and ship readiness will be incurred while the ship is still alongside the berth.

Additional time resulting from these causes will, therefore, be captured during the period between 4. Last Lift and 5. All Lines Up ("berth departure).

FIGURE 2.1 • The Anatomy of a Port Call



Source: Original figure produced for this publication.

Ships may spend extra time in a port after the departure from a berth, but the time associated with these additional activities is excluded from the CPPI, as they are not influenced by the operational performance of the terminal or port. Ships may dwell within a port's limits for bunkering, repairs, or simply waiting in a safe area if they are unable to berth on arrival at their next port. Apart from bunkering being performed simultaneously with cargo operations, these causes of additional port time are not necessarily reflective of poor performance and hence, are excluded from the CPPI.

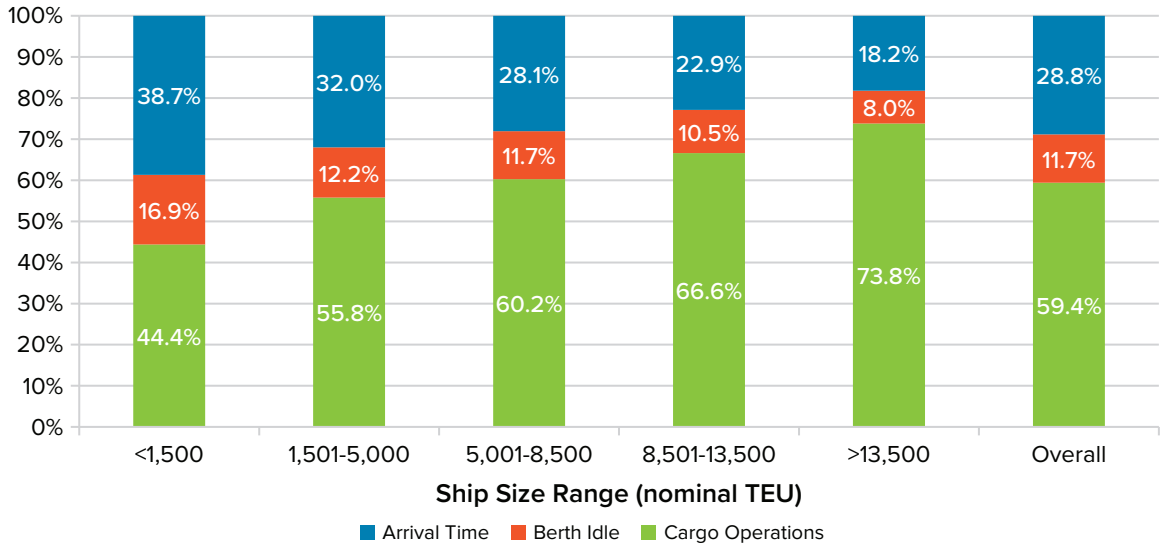
Although none of these factors necessarily indicate port inefficiency, they can contribute to additional time spent in the port. For instance, clearance authorities' delays can result in delays in the first lift and idle time after cargo operations have concluded. However, the data available do not provide enough detail to identify the root causes of such delays. It is assumed that only a small percentage of ships idle at the berth after cargo operations due to factors unrelated to port performance, and their inclusion does not significantly affect the CPPI rankings.

The other four components of the port call can logically be grouped into two distinct blocks of time. The first comprises elapsed time between Arrival Port Limits and All Lines Fast (steps 1 and 2 in Figure 2.1); the second comprises time elapsed between All Lines Fast and All Lines Up (steps 2 to 5, also commonly referred to as 'berth time' or 'berth hours'). The logic behind this division is that while there will always need to be time consumed between steps 2 and 5, the bulk of time between steps 1 and 2, excluding actual sailing in time, is waiting time, which can be eliminated.

Overall Port Time Distribution

The time stamps in the source data allow us to break down and summarize total port time into three categories: Arrival Time, Berth Idle, and Cargo Operations. Expressed as a percentage of total port hours recorded, the distribution of port time per ship size range and globally aggregated is shown in Figure 2.2.

FIGURE 2.2 • In-Port Time Consumption



Source: Original figure produced for this publication, based on CPPI 2023 data.

As there is naturally some correlation between ship size and call size, a higher percentage of time is required for cargo operations for the larger ships, and this will be explored in detail later in this report. What is interesting, and surprising at the same time is that only 60 percent of the total port time is attributable to cargo operations, meaning there is potentially a lot of 'wastage' in terms of excess time in the system.

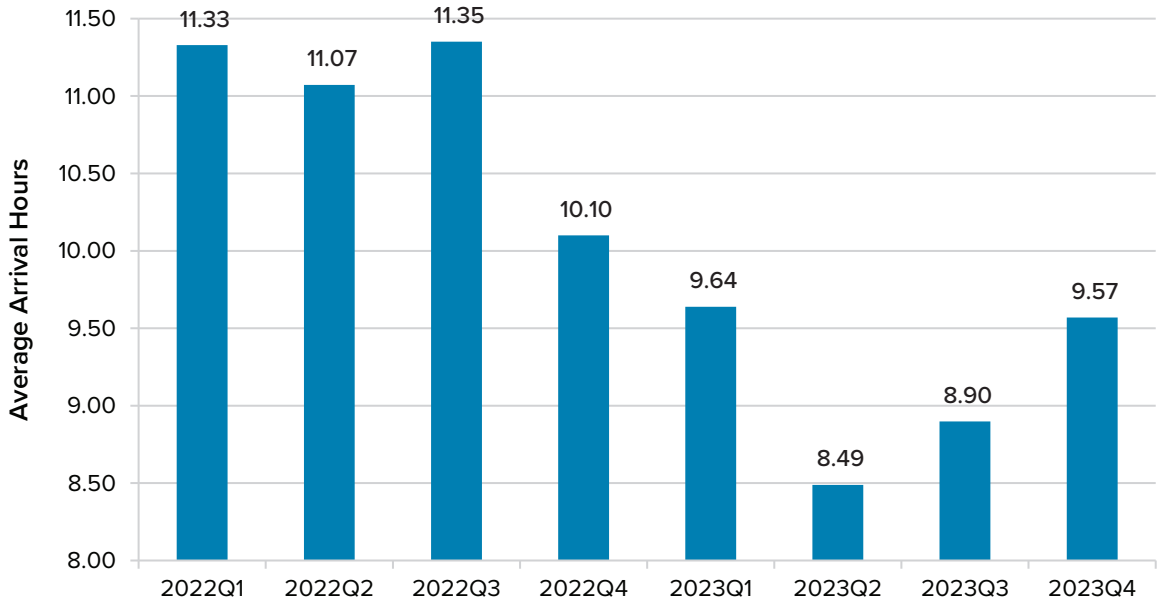
The average duration of a port call in 2023 was 40.5 hours, which represents a slight increase over the global average of 36.8 hours in 2022. About 11.7 percent (or 3.71 hours) was idle time consumed at the berth immediately before and after cargo operations. Also known as the 'Start-Up' and 'Finish' sub-processes of a port call, each activity does not necessarily need to take more than 30 minutes to complete safely.

There is, therefore, an opportunity to eliminate almost nearly four hours per call of port time globally simply through better planning, preparation, communication, and process streamlining. This time saved equates to more hours at sea, leading to slower sailing speeds, lower GHG emissions, and cost savings for the ship operator, which would be significant for each port call.

In the second half of 2020, there was a rebound in the global sales of durable goods, most prominently in the US, and a sharp increase in the overall container volume demand. This coincided with continued COVID-19 restrictions and resulted in the emergence of severe port congestion. In 2021, this port congestion was still manifesting itself, reaching a peak in the third quarter of 2021 and the average

arrival time per port call globally remained above 11 hours until the third quarter of 2022. The fourth quarter of 2022 saw reducing volumes and many ports were able to clear backlogs and reduce average arrival times to close to 10 hours per port call. The expectation was that the average port arrival time globally in 2023 will continue to decline to levels prior to the start of 2021, which is what has transpired. (see Figure 2.3)

FIGURE 2.3 • Global Average Arrival Time Development 2022-2023



Source: Original figure produced for this publication, based on CPPI 2022-23 data.

At a regional level and broken down by ship size groups, the change in average arrival time per region and per ship size group over the 2022-2023 period is illustrated in Table 2.1. The column 'All' shows the aggregate change in quantity of hours from arrival at port limits or start of anchorage time, to berthing for cargo operations to commence for each region, across all ship size groups.

TABLE 2.1 • Average Arrival Time Development per Region and Ship Size, 2022–2023

CHANGE (HR)	SHIP SIZE RANGE					
REGION	1 <1,500	2 1,501–5,000	3 5,001–8,500	4 8,501–13,500	5 >13,500	ALL
AFR	3.8	2.0	(2.5)	7.4	14.4	2.0
LAM	1.4	0.3	1.3	0.5	(0.0)	0.6
MED	2.2	1.4	(0.3)	(0.6)	(4.0)	0.9
MEI	4.3	2.6	1.5	(0.0)	(0.1)	1.6
NAM	(3.7)	(10.0)	(19.9)	(28.0)	(33.8)	(19.1)
NEA	(1.6)	(2.0)	(1.1)	(0.8)	(0.3)	(1.4)
NEU	0.2	(0.3)	(4.7)	(6.9)	(7.6)	(3.1)
OCE	(2.1)	(1.1)	(2.4)	(0.2)		(1.3)
SEA	(2.8)	(2.8)	(1.2)	(0.6)	(0.7)	(2.0)
Global	1.0	(0.9)	(3.6)	(3.3)	(3.4)	(1.8)

Source: Original table produced for this publication, based on CPPI 2022 and 2023 data.

At a global level, on average each port arrival decreased by 1.8 hours, as illustrated in Table 2.2. The largest increase in average arrival time was witnessed in North America (USA and Canada) with an average increase in time of 19.1 hours over all vessel sizes. By contrast, performance improved in Africa (Sub-Sahara) with an average 2.0-hour improvement in arrival time across all vessel sizes. Improvements in East Asia and Southeast Asia were also recorded.

The overall improvements and reductions in average arrival hours in African ports has been driven by Dar Es Salaam, Monrovia, Douala, Pointe-Noire, Tema, Luanda, Lomé, Lagos, Port Victoria, Dakar, and Ngqura. The increase is slightly offset by increased average arrival time in Cape Town, San Pedro, Abidjan, and Mombasa. In East Asia, improvements were seen in Yantian and Yangshan but countered by increased time in Manila and Qingdao. There are no European ports in the top 20 improvers. Poti, La Spezia, Mersin, Trieste, Hamburg, and Koper all experienced longer average arrival times.

Waiting time, defined as the period between 'Arrival Port Limits' or when the ship enters an anchorage zone, and 'All Lines Fast' can generally be regarded as wasted time. As such, in the construction of the CPPI, one possibility was to apply a penalty to waiting time. The decision was taken not to do so, as the introduction of a penalty of this type would be a normative judgement inconsistent with the overall aim of the study to create bean objective quantitative index.

There was consideration as to whether to apply a discount to waiting time for the smallest segment of ships. Smaller ships generally suffer less priority than larger ones, and in some hub ports might be purposely idled at anchorage waiting to load cargo which is arriving from off-schedule ocean going ships. However, after reviewing average arrival time for the various ship size segments on a regional basis, the data did not support applying a discount to waiting time for the smallest segment of ships. (see Table 2.2).

TABLE 2.2 • Average Arrival Time Performance per Ship Size Range per Region

2023	SHIP SIZE RANGE					
REGION	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	AVERAGE
AFR	31.7	29.4	30.5	27.4	28.1	29.7
LAM	9.3	7.6	10.0	8.2	10.4	8.3
MED	11.8	9.7	6.8	6.7	7.1	9.6
MEI	18.2	10.0	7.2	6.7	7.1	8.8
NAM	5.5	7.2	11.6	15.8	20.3	11.7
NEA	4.7	6.2	7.3	6.3	5.7	6.2
NEU	9.1	7.7	8.8	8.2	9.4	8.6
OCE	15.5	13.1	11.9	8.4		12.6
SEA	7.4	7.4	5.3	5.5	3.7	6.6
Average	11.0	9.3	9.3	8.3	7.2	9.1

Source: Original table produced for this publication, based on CPPI 2023 data.

To test the significance of purposely delayed smaller feeder vessels on the overall ranking, we conducted a simulation within the overall CPPI model. For all ports (not only the focus ports), we reduced the quantity of arrival hours by 50 percent for all ship calls where the capacity of the ship is 1,500 TEU or less in size. The quantity of berth hours for all ships was maintained at 100 percent, as was the average arrival hours for all other ship size groups.

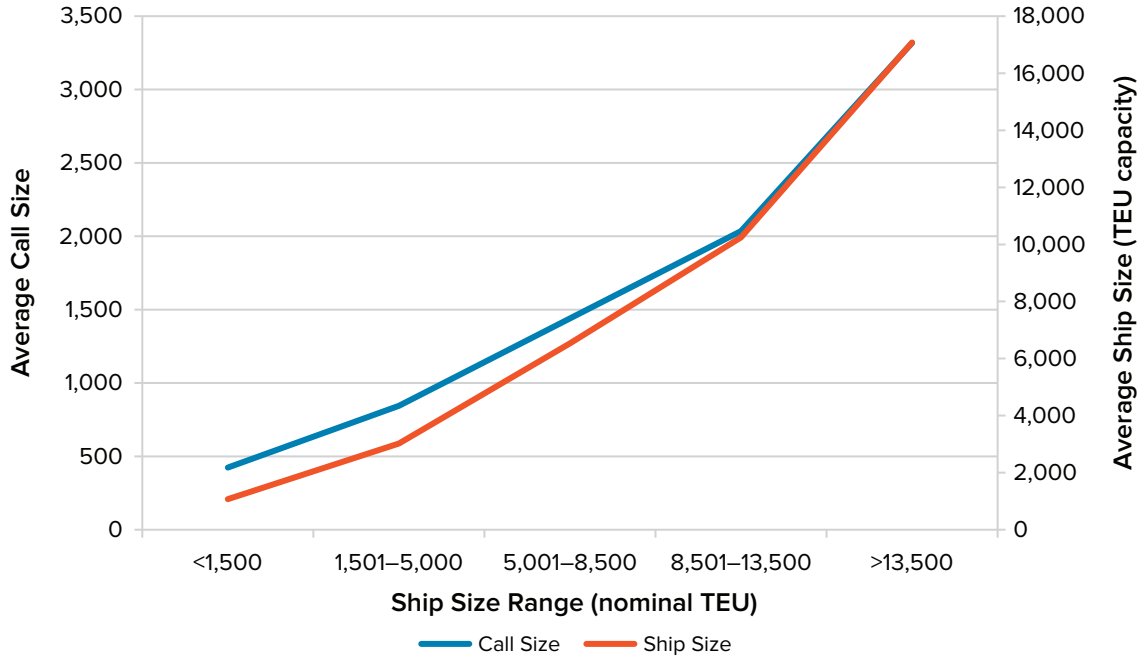
Since it is not possible to see from the data whether waiting time is voluntary or forced, it is difficult to find a suitable level at which to discount waiting time in this scenario. The port calls of ships with less than 1,500 TEUs of capacity comprise just 10 percent of the total calls in the CPPI. Therefore, the disparity in waiting times between ships with less than 1,500 TEUs of nominal capacity and other segments, as simulated, has only a small impact to the overall CPPI. To keep the data pure and avoid normative judgment that is inconsistent with an objective quantitative index, the rankings published in this iteration are not influenced by adjustments made to empirically recorded port hours.

The Significance of Call Size

As illustrated in Figure 2.4, over 60 percent of a port call is consumed through cargo operations, for the handling of containers. In this aspect of the call, call size is of great significance. Call size is far less significant when it comes to arrival time, which is more likely to be influenced by ship size.

There have been several earlier studies, in which ships are grouped into size segments (ranges) based upon their size or capacity and port calls are ranked based on the time elapsed in port or on the berth. While these studies provide an indication, the optimum outcome requires the workload for each call to be taken into consideration. In this index, workload is represented by ‘Call Size,’ defined as the total quantity of containers (regardless of size), which were physically discharged, loaded, or restowed during a port call.

FIGURE 2.4 • The Aggregated Correlation between Ship and Call Size



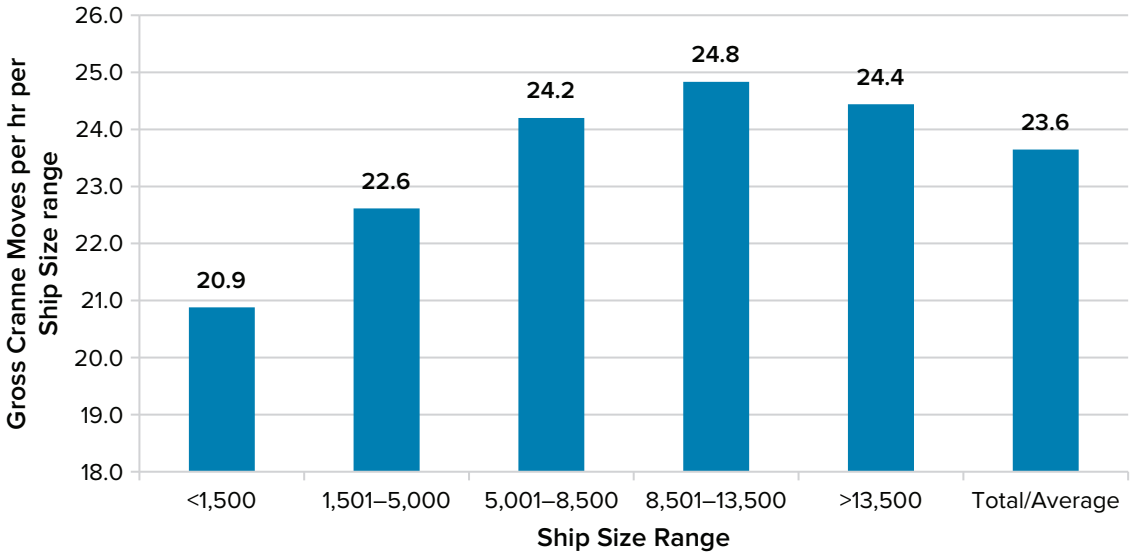
Source: Original figure produced for this publication, based on CPPI 2023 data.

Although there will be some level of correlation between the ship and call size, it is not a perfect correlation. For example, an 18,000 TEU capacity ship calling at a port in Thailand or southern Vietnam might exchange 1,000-2,000 containers per call, but that same ship in Yangshan or Singapore might exchange more than 4,000 containers. Similarly, in the Thai or southern Vietnamese ports, a 3,000 TEU ('feeder' ship) might exchange more than 3,000 containers, potentially twice that of an 18,000 TEU mainline ship at the same port.

The 60 percent of a port call, during which containers are exchanged, is influenced by two sub-factors:

1. The quantity of cranes deployed
2. The speed at which the cranes, especially the long crane (the crane with the highest workload in terms of cycles), operate

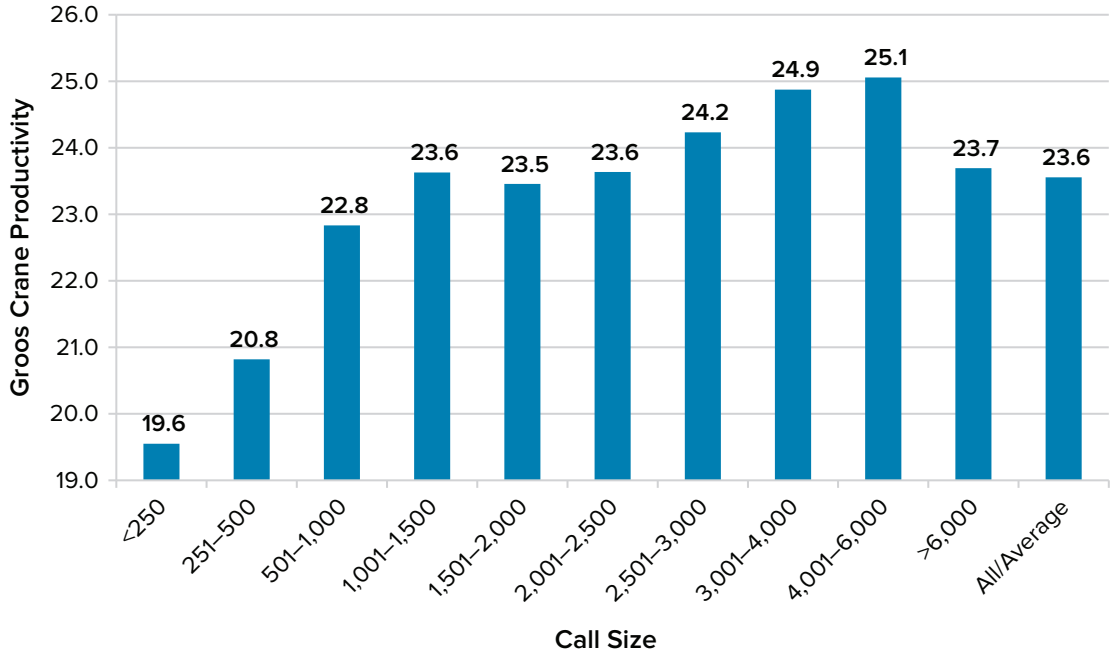
FIGURE 2.5 • Container Moves Performed per gross Crane Hour across Various Ship Sizes



Source: Original figure produced for this publication, based on CPPI 2023 data.

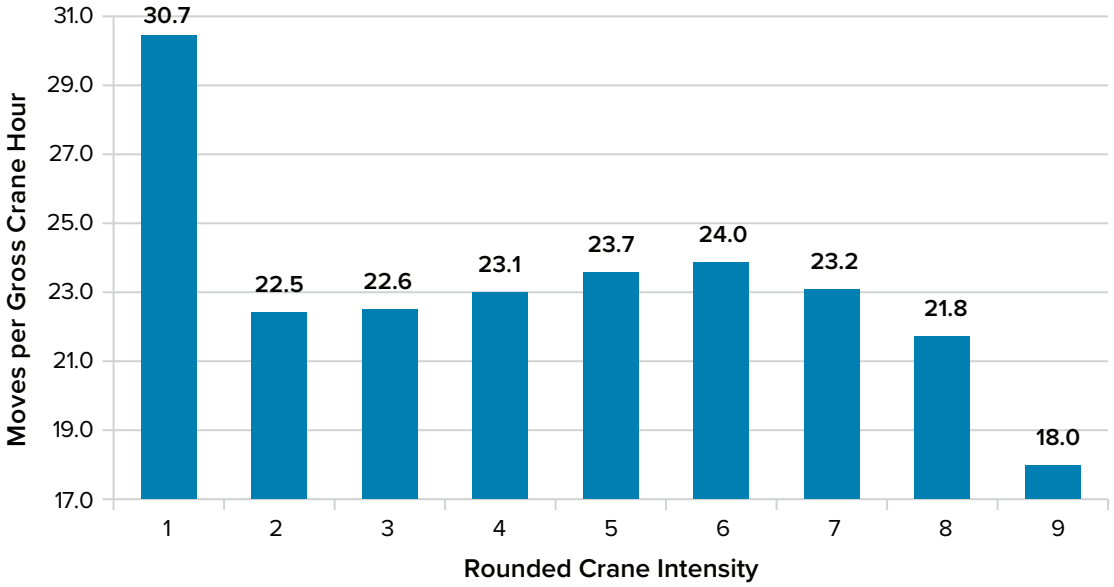
The variation in containers handled per gross crane hour across all ship sizes is statistically minor. The global average for all ships is 23.5 moves per hour, so the smallest ships are 9.4 percent less efficient than the average, whereas ships in the 8,501 TEU-13,500 TEU range are 3.6 percent more efficient than the average. It is often implied that larger ships are more difficult to work, but the data says otherwise. On the larger ships, the crane operator has higher hoists and longer trolley distances, which increases cycle time, but this is offset by more moves per bay and hatch, resulting in more containers handled per gantry or hatch-cover move. The smaller ships can often encounter list or trim issues, making it harder for the operator to hit the cell-guides and the hatch-cover and lashing systems.

FIGURE 2.6 • Gross Crane Productivity by Call Size



Source: Original figure produced for this publication, based on CPPI 2023 data.

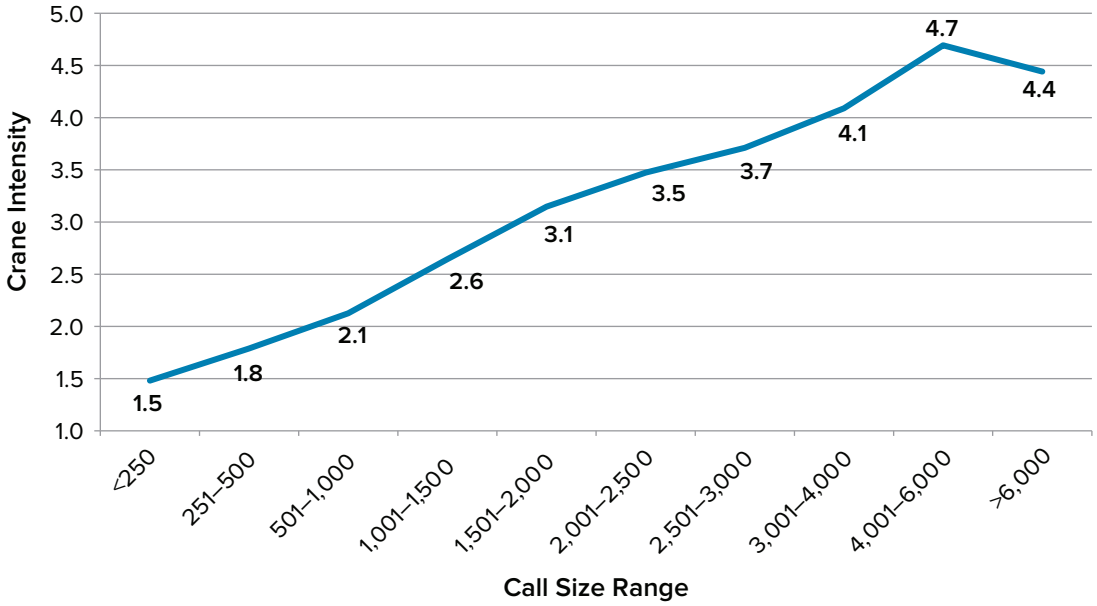
FIGURE 2.7 • Crane Productivity by Crane Intensity



Source: Original figure produced for this publication, based on CPPI 2022 data.

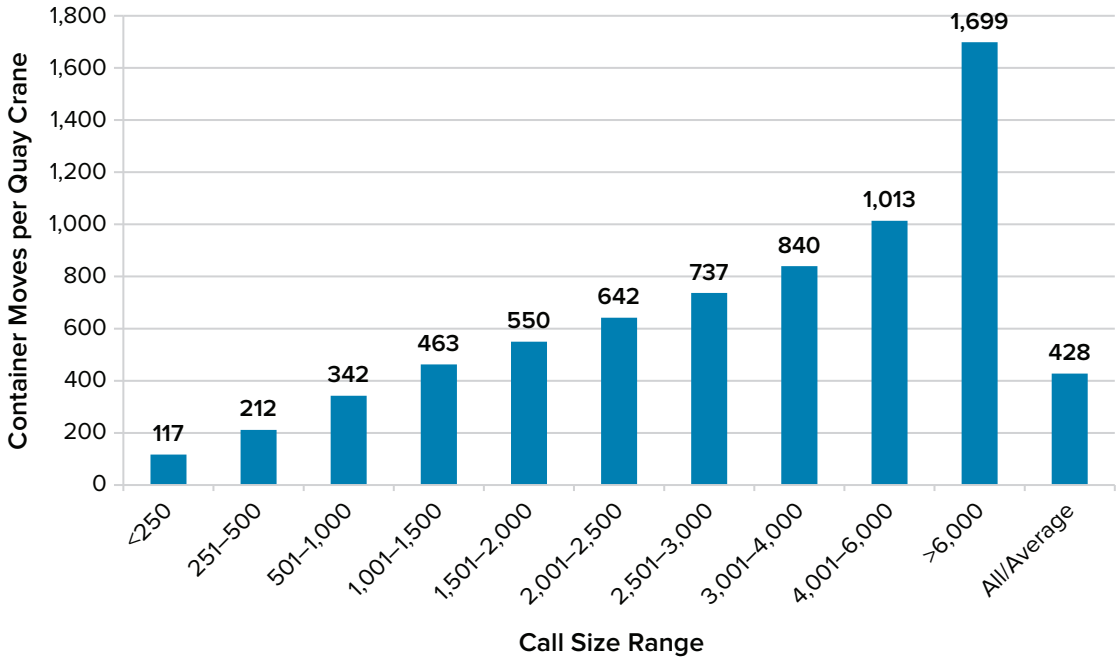
A review of gross crane productivity versus call size and crane intensity reveals no strong increases or decreases through the ranges. Assessed on call size ranges, there is a −5.2 percent to 3.8 percent variation to the average. Meanwhile, an assessment of crane intensity reveals that the first and last segments have extremely high and low performances, respectively, but in the mid-range, there is little difference in crane productivity across the seven ranges. This implies that crane speed (productivity) does not gradually increase (or decrease) as ship size, call size, or crane intensity increases. It is therefore statistically not a key determinant of operating hours. The far more significant influencer of operating time is the quantity of cranes deployed (crane intensity).

FIGURE 2.8 • Call Size versus Crane Intensity



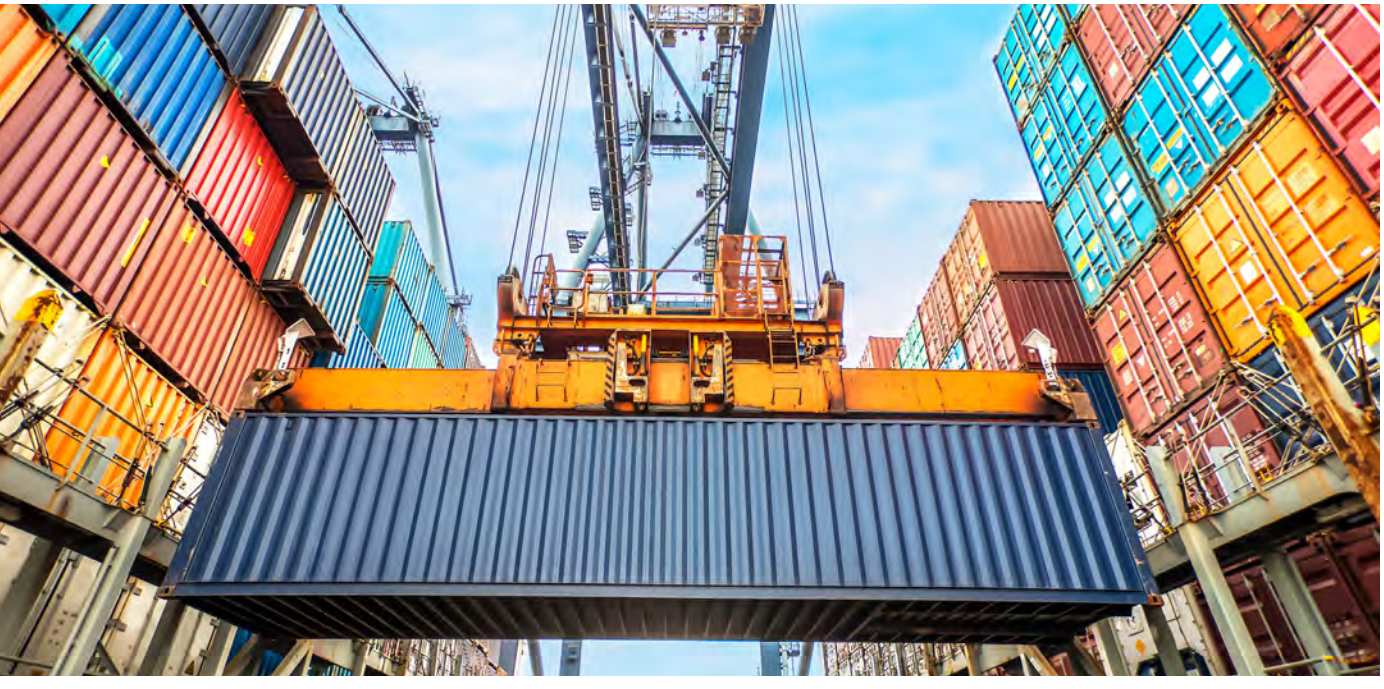
Source: Original figure produced for this publication, based on CPPI 2023 data.

FIGURE 2.9 • Average Moves per Crane



Source: Original figure produced for this publication, based on CPPI 2023 data.

As might be expected, the more container moves are to be handled, the more cranes must be deployed. However, crane intensity lags call size growth, which means that as the call size grows, each crane is required to handle more containers. Theoretically, if a call with 1,000 moves was assigned 2 cranes, then one with 5,000 moves would require 10 cranes for a status quo, and that does not happen often, if at all. Since the exchange rate per crane does not increase progressively with ship size, call size, or crane intensity growth, the overall operating time increases. This makes call size differentiation the critical factor to consider when attempting port performance benchmarking and ranking.



3. The Approach and Methodology

The Structure of the Data

Before discussing the methodology employed in constructing the CPPI with matrix factorization, it is helpful to first summarize the structure of available data. The data set is segmented by the following five categories of ship sizes:

- Feeders: <1,500 TEUs
- Intra-regional: 1,500 TEUs–5,000 TEUs
- Intermediate: 5,000 TEUs–8,500 TEUs
- Neo-Panamax: 8,500 TEUs–13,500 TEUs
- Ultra-large container carriers: >13,500 TEUs

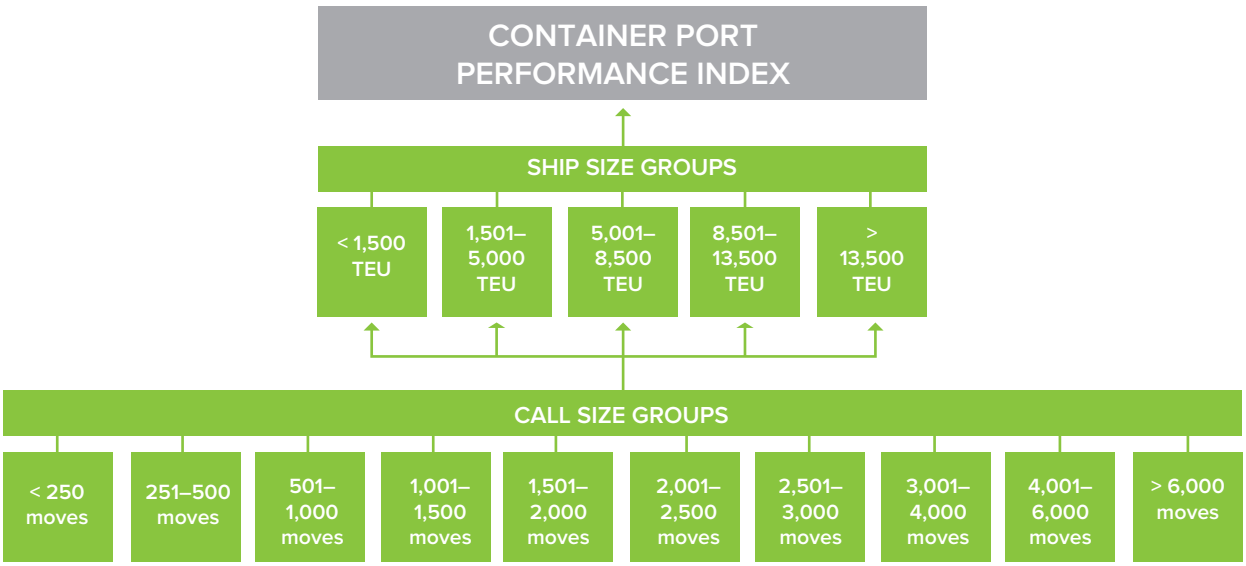
For each category, there are 10 different bands for call size. The port productivity is captured by average idle hour, which consists of two parts: port-to-berth (PB) and on-berth (B). In the previous CPPI iteration,

total variables used = 5 x 10 x 2. Of course, many of them have missing values. The objective is to build a model to summarize these variables and then construct a port productivity index for all ports under consideration. The average waiting time and average berth time is calculated for each call size. The resulting data is a table/matrix whose rows represent ports and whose columns contain the average waiting and berth times of each call size.

Moving on to the construction of the dataset for the CPPI, for a port to qualify for inclusion in the CPPI it must have registered at least 24 valid port calls where port hours can be calculated within the full calendar year. Of the 508 ports for which S&P Global received port call information, 405 are included in the main index of CPPI 2023. There were 182,855 distinct port calls recorded in the data over the period at those 405 main ports. A further 103 ports registered less than 24 calls each, these ports are excluded from the CPPI 2023.

The CPPI is based solely on the average port hours per port call, with port hours being the total time elapsed from when a ship first entered a port to when it departed from the berth. Due to the large volume of data, it was possible and prudent to break it down into ship size and call size groups or ranges. However, too much fragmentation would have diluted the data to the extent that more assumptions than actual empirical data would be present in the index. Therefore, the data were grouped into five distinct ship sizes, and then within each ship size group by call size group, as reflected in Figure 3.1 below.

FIGURE 3.1 • The Structure of the CPPI



Source: Original figure produced for this publication.

The number of ship size groups was limited to five, and the number of call size groups to 10. That results in a 50 (5 x 10) matrix for the qualifying ports for the main index of CPPI 2022. However, there were insufficient port calls in the larger five call size groups for the less than 1,500 TEU ship size group and similarly for the two larger call size groups for the 1,501 TEU-5,000 TEU ship size group. In total, the data was distributed into 43 ship-call size groups.

TABLE 3.1 • Port Calls Distribution

	CALL SIZE GROUP									
SHIP SIZE GROUP	**<250**	**251-500**	**501–1000**	**1001–1500**	**1501–2000**	**2001–2500**	**2501–3000**	**3001–4000**	**4001–6000**	**>6000**
1 <1,500	12.0%	30.5%	46.1%	8.0%	1.1%	0.5%	0.3%	0.2%	0.6%	0.8%
2 1,501–5,000	2.1%	10.6%	30.4%	25.0%	15.4%	8.5%	3.9%	3.3%	0.7%	0.0%
3 5,001–8,500	0.4%	2.6%	14.0%	19.6%	19.1%	14.2%	10.4%	11.4%	6.8%	1.7%
4 8,501–13,500	0.1%	1.1%	6.5%	11.8%	13.4%	13.6%	12.1%	18.1%	15.6%	7.7%
5 >13,500	0.0%	0.2%	1.5%	3.6%	5.8%	7.9%	9.2%	19.6%	28.9%	23.2%

Source: Original table produced for this publication, based on CPPI 2023 data.

The five ship size groups were based on where they might be deployed and the similarities of ships within each group. Although a sixth group for ships more than 18,000 TEU or 24,000 TEU could have been added, it would have highly diluted the data in the two larger ship size groups.

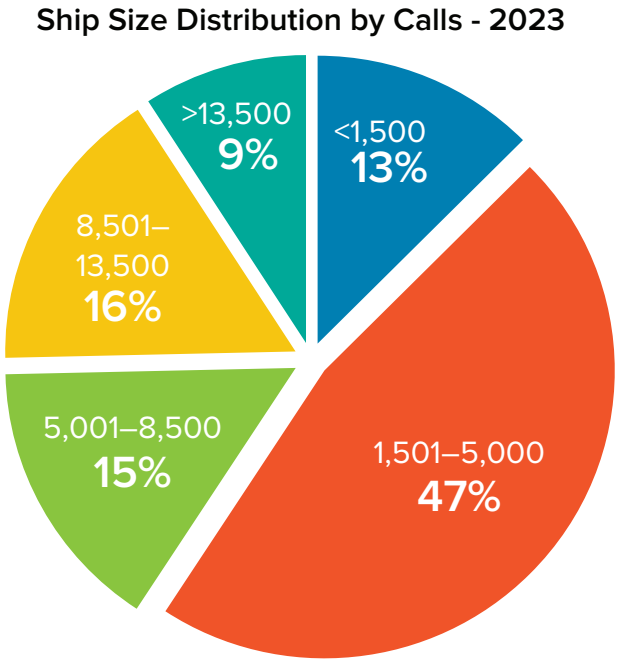
TABLE 3.2 • Ship Size Group Definitions

NOMINAL TEU CAPACITY RANGE	DESCRIPTION
Less than 1,500	Almost exclusively feeder vessels, often connecting small outlying ports with regional hub ports. Some intra-regional services will also have ships in this size range.
1,500 to 5,000	A significant quantity of these classic Panamax ships are deployed on intra-regional trades. They are found on North-South trades to and from Africa, Latin America, and Oceania, as well as Transatlantic services.
5,000 to 8,500	Vessels within this size group are mainly deployed on the North-South trade lanes. Vessel cascading and improving port capabilities has seen them start to emerge as stock vessels for Africa, Latin America, and Oceania trades. There is some presence on Transatlantic and Asia–Middle East trades as well.
8,500 to 13,500	These Neo-Panamax vessels are largely deployed on East-West trades, particularly Trans-Pacific, both to North America's west coast as well as via either the Panama or Suez Canals to North America's east coast. They also feature on Asia–Middle East trades, with some deployed on Asia–Mediterranean rotations.
Greater than 13,500	These ultra-large container ships (ULCS) are mainly deployed on Asia–Europe (serving both North Europe and the Mediterranean) and Asia–United States trades, especially on Trans-Pacific services calling at North America's west coast ports.

Source: Original table produced for this publication.

The application of ship size groups is less important than call size groups, particularly since the call data is already split into 10 call size groups. However, the objective of the CPPI is to highlight through comparison the performance gaps and opportunities to save fuel and reduce emissions. The analysis should, therefore, consider that the larger the ship, the more fuel it consumes, and the higher the potential to save fuel and reduce emissions.

FIGURE 3.2 • Percentage of Port Calls per Ship Size Group - 2023



Source: Original figure produced for this publication, based on CPPI 2023 data.

Almost 47 percent of all ship port calls in 2023 were from the Panamax (1,501-5,000 TEU) size of ships. With just 9 percent of port calls made by ships more than 13,500 TEU, it was decided not to disaggregate these further. As the main participants of the Port Performance Program are primarily deep-sea operators, there was a relatively small number of calls in the feeder segment (less than 1,500 TEU capacity).

An attempt has been made to make the 10 call size groups as narrow as possible by grouping together calls in instances where they are most likely to have received similar crane intensity provisions. The analysis then compares all qualifying ports on how close (or far) the individual call size is to the average call size within each call size group.

TABLE 3.3 • Call Size Sensitivity

CALL SIZE SENSITIVITY	CALL SIZE GROUP									
	<250	251–500	501–1000	1001–1500	1501–2000	2001–2500	2501–3000	3001–4000	4001–6000	>6000
Average	166	377	730	1,228	1,732	2,230	2,735	3,437	4,755	7,804
Median	177	379	722	1,218	1,719	2,220	2,726	3,408	4,667	6,932
Lower Range	166	377	730	1,228	1,732	2,230	2,735	3,437	4,755	7,804
Upper Range	177	379	722	1,218	1,719	2,220	2,726	3,408	4,667	6,932
Total Ports	367	389	369	313	259	213	182	153	112	60
Within Range	254	355	323	304	259	213	182	153	110	49
Percentage in Range	69.2%	91.3%	87.5%	97.1%	100.0%	100.0%	100.0%	100.0%	98.2%	81.7%

Source: Original table produced for this publication, based on CPPI 2023 data.

To assess the sensitivity within each call size group across all 405 qualifying ports, the median call size between all ports within a call size group was taken and a tolerance range of 15 percent above and below the median created (see Table 3.5). In the six call size groups from the 1,001–1,500 to 4,001–6,000 moves groups, more than 96.9 percent of ports have an average call size well within this tolerance range.

Beyond the threshold of 6,000 moves per call, the call size has a much lower impact on crane intensity. This is because the number of cranes that can be deployed is limited by the overall number of cranes available or stowage splits. The quantity of ports with an average call size within the tolerance range in the three smallest call size groups is not as high as the quantity in the six call size groups from the 1,001–1,500 to 4,001–6,000 moves groups. However, for ports with an average call size above the tolerance range, it would be possible to increase crane intensity to match the slightly higher call sizes, and, therefore, the conclusion is that objective comparisons can be made within all 10 call size groups.

The objective of preparing the index and the ranking is that it should reflect as closely as possible actual port performance, whilst also being statistically robust. With respect to the largest ports—the top 100 ports by annual move count—there is real empirical data present in each of the 43 distinct ship size and call size categories. However, for smaller ports there are many categories with no data, particularly those with only a few hundred calls in total. If these unpopulated categories are ignored, the appraisal of performance would be undertaken on different quantities of categories, which is likely to unduly disadvantage smaller ports that might well be quite efficient despite their modest size and throughput.

Constructing the Index: The Administrative Approach

Imputing missing values: The administrative approach

The handicap of missing values can be addressed in two different ways in the administrative approach and the statistical approach. The former involves assigning values to empty categories based on data that are available when a port has registered a data point within a specific ship size range.

TABLE 3.4 • Quantity of Ports Included per Ship Size Group

SHIP SIZE RANGE	QUANTITY OF PORTS INCLUDED	BASE CALL SIZE
Less than 1,500 TEUs	327	251–500
1,500–5,000 TEUs	374	501–1,000
5,000–8,500 TEUs	227	1,001–1,500
8,500–13,500 TEUs	186	1,501–2,000
More than 13,500 TEUs	117	3,001–4,000

Source: Original table produced for this publication, based on CPPI 2023 data.

For each ship size group, the call size group that has the largest quantity of data representation is selected (see Table 3.4) as the Base Call Size group. Ideally, this is a mid-range call size group because the lowest and highest groups can demonstrate some uniqueness. In cases where there is no actual data for the base call size group, the next highest group is examined to find an actual data set. If none is found, then the approach involves looking at the immediately lower call size band. At the end of this exercise, every port has a value assigned for the base call size group.

Imputing vessel arrival values. Where a call size group does not have an arrival hours value, it is populated using the overall average arrival time for all vessels registered at that port across all call size groups within each specific ship size group. This is logical as call size is a less important determinant of waiting time than ship size.

Imputing berth hours. From the base call size group, moving left toward the lowest group and right toward the highest group, in groups where no value exists, a value is determined on a pro rata basis given the adjacent call size group value, actual data or imputed. The rationale is that if within one call size group a port has either higher or lower berth hours than the average, the adjacent call size group too is likely to show similar trends.

Table 3.5 contains an illustrative example. In this case, port A had a higher quantity of hours in the base call size group than the group average. It is assumed that would also have been the case had the port registered actual calls in the 501–1,000 and 1,501–2,000 call size groups. The opposite is true for port B, which achieved a lower quantity of hours in the base call size group. The calculation for port A in the 501–1,000 call size group is actual hours within the group 1,001–1,500 (12.0) multiplied by the group average factor (0.9) for a prorated quantity of average berth hours of (10.8).

TABLE 3.5 • An Example of Imputing Missing Values

PORT	CALL SIZE GROUP		
	501–1,000	1,001–1,500	1,501–2,000
Port A	10.8	12.0	14.4
Port B	7.2	8.0	9.6
Group Average	9.0	10.0	12.0
Factor Multiplier	0.9	Base	1.2

Source: Original table produced for this publication, based on CPPI 2023 data.
Note: The numbers in the green highlighted cells have been imputed by multiplying the base cells by the factor multiplier determined by the overall group average.

The inherent risk with this approach is that poor or good performance within just one group will cascade across all call size groups. It also assumes that a port's ability to add cranes to larger call size groups exists, which might not be true in all cases. On the other hand, it would be illogical to blindly assume that any port would simply achieve the average of the entire group or, possibly worse, to assume that a port performing below average in one call size group would miraculously perform much better than average in others where it did not record any actual calls.

Constructing the index: the administrative approach

Aggregating arrival and berth hours into total port hours. This report indicated earlier that a case could be made for penalizing waiting time which is regarded as pure waste. However, as expressed earlier, this would be a normative judgment, accordingly both arrival and berth hours are weighted as 1.0 and the two time segments are summed to form total port hours in CPPI 2021.

Appraising port hours performance. Average port hours are naturally higher in the larger than smaller call size groups. This can magnify the difference in hours between a subject port and the average port hours of the overall group. So, appraising on the difference between a port's average hours and average hours of the group may skew the scoring unduly toward the larger call size calls. There are also

far fewer calls within the larger than smaller call size groups, and this also needs to be reflected in the construction of the CPPI to retain maximum objectivity.

The method applied to each call size group individually is that the port's average port hours is compared with the group's average port hours as a negative or positive quantity of hours. The result of that comparison is weighted by the ratio of port calls in each call size group for the entire group of ports Table 3.6 provides an illustration as to how it is done.[7]

TABLE 3.6 • Port Hours Performance Appraisal

PORT	PORT HOURS	HOURS DIFFERENCE	CALL SIZE GROUP WEIGHT	RESULT
Example Port	22.56	12.09	0.160	1.9344
Group Average	34.65			

Source: Original table produced for this publication, based on CPPI 2023 data.

In this illustrative example, the subject port used 12.09 fewer hours than the average of the entire group (22.56 versus 34.65). Since 16.0 percent of all port calls in this ship size group were in the subject call size group, the difference in hours (12.09) is multiplied by ratio 0.160 for an overall index points result of 1.9344. Where a port uses more port time than the average for all ports, the index points become negative.

Aggregation to a score and rank per ship size group. The "results" achieved per port within each of the 10 call size groups are then summed together to calculate a score within the overall ship size group (it is five and eight groups rather than 10 groups in the case of the two smaller ship size groups, respectively). Based upon these scores, there is a sub-ranking performed within each ship size group that can be reviewed in the final CPPI rankings.

However, the imputation method might unfairly appraise some ports that only recorded data within a few call size groups. If, for example, the performance in a few call size groups was worse than the average for all ports within the ship size group, this would be prorated to all call size groups. This required a judgment, as the alternative of ignoring call size groups without actual data, effectively resulting in a zero score for those groups, would not necessarily result in a better outcome. In the latter case, ports with limited call size diversity would not be credited with positive scores in each and every call size group which they are likely to have achieved if they had a greater diversity of call sizes.

Aggregating all ship size groups

No allowance was made for ports that did not handle ships within specific ship size groups during the period under consideration. The quantity of ports being included per ship size group was presented earlier in table 3.2. The primary reason is many of the smaller ports are not capable of handling some of the larger ship sizes and so would in effect be awarded positive (or negative) results for scenarios that are physically impossible. The omission of scores within some ship size groups would only be an issue if an attempt was made to compare the performance of major mainline ports with those of far smaller ports. But this is a comparison that is neither fair nor valuable.

For the comparison between similarly sized ports, this factor will not contribute, or at least not significantly. In aggregating the scores from the various ship size groups into the overall CPPI in the administrative approach, a factor was built in to differentiate the importance and significance of better performance

of larger ships over smaller ones. This was constructed based on the relative fuel consumption (and, therefore, emissions and cost) of different ship sizes in the form of an index (see Table 3.7). For each ship size group, a typical mid-range example ship was selected. Based upon the expected deployment of such ships, a range of sea legs were defined (and weighted), at a typical pro forma service speed, and the impact on fuel consumption that one hour longer (or shorter) in port would be likely to yield.

TABLE 3.7 • Assumptions to Determine a Fuel Consumption Index

NOMINAL TEU CAPACITY RANGE	EXPECTED DEPLOYMENT	SEA LEG	WEIGHT (PERCENT)	INDEX WEIGHT
Less than 1,500 TEUs	Feeders	Singapore–Surabaya	25	0.46
	Intra-regional	Rotterdam–Dublin	25	
		Kingston–Port-au-Prince	25	
		Busan–Qingdao	25	
1,500 to 5,000 TEUs	Intra-regional	Shanghai–Manila	30	1.00
	Africa	Rotterdam–Genoa	30	
	Latin America	Algeciras–Tema	10	
	Oceania	Charleston–Santos	10	
	Transatlantic	Xiamen–Brisbane	10	
		Felixstowe–New York	10	
5,000 to 8,500 TEUs	Africa	Hong Kong–Tema	20	1.54
	Latin America	Charleston–Santos	20	
	Oceania	Xiamen–Brisbane	20	
	Transatlantic	Felixstowe–New York	20	
	Asia–Middle East	Shanghai–Dubai	20	
8,500 to 13,500 TEUs	Transpacific	Busan–Charleston (via Panama)	25	1.97
	Asia–Middle East	Hong Kong–Los Angeles	25	
	Asia–Mediterranean	Shanghai–Dubai	25	
		Singapore–Piraeus	25	
Greater than 13,500 TEUs	Asia–Mediterranean	Singapore–Piraeus	40	2.57
	Asia–North Europe	Singapore–Rotterdam	40	
	Transpacific	Hong Kong–Los Angeles	20	

Source: Original table produced for this publication, based on CPPI 2023 data.

The index weight then suggests that it is 2.57 times more costly to recover an additional hour of port time at sea for a ship with capacity in excess of 13,500 TEUs than it would be for a ship in the 1,500–5,000 TEU capacity range. The total aggregated index points per port within each ship size group are then weighted by this "cost" factor. The sum of the weighted index points for each port across all five ship size groups are then summed and the final CPPI ranking is based upon those weighted values.

The primary focus was micro-delays and it was assumed that these would be recovered on long-haul ocean legs, and not between coastal ports, which would be more costly. Through simulation, if the index values are tweaked up or down by up to 10 percent the overall ranking is unaffected. If they are adjusted so that larger ship size groups have lower indices than smaller ones it results in radical changes to the overall ranking. To achieve a final CPPI score and ranking in the administrative approach, accumulated results within each ship size group are multiplied by the index values per ship size group

and then summed. The ranking is then based in descending order on final summed totals across all ship size groups. The resulting index using the administrative approach is presented in chapter 3 and appendix A.

Constructing the index: the statistical approach

Imputation of Missing Values

A major practical problem is that most idle hour variables have a significant number of missing values. For instance, in the port performance data set, the two smaller ship sizes contain little data for the larger call sizes. Consequently, as in the administrative approach, the call size groups with more than 2,000 moves were removed from the <1,500 TEU ship category, and the call size groups with more than 4,000 moves were removed from the 1,501 TEU–5,000 TEU ship category.

A more sophisticated approach is to use likelihood-based methods to impute those missing values. For the current data set, expectation–maximization (EM) algorithm can be utilized to provide a maximum-likelihood estimator for each missing value. It relies on two critical assumptions. The first assumption is that gaps are random, or more specifically, the gaps are not caused by sample selection bias. The second assumption is that all variables under consideration follow a normal distribution.

Given the data set, these two assumptions are plausible. EM computes the maximum likelihood estimator for the mean and variance of the normal distribution given the observed data. Knowing the distribution that generates the missing data, we can then replace the missing values by their conditional expectation given the available data. Matrix factorization can then be performed on the resulting data set, instead of the original one filled with missing values.

Missing values in the resulting table/matrix are reconstructed using the EM algorithm (Dempster, Laird, and Rubin 1977). A non-negativity constraint is added to make sure the reconstructed times are non-negative. Assuming the data has a multivariate Gaussian distribution with mean vector μ and covariance matrix ∑, the EM algorithm provides an estimate of the two parameters μ and ∑ via maximum likelihood.

Missing values are imputed using their conditional expectation. In this approach, given a row with available values and x_a missing values x_m, the missing values are imputed by their conditional expectation E(x_m 1_(x_m) ≥ | x_a) given the available data, where the expected value is computed only over the non-negative values of to ensure the imputed values are non-negative.

In this iteration, arrival and berth hours are aggregated into total port hours, just like in the administrative approach. The data structure after this aggregation for a particular category k (k = 1, 2, 3, 4, 5) can be summarized as shown in Table 3.8.

TABLE 3.8 • Sample Port Productivity Data Structure by Ship Size

SHIP SIZE (K)	CALL SIZE BAND (NUMBER OF MOVES)									
	<250			251–500			.....	>6,000		
PORTS	PORT-TO-BERTH	BERTH	TOTAL PORT HOURS	PORT-TO-BERTH	BERTH	TOTAL PORT HOURS		PORT-TO-BERTH	BERTH	TOTAL PORT HOURS
1										
2										
3										
. . .										

Source: Original table produced for this publication.

Why Is Matrix Factorization Useful?

Essentially, for each port, quite a few variables contain information about its efficiency. These include average time cost under various categories: (1) different call size bands, and (2) berth/port-to-berth. The reason matrix factorization can be helpful is that these variables are in fact determined by a small number of unobserved factors, which might include quality of infrastructure, expertise of staff, and so on. Depending on the data, very few of such factors can summarize almost all useful information. The challenge lies in the inability to observe those latent factors; however, a simple example could be helpful: Imagine three ports, each with four different types of time cost, as shown in table 3.9.

TABLE 3.9 • Sample Illustration of Latent Factors

PORT	COST 1	COST 2	COST 3	COST 4
A	1	2	3	4
B	2	4	6	8
C	3	6	9	12

Source: Original table produced for this publication.

As one can observe, costs 2 to 4 are just some multiples of cost 1. Although we have four variables, to rank the efficiency of these three ports, just one variable is enough (A>B>C). This is an extreme case, but the idea can be generalized if these variables are somehow correlated, but to a less extreme extent. In that case, the factors are computed as some linear combination of costs 1 to 4. Of course, if costs 1 to 4 are completely independent of each other, then this method makes no sense. Fortunately, this is not the case for our data set. Thus, for each port, we can compute its score on all factors and then combine those scores together to reach a final efficiency score.

Note that in the statistical approach using matrix factorization, the scores are not calculated for each call size range. On the contrary, the whole data set, including the smaller ports, is used simultaneously to obtain latent factors. This is in sharp contrast to the administrative approach. The statistical approach factors in all the correlations among hours for various call size bands, which purely from a statistical perspective is more efficient.

There is no right or wrong methodology, but the two different approaches are considered complementary. Hence, the decision in this iteration of the CPPI to maintain both approaches, to try and ensure that the resulting ranking(s) of container port performance reflects as closely as possible actual port performance, whilst also being statistically robust.

The Statistical Methodology

The data are scaled and weighted as in the administrative approach.

- Let p_{ij} denote average port time of port i in call size j.
- Let p_{avgj} denote the average of the average port time of all ports in the given call size.
- Let w_j denote the ratio of port calls that are in the call size group j

The data are scaled by replacing p_{ij} by: $x_{ij} = (p_{avg,j} - p_{ij}).w_i$

A positive value of x_{ij} means the port is doing better than average, whereas a negative value means it is doing worse than average.

Let $X = (x_{ij})$ denote the resulting matrix of scaled port time. Assume X has n rows (n ports) and p columns (p call size bands). As in the previous iteration of the CPPI, the matrix X is decomposed as $X \approx WH$ where W is a $n \times k$ matrix and H is an entrywise non-negative $k \times p$ matrix. The integer k (the number of columns of W) is chosen to be a small number to compress the data. The matrix W represents factors and the matrix H factor loadings that are used to explain the data X. A number of k = 3 factors was found to be adequate to approximate the data matrix X.

Note: Traditional factor analysis (FA) used in statistical analysis produces a matrix factorization $X \approx WH$ as above, except that the matrix H does not need to be non-negative. This is a problem since a large positive factor does not necessarily represent a small port time if the corresponding loading is negative. In contrast, our method enforces non-negativity in the loadings matrix H. This approach produces results that are consistent with the administrative approach.

The CPPI for each ship size is obtained by adding the three columns of W.

The CPPI index is a weighted sum of these indices: Let CPPIi denote the CPPI index for ship size i (i = 1, . . . ,5).

$$CPPI = \sum_{i=1}^{5} CPPI_i \cdot \alpha_i$$

where $(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5) = (0.46, 1.00, 1.54, 1.97, 2.57)$

Constructing the CPPI 2023 Index Using a Ranking Aggregation Method

The CPPI has in previous iterations utilized two distinct methodologies: the administrative, or technical approach that employs expert knowledge and judgment to produce a practical methodology, and a statistical approach that utilizes factor analysis (FA). CPPI 2022 went a step further to aggregate the two rankings to produce one index that to present the performance of ports via both methodologies, an approach that is continued in CPPI 2023.

Borda-Type Approach for Index Aggregation

Rank aggregation, that is the process of combining multiple rankings into a single ranking, is an important problem arising in many areas (Langville and Meyer 2012). For example, in a ranked voting system, citizens rank candidates in their order of preference and a single winner needs to be determined. Similarly, recommender systems and search engines can produce many different rankings of items that are likely to be of interest to a given user. Such rankings can naturally be aggregated to produce a more robust list of items (Pappa et al. 2020).

Many strategies were proposed in the literature to combine several rankings into one that is as consistent as possible with the individual rankings (Langville and Meyer 2012, Fagin et al. 2003, Dwork et al. 2001, Dwork et al. 2012, Oliveira et al. 2020) and references therein. The Borda count (Langville and Meyer 2012, Chapter 14) provides a simple and effective approach for aggregating rankings, wherein each item to rank is given points according to the number of items it outranks in its segment. These points are added and then used to produce a new ranking. Our approach to combine the administrative and the statistical rankings is inspired by the Borda count, but also considers the index values for attributing the number of points.

The process is as follows: First, each index is scaled to take values into the interval [0,1]. This is accomplished by applying the following linear transformation:

$$f(x) = \frac{x}{M-m} - \frac{m}{M-m},$$

where m is the minimum value of the index and M the maximum value. Observe that the port with the smallest index is always given a scaled value of 0 and the port with largest index a scaled value of 1. The other ports get a scaled value between 0 and 1. Once the indices are scaled, they are added to produce a combined index. Finally, a ranking is obtained by sorting the ports according to the combined index in decreasing order. Thus, the port with the largest combined index is ranked first and the port with the smallest combined index is ranked last.

TABLE 3.10 • An Example of Aggregated Rankings for Four Ports with Randomly Generated Administrative and Statistical Index Values

PORTS	ADMINISTRATIVE INDEX	STATISTICAL INDEX	SCALED ADMINISTRATIVE INDEX	SCALED STATISTICAL INDEX	COMBINED INDEX	FINAL RANKING
Port 1	1.45	1.97	1.000	1.000	2.000	1
Port 2	1.26	1.21	0.678	0.392	1.070	3
Port 3	1.23	1.31	0.627	0.472	1.099	2
Port 4	0.86	0.72	0.000	0.000	0.000	4

Source: Original table produced for this publication.

For example, the scaled administrative index value of Port 2 (x = 1.26) is computed as follows: the minimum and maximum values of the administrative index are m = 0.86 and M = 1.45. Thus, the scaled value is

$$f(x) = \frac{1.26}{1.45 - 0.86} - \frac{0.86}{1.45 - 0.86} = 0.678$$

NOTES

1 International Maritime Organization (IMO) Resolution MSC.74(69) Annex 3.

2 See the International Maritime Organization's website on "International Convention for the Safety of Life at Sea (SOLAS), 1974," (accessed March 2022), at https://www.imo.org/en/About/Conventions/ Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx.

3 International Convention for the Safety of Life at Sea (SOLAS), under the revised SOLAS 1974 Chapter V (as amended)—Safety of Navigation, section 19.2.415, carriage requirements for shipborne navigational systems and equipment.

4 See ITU's website on "Technical Characteristics for an Automatic Identification System Using Time Division Multiple Access in the VHF Maritime Mobile Frequency Band," (accessed November 2021), at https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1371-5-201402-I!!PDF-E.pdf.

5 It may be a conventional land-based port or a stretch of water designated as an area for transferring cargo or passengers from ship to ship.

6 The precise approach to produce a robust data set is detailed in appendix B.

7 The actual equation is: (Group Average Port Hours/Example Port Hours) x Call Size Group Weight.

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4. The Container Port Performance Index 2023

Introduction

The rankings of container port performance, based on the ranking aggregation approach, are presented in this chapter. The following section presents the rankings for the top 100 best performing container ports, with the full rankings of all ports by both approaches presented in Appendix A. The subsequent sections present a summary by region and port throughput (large, medium, small), so ports in the same region, or with the same throughput within broad categories, can be easily compared.

The CPPI 2023

Table 4.1 presents the top 100 in the rankings of container port performance in the CPPI 2023. It reflects the aggregation of the scores from the results from the administrative approach and the statistical approach in the manner described in the previous section.

In the aggregate index, the two top-ranked container ports in the CPPI 2023 are Yangshan Port (China) in first place, followed by the Port of Salalah (Oman) in second place. These two ports occupy the same positions in the rankings generated by the constituent approaches. The Port of Salalah was ranked second in both approaches in CPPI 2021, while the Yangshan Port ranked third and fourth in the statistical and administrative approaches, respectively, in CPPI 2021.

The top-ranked container ports in the CPPI 2023 are Yangshan Port (China) in first place, followed by the Port of Salalah (Oman) in second place, retaining their ranking from the CPPI 2022. Third place in the CPPI 2023 is occupied by the port of Cartagena, up from 5th place in the CPPI 2022, whilst Tangier-Mediterranean retains it 4th ranking. Tanjung Pelepas improved one position to 5th, Ningbo moved up from 12th in 2022 to 7th in 2023, and Port Said moved from 16th to 10th in 2023. Yokohama fell from 10th and 12th in CPPI 2021 to 15th place in CPPI 2022 is now back to 9th in 2023. Ports moving in the other direction in the top ten: Khalifa port falls from 3rd position in 2022 to 29th position in CPPI 2023. Hamad Port which fell from 8th in 2022 to 11th in 2023. There are 55 new entrants to the CPPI 2023, and several significant gainers in terms of ranking.

TABLE 4.1 • The CPPI 2023

PORT NAME	OVERALL RANKING
YANGSHAN	1
SALALAH	2
CARTAGENA (COLOMBIA)	3
TANGER-MEDITERRANEAN	4
TANJUNG PELEPAS	5
CHIWAN	6
CAI MEP	7
GUANGZHOU	8
YOKOHAMA	9
ALGECIRAS	10
HAMAD PORT	11
NINGBO	12
MAWAN	13
DALIAN	14
HONG KONG	15
PORT SAID	16
SINGAPORE	17
KAOHSIUNG	18
VISAKHAPATNAM	19
YEOSU	20
TIANJIN	21
YANTIAN	22
TANJUNG PRIOK	23
LIANYUNGANG	24
SHEKOU	25
CALLAO	26
MUNDRA	27
PORT KLANG	28
KHALIFA PORT	29
KING ABDULLAH PORT	30
XIAMEN	31
BUSAN	32
GEMLIK	33
BARCELONA	34
DAMMAM	35
SAVONA-VADO	36
POSORJA	37
FUZHOU	38
ZEEBRUGGE	39
COLOMBO	40
PIPAVAV	41
RIO DE JANEIRO	42
KHALIFA BIN SALMAN	43
BUENAVENTURA	44
LAEM CHABANG	45
SHIMIZU	46
KAMARAJAR	47
INCHEON	48
JEBEL ALI	49
LAZARO CARDENAS	50
AARHUS	51
DA CHAN BAY TERMINAL ONE	52
CHARLESTON	53
TOKYO	54
PHILADELPHIA	55
NAGOYA	56
KATTUPALLI	57
JEDDAH	58
JUBAIL	59
QINZHOU	60
KARACHI	61
KEELUNG	62
COCHIN	63
KOBE	64

PORT NAME	OVERALL RANKING
PORT EVERGLADES	65
SOHAR	66
SALVADOR	67
HAZIRA	68
LONDON	69
HAIPHONG	70
KRISHNAPATNAM	71
WILHELMSHAVEN	72
BEIRUT	73
MIAMI	74
BOSTON (USA)	75
ANTWERP	76
DILISKELESI	77
ITAPOA	78
PUERTO LIMON	79
CHENNAI	80
WILMINGTON (USA-N CAROLINA)	81
MARSAXLOKK	82

PORT NAME	OVERALL RANKING
ZHOUSHAN	83
SOUTHAMPTON	84
OSAKA	85
HAIFA	86
AQABA	87
BREMERHAVEN	88
SANTA CRUZ DE TENERIFE	89
MALAGA	90
ROTTERDAM	91
NEW YORK & NEW JERSEY	92
JOHOR	93
POINTE-A-PITRE	94
YOKKAICHI	95
JAWAHARLAL NEHRU PORT	96
CORONEL	97
TRIPOLI (LEBANON)	98
JACKSONVILLE	99
ALTAMIRA	100

Source: Original table produced for this publication, based on CPPI 2023 data.

The CPPI 2023 shows a great consistency between the two approaches, as in its 2022 edition. In CPPI 2023, more than 40 percent of all ports (162 ports) are ranked within 6 places or less from themselves in the dual rankings, whereas 50 percent of the ports are ranked within 8 places. The consistency between the two approaches contributes significantly to having a well-balanced aggregated index.

Ranking by Region

This section presents an overview of the outcomes from the CPPI 2023 report. The first edition of CPPI was modified based on requests for the presentation of results and rankings by region and throughput for an improved comparison of ports within the same region and those with similar throughput. The subsequent sections include a concise tabulation of the results and ranking (from Table 4.2) for the designated regions based on the administrative CPPI.

- North America (United States and Canada)
- Central America, South America, and the Caribbean Region
- West, Central, and South Asia (Saudi Arabia to Bangladesh)
- East Asia (Myanmar to Japan)
- Oceania (Australia, New Zealand, and the Pacific Islands)
- Sub-Saharan Africa
- Europe and North Africa

TABLE 4.2 • The CPPI by Region: North America

PORT NAME	REGION	OVERALL RANKING
PHILADELPHIA	NAM	50
CHARLESTON	NAM	60
PORT EVERGLADES	NAM	63
WILMINGTON (USA-N CAROLINA)	NAM	72
BOSTON (USA)	NAM	73
MIAMI	NAM	77
JACKSONVILLE	NAM	83
HALIFAX	NAM	95
NEW YORK & NEW JERSEY	NAM	99
NEW ORLEANS	NAM	133
MOBILE	NAM	186
BALTIMORE (USA)	NAM	191
PORT TAMPA BAY	NAM	214
HONOLULU	NAM	219
APRA HARBOR	NAM	223
SAINT JOHN	NAM	265
HUENEME	NAM	277
PORT OF VIRGINIA	NAM	306
HOUSTON	NAM	327
MONTREAL	NAM	351
SEATTLE	NAM	356
VANCOUVER (CANADA)	NAM	363
LONG BEACH	NAM	376
LOS ANGELES	NAM	378
OAKLAND	NAM	396
PRINCE RUPERT	NAM	397
SAVANNAH	NAM	398
TACOMA	NAM	402

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.3 • The CPPI by Region: Central America, South America, and the Caribbean Region

PORT NAME	REGION	OVERALL RANKING
CARTAGENA (COLOMBIA)	LAC	6
CALLAO	LAC	26
POSORJA	LAC	39
BUENAVENTURA	LAC	42
RIO DE JANEIRO	LAC	45
LAZARO CARDENAS	LAC	51

PORT NAME	REGION	OVERALL RANKING
SALVADOR	LAC	62
PUERTO LIMON	LAC	79
ITAPOA	LAC	80
ALTAMIRA	LAC	87
POINTE-A-PITRE	LAC	89
CORONEL	LAC	91

PORT NAME	REGION	OVERALL RANKING
FORT-DE-FRANCE	LAC	104
COLON	LAC	107
RIO GRANDE (BRAZIL)	LAC	108
VERACRUZ	LAC	115
SAN ANTONIO	LAC	116
PUERTO BARRIOS	LAC	122
PARANAGUA	LAC	130
SUAPE	LAC	131
SAN JUAN	LAC	140
SANTA MARTA	LAC	141
VALPARAISO	LAC	154
RIO HAINA	LAC	155
BARRANQUILLA	LAC	161
PUERTO BOLIVAR (ECUADOR)	LAC	162
LIRQUEN	LAC	164
PUERTO PROGRESO	LAC	171
PUERTO CORTES	LAC	175
BASSETERRE	LAC	178
GUSTAVIA	LAC	179
GENERAL SAN MARTIN	LAC	183
PECEM	LAC	184
SANTO TOMAS DE CASTILLA	LAC	187
PHILIPSBURG	LAC	199
LA GUAIRA	LAC	202
POINT LISAS PORTS	LAC	210
CASTRIES	LAC	225
BRIDGETOWN	LAC	232
PORT AU PRINCE	LAC	234
BIG CREEK	LAC	235
PAITA	LAC	240
MARIEL	LAC	241
PARAMARIBO	LAC	243

PORT NAME	REGION	OVERALL RANKING
BUENOS AIRES	LAC	246
PUERTO QUETZAL	LAC	247
CALDERA (COSTA RICA)	LAC	255
CAUCEDO	LAC	257
NASSAU	LAC	259
CRISTOBAL	LAC	261
MANAUS	LAC	267
ZARATE	LAC	268
PORT OF SPAIN	LAC	272
SEPETIBA	LAC	279
VILA DO CONDE	LAC	283
GEORGETOWN (GUYANA)	LAC	288
PUERTO CABELLO	LAC	298
ENSENADA	LAC	299
BALBOA	LAC	305
ARICA	LAC	312
MAZATLAN	LAC	314
SAN VICENTE	LAC	315
GUAYAQUIL	LAC	320
MANZANILLO (MEXICO)	LAC	323
CORINTO	LAC	325
TURBO	LAC	326
MEJILLONES	LAC	331
VITORIA	LAC	332
SANTOS	LAC	334
IQUIQUE	LAC	357
FREEPORT (BAHAMAS)	LAC	359
MONTEVIDEO	LAC	365
IMBITUBA	LAC	374
ACAJUTLA	LAC	377
KINGSTON (JAMAICA)	LAC	386
ITAJAI	LAC	393

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.4 • The CPPI by Region: West, Central, and South Asia (Saudi Arabia to Bangladesh)

PORT NAME	REGION	OVERALL RANKING
SALALAH	WCSA	2
HAMAD PORT	WCSA	10
VISAKHAPATNAM	WCSA	18
MUNDRA	WCSA	22
KING ABDULLAH PORT	WCSA	30
KHALIFA PORT	WCSA	32
PIPAVAV	WCSA	34
DAMMAM	WCSA	37
COLOMBO	WCSA	40
KHALIFA BIN SALMAN	WCSA	43
KAMARAJAR	WCSA	47
KATTUPALLI	WCSA	54
COCHIN	WCSA	55
KARACHI	WCSA	56
JUBAIL	WCSA	57
JEBEL ALI	WCSA	58
JEDDAH	WCSA	64
SOHAR	WCSA	66
HAZIRA	WCSA	69
AQABA	WCSA	70
KRISHNAPATNAM	WCSA	75
CHENNAI	WCSA	78
JAWAHARLAL NEHRU PORT	WCSA	90
SHARJAH	WCSA	128
AL DUQM	WCSA	135
MUHAMMAD BIN QASIM	WCSA	157
SHUAIBA	WCSA	160
SHUWAIKH	WCSA	212
ADEN	WCSA	222
NEW MANGALORE	WCSA	231
SYAMA PRASAD MOOKERJEE PORT	WCSA	258
UMM QASR	WCSA	282
DJIBOUTI	WCSA	337
CHATTOGRAM	WCSA	339
PORT SUDAN	WCSA	388

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.5 • The CPPI by Region: East Asia (Myanmar to Japan)

PORT NAME	REGION	OVERALL RANKING
YANGSHAN	EAS	1
TANJUNG PELEPAS	EAS	4
CHIWAN	EAS	5
GUANGZHOU	EAS	7
CAI MEP	EAS	8
YOKOHAMA	EAS	9
NINGBO	EAS	11
MAWAN	EAS	13
DALIAN	EAS	14
HONG KONG	EAS	15
YEOSU	EAS	17
SINGAPORE	EAS	19
TANJUNG PRIOK	EAS	20
LIANYUNGANG	EAS	21
KAOHSIUNG	EAS	23
YANTIAN	EAS	24
SHEKOU	EAS	25
TIANJIN	EAS	28
PORT KLANG	EAS	29
XIAMEN	EAS	31
BUSAN	EAS	35
FUZHOU	EAS	36
SHIMIZU	EAS	44
LAEM CHABANG	EAS	46
INCHEON	EAS	48
DA CHAN BAY TERMINAL ONE	EAS	49
QINZHOU	EAS	52
NAGOYA	EAS	53
TOKYO	EAS	59
KEELUNG	EAS	61
KOBE	EAS	65
HAIPHONG	EAS	67
OSAKA	EAS	81
YOKKAICHI	EAS	86
JOHOR	EAS	88
ZHOUSHAN	EAS	94
TANJUNG PERAK	EAS	105
SHANTOU	EAS	106
NAHA	EAS	111
CAT LAI	EAS	112
SHANGHAI	EAS	114
DANANG	EAS	118
HAKATA	EAS	120
MOJI	EAS	123
SIAM SEAPORT	EAS	124
TAICHUNG	EAS	129
BATANGAS	EAS	137
OMAEZAKI	EAS	139
SAIGON	EAS	144
CHU LAI	EAS	147
CEBU	EAS	148
QUANZHOU	EAS	149
QINGDAO	EAS	150
CHIBA	EAS	153
TANJUNG EMAS	EAS	156
CAGAYAN DE ORO	EAS	158
HIBIKINADA	EAS	159
KOMPONG SOM	EAS	168
QUY NHON	EAS	181
PYEONG TAEK	EAS	185
PANJANG	EAS	190
MUARA	EAS	192
SHIBUSHI	EAS	195
OITA	EAS	218
SUBIC BAY	EAS	220
NGHI SON	EAS	226
SONGKHLA	EAS	236
YANGON	EAS	238
KUANTAN	EAS	239
GENERAL SANTOS	EAS	263
BANGKOK	EAS	278
DAVAO	EAS	284
KOTA KINABALU	EAS	290
KUCHING	EAS	295
PENANG	EAS	297
BELAWAN	EAS	300
MANILA	EAS	307
BINTULU	EAS	371

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.6 • The CPPI by Region: Oceania (Australia, New Zealand, and the Pacific Islands)

PORT NAME	REGION	OVERALL RANKING
WELLINGTON	OCE	100
PAPEETE	OCE	166
BELL BAY	OCE	215
BLUFF	OCE	266
NELSON	OCE	271
TIMARU	OCE	274
NOUMEA	OCE	276
PORT MORESBY	OCE	280
OTAGO HARBOUR	OCE	296
LAE	OCE	311
MELBOURNE	OCE	313
NAPIER	OCE	336
TAURANGA	OCE	343
BRISBANE	OCE	348
PORT BOTANY	OCE	350
ADELAIDE	OCE	352
AUCKLAND	OCE	353
FREMANTLE	OCE	384
LYTTELTON	OCE	385

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.7 • The CPPI by Region: Sub-Saharan Africa

PORT NAME	REGION	OVERALL RANKING
BERBERA	SSA	103
MOGADISCIO	SSA	176
CONAKRY	SSA	208
MALABO	SSA	237
FREETOWN	SSA	252
BATA	SSA	269
TAKORADI	SSA	273
TOAMASINA	SSA	294
NAMIBE	SSA	302
MAYOTTE	SSA	303
PORT VICTORIA	SSA	304
ONNE	SSA	308
LAGOS (NIGERIA)	SSA	309
MAPUTO	SSA	317
SAN PEDRO (COTE D'IVOIRE)	SSA	318
LOME	SSA	319
PORT REUNION	SSA	324
MOMBASA	SSA	335
MONROVIA	SSA	340

PORT NAME	REGION	OVERALL RANKING
ABIDJAN	SSA	342
BEIRA	SSA	347
OWENDO	SSA	354
NOUAKCHOTT	SSA	355
TIN CAN ISLAND	SSA	364
NACALA	SSA	366
KRIBI DEEP SEA PORT	SSA	367
PORT LOUIS	SSA	369
DOUALA	SSA	372
DAR ES SALAAM	SSA	373
TEMA	SSA	380
DAKAR	SSA	381
WALVIS BAY	SSA	382
MATADI	SSA	387
PORT ELIZABETH	SSA	391
LUANDA	SSA	392
POINTE-NOIRE	SSA	395
DURBAN	SSA	399
COTONOU	SSA	401
NGQURA	SSA	404
CAPE TOWN	SSA	405

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.8 • The CPPI by Region: Europe and North Africa

PORT NAME	REGION	OVERALL RANKING
TANGER-MEDITERRANEAN	ENA	3
ALGECIRAS	ENA	12
PORT SAID	ENA	16
GEMLIK	ENA	27
SAVONA-VADO	ENA	33
ZEEBRUGGE	ENA	38
BARCELONA	ENA	41
BEIRUT	ENA	68
AARHUS	ENA	71
DILISKELESI	ENA	74
LONDON	ENA	76
ANTWERP	ENA	82
SANTA CRUZ DE TENERIFE	ENA	84
MALAGA	ENA	85

PORT NAME	REGION	OVERALL RANKING
MARSAXLOKK	ENA	92
SOUTHAMPTON	ENA	93
YARIMCA	ENA	96
ROTTERDAM	ENA	97
WILHELMSHAVEN	ENA	98
TALLINN	ENA	101
TRIPOLI (LEBANON)	ENA	102
OSLO	ENA	109
BREMERHAVEN	ENA	110
IZMIR	ENA	113
HAMBURG	ENA	117
HAIFA	ENA	119
LISBON	ENA	121
PIRAEUS	ENA	125

PORT NAME	REGION	OVERALL RANKING
SINES	ENA	126
VIGO	ENA	127
LAS PALMAS	ENA	132
ALEXANDRIA (EGYPT)	ENA	134
PORT AKDENIZ	ENA	136
SOKHNA	ENA	138
CORK	ENA	142
KLAIPEDA	ENA	143
BORUSAN	ENA	145
MUUGA HARBOUR	ENA	146
FREDERICIA	ENA	151
VALENCIA	ENA	152
LIMASSOL	ENA	163
SAGUNTO	ENA	165
HELSINGBORG	ENA	167
DUNKIRK	ENA	169
BURGAS	ENA	170
TARRAGONA	ENA	172
BAR	ENA	173
FELIXSTOWE	ENA	174
NORRKOPING	ENA	177
LATAKIA	ENA	180
ARRECIFE DE LANZAROTE	ENA	182
GIOIA TAURO	ENA	188
HUELVA	ENA	189
RAVENNA	ENA	193
GIJON	ENA	194
RAUMA	ENA	196
CIVITAVECCHIA	ENA	197
LARVIK	ENA	198
PLOCE	ENA	200
NEMRUT BAY	ENA	201
COPENHAGEN	ENA	203
BREST	ENA	204
TARTOUS	ENA	205
CADIZ	ENA	206
FERROL	ENA	207
CASTELLON	ENA	209
GAVLE	ENA	211
HELSINKI	ENA	213
GOTHENBURG	ENA	216
KRISTIANSAND	ENA	217
NANTES-ST NAZAIRE	ENA	221
TEESPORT	ENA	224

PORT NAME	REGION	OVERALL RANKING
HERAKLION	ENA	227
SALERNO	ENA	228
ANCONA	ENA	229
BORDEAUX	ENA	230
PALERMO	ENA	233
VOLOS	ENA	242
BILBAO	ENA	244
VARNA	ENA	245
RADES	ENA	248
ALICANTE	ENA	249
NOVOROSSIYSK	ENA	250
SEVILLE	ENA	251
TRABZON	ENA	253
BARI	ENA	254
GHAZAOUET	ENA	256
BATUMI	ENA	260
KOTKA	ENA	262
GRANGEMOUTH	ENA	264
GDYNIA	ENA	270
VENICE	ENA	275
AGADIR	ENA	281
VLISSINGEN	ENA	285
SAMSUN	ENA	286
AMBARLI	ENA	287
CATANIA	ENA	289
RIGA	ENA	291
LEIXOES	ENA	292
LIVERPOOL (UNITED KINGDOM)	ENA	293
DUBLIN	ENA	301
LIVORNO	ENA	310
KHOMS	ENA	316
THESSALONIKI	ENA	321
GENOA	ENA	322
EL DEKHEILA	ENA	328
CASABLANCA	ENA	329
LA SPEZIA	ENA	330
SETUBAL	ENA	333
DURRES	ENA	338
POTI	ENA	341
NAPLES	ENA	344
GDANSK	ENA	345
GREENOCK	ENA	346
ALGIERS	ENA	349
KOPER	ENA	358

PORT NAME	REGION	OVERALL RANKING
MARSEILLE	ENA	360
CONSTANTZA	ENA	361
BENGHAZI	ENA	362
BRISTOL	ENA	368
ASHDOD	ENA	370
QASR AHMED	ENA	375

PORT NAME	REGION	OVERALL RANKING
BEJAIA	ENA	379
LE HAVRE	ENA	383
DAMIETTA	ENA	389
ISKENDERUN	ENA	390
TRIESTE	ENA	394
RIJEKA	ENA	400
MERSIN	ENA	403

Source: Original table produced for this publication, based on CPPI 2023 data.

Ranking by Throughput

This section presents the CPPI 2023 by throughput. It offers a summary tabulation (from Table 4.9) by throughput using the following defined ranges:

- Large: more than 4 million TEUs per year
- Medium: between 0.5 million and 4 million TEUs per year
- Small: less than 0.5 million TEUs per year

TABLE 4.9 • The CPPI by Throughput: Large Ports (More than 4 million TEUs per Year)

PORT NAME	REGION	OVERALL RANKING
YANGSHAN	Large	1
SALALAH	Large	2
TANGER-MEDITERRANEAN	Large	3
TANJUNG PELEPAS	Large	4
CHIWAN	Large	5
GUANGZHOU	Large	7
CAI MEP	Large	8
NINGBO	Large	11
ALGECIRAS	Large	12
MAWAN	Large	13
DALIAN	Large	14
HONG KONG	Large	15
PORT SAID	Large	16
SINGAPORE	Large	19
TANJUNG PRIOK	Large	20
LIANYUNGANG	Large	21
MUNDRA	Large	22
KAOHSIUNG	Large	23
YANTIAN	Large	24
SHEKOU	Large	25
TIANJIN	Large	28
PORT KLANG	Large	29
XIAMEN	Large	31
BUSAN	Large	35
COLOMBO	Large	40
LAEM CHABANG	Large	46
QINZHOU	Large	52
JEBEL ALI	Large	58
TOKYO	Large	59
JEDDAH	Large	64
ANTWERP	Large	82
JAWAHARLAL NEHRU PORT	Large	90
ZHOUSHAN	Large	94
ROTTERDAM	Large	97
NEW YORK & NEW JERSEY	Large	99
COLON	Large	107
BREMERHAVEN	Large	110
CAT LAI	Large	112
SHANGHAI	Large	114
HAMBURG	Large	117
PIRAEUS	Large	125
SAIGON	Large	144
QINGDAO	Large	150
VALENCIA	Large	152
MANILA	Large	307
SANTOS	Large	334
LONG BEACH	Large	376
LOS ANGELES	Large	378
SAVANNAH	Large	398

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.10 • The CPPI by Throughput: Medium Ports (between 0.5 million and 4 million TEUs per Year)

PORT NAME	REGION	OVERALL RANKING
CARTAGENA (COLOMBIA)	Medium	6
YOKOHAMA	Medium	9
HAMAD PORT	Medium	10
YEOSU	Medium	17
VISAKHAPATNAM	Medium	18
CALLAO	Medium	26
GEMLIK	Medium	27
KING ABDULLAH PORT	Medium	30
KHALIFA PORT	Medium	32
SAVONA-VADO	Medium	33
PIPAVAV	Medium	34
FUZHOU	Medium	36
DAMMAM	Medium	37
ZEEBRUGGE	Medium	38
POSORJA	Medium	39
BARCELONA	Medium	41

PORT NAME	REGION	OVERALL RANKING
BUENAVENTURA	Medium	42
SHIMIZU	Medium	44
INCHEON	Medium	48
DA CHAN BAY TERMINAL ONE	Medium	49
PHILADELPHIA	Medium	50
LAZARO CARDENAS	Medium	51
NAGOYA	Medium	53
KARACHI	Medium	56
JUBAIL	Medium	57
CHARLESTON	Medium	60
KEELUNG	Medium	61
PORT EVERGLADES	Medium	63
KOBE	Medium	65
SOHAR	Medium	66
HAIPHONG	Medium	67
BEIRUT	Medium	68
AQABA	Medium	70
AARHUS	Medium	71
KRISHNAPATNAM	Medium	75
LONDON	Medium	76
MIAMI	Medium	77
CHENNAI	Medium	78
ITAPOA	Medium	80
OSAKA	Medium	81
JACKSONVILLE	Medium	83
ALTAMIRA	Medium	87
JOHOR	Medium	88
MARSAXLOKK	Medium	92
SOUTHAMPTON	Medium	93
HALIFAX	Medium	95
YARIMCA	Medium	96
WILHELMSHAVEN	Medium	98
TANJUNG PERAK	Medium	105
SHANTOU	Medium	106
RIO GRANDE (BRAZIL)	Medium	108
NAHA	Medium	111
IZMIR	Medium	113
VERACRUZ	Medium	115
SAN ANTONIO	Medium	116
DANANG	Medium	118
HAIFA	Medium	119
HAKATA	Medium	120

PORT NAME	REGION	OVERALL RANKING
PUERTO BARRIOS	Medium	122
SIAM SEAPORT	Medium	124
SINES	Medium	126
TAICHUNG	Medium	129
PARANAGUA	Medium	130
LAS PALMAS	Medium	132
NEW ORLEANS	Medium	133
ALEXANDRIA (EGYPT)	Medium	134
SOKHNA	Medium	138
SANTA MARTA	Medium	141
KLAIPEDA	Medium	143
MUUGA HARBOUR	Medium	146
QUANZHOU	Medium	149
VALPARAISO	Medium	154
TANJUNG EMAS	Medium	156
MUHAMMAD BIN QASIM	Medium	157
PAPEETE	Medium	166
KOMPONG SOM	Medium	168
FELIXSTOWE	Medium	174
PUERTO CORTES	Medium	175
PYEONG TAEK	Medium	185
MOBILE	Medium	186
SANTO TOMAS DE CASTILLA	Medium	187
GIOIA TAURO	Medium	188
BALTIMORE (USA)	Medium	191
NEMRUT BAY	Medium	201
CONAKRY	Medium	208
HELSINKI	Medium	213
GOTHENBURG	Medium	216
HONOLULU	Medium	219
SUBIC BAY	Medium	220
SONGKHLA	Medium	236
YANGON	Medium	238
BILBAO	Medium	244
VARNA	Medium	245
BUENOS AIRES	Medium	246
NOVOROSSIYSK	Medium	250
FREETOWN	Medium	252
CAUCEDO	Medium	257
SYAMA PRASAD MOOKERJEE PORT	Medium	258
CRISTOBAL	Medium	261
KOTKA	Medium	262

PORT NAME	REGION	OVERALL RANKING
MANAUS	Medium	267
GDYNIA	Medium	270
VENICE	Medium	275
BANGKOK	Medium	278
UMM QASR	Medium	282
DAVAO	Medium	284
AMBARLI	Medium	287
LEIXOES	Medium	292
LIVERPOOL (UNITED KINGDOM)	Medium	293
OTAGO HARBOUR	Medium	296
PENANG	Medium	297
PUERTO CABELLO	Medium	298
BELAWAN	Medium	300
DUBLIN	Medium	301
BALBOA	Medium	305
PORT OF VIRGINIA	Medium	306
LAGOS (NIGERIA)	Medium	309
LIVORNO	Medium	310
MELBOURNE	Medium	313
LOME	Medium	319
GUAYAQUIL	Medium	320
GENOA	Medium	322
MANZANILLO (MEXICO)	Medium	323
PORT REUNION	Medium	324
HOUSTON	Medium	327
EL DEKHEILA	Medium	328
LA SPEZIA	Medium	330
MOMBASA	Medium	335
DJIBOUTI	Medium	337
CHATTOGRAM	Medium	339
MONROVIA	Medium	340
POTI	Medium	341
ABIDJAN	Medium	342
TAURANGA	Medium	343
NAPLES	Medium	344
GDANSK	Medium	345

PORT NAME	REGION	OVERALL RANKING
BRISBANE	Medium	348
ALGIERS	Medium	349
PORT BOTANY	Medium	350
MONTREAL	Medium	351
ADELAIDE	Medium	352
AUCKLAND	Medium	353
SEATTLE	Medium	356
KOPER	Medium	358
FREEPORT (BAHAMAS)	Medium	359
MARSEILLE	Medium	360
CONSTANTZA	Medium	361
VANCOUVER (CANADA)	Medium	363
TIN CAN ISLAND	Medium	364
MONTEVIDEO	Medium	365
PORT LOUIS	Medium	369
ASHDOD	Medium	370
DOUALA	Medium	372
DAR ES SALAAM	Medium	373
TEMA	Medium	380
DAKAR	Medium	381
LE HAVRE	Medium	383
FREMANTLE	Medium	384
KINGSTON (JAMAICA)	Medium	386
DAMIETTA	Medium	389
ISKENDERUN	Medium	390
LUANDA	Medium	392
ITAJAI	Medium	393
TRIESTE	Medium	394
POINTE-NOIRE	Medium	395
OAKLAND	Medium	396
PRINCE RUPERT	Medium	397
DURBAN	Medium	399
COTONOU	Medium	401
TACOMA	Medium	402
MERSIN	Medium	403
NGQURA	Medium	404
CAPE TOWN	Medium	405

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE 4.11 • The CPPI by Throughput: Small Ports (Less than 0.5 million TEUs per Year)

PORT NAME	REGION	OVERALL RANKING
KHALIFA BIN SALMAN	Small	43
RIO DE JANEIRO	Small	45
KAMARAJAR	Small	47
KATTUPALLI	Small	54
COCHIN	Small	55
SALVADOR	Small	62
HAZIRA	Small	69
WILMINGTON (USA-N CAROLINA)	Small	72
BOSTON (USA)	Small	73
DILISKELESI	Small	74
PUERTO LIMON	Small	79
SANTA CRUZ DE TENERIFE	Small	84
MALAGA	Small	85
YOKKAICHI	Small	86
POINTE-A-PITRE	Small	89
CORONEL	Small	91
WELLINGTON	Small	100
TALLINN	Small	101
TRIPOLI (LEBANON)	Small	102
BERBERA	Small	103
FORT-DE-FRANCE	Small	104
OSLO	Small	109
LISBON	Small	121
MOJI	Small	123
VIGO	Small	127
SHARJAH	Small	128
SUAPE	Small	131
AL DUQM	Small	135
PORT AKDENIZ	Small	136
BATANGAS	Small	137
OMAEZAKI	Small	139
SAN JUAN	Small	140
CORK	Small	142
BORUSAN	Small	145
CHU LAI	Small	147
CEBU	Small	148
FREDERICIA	Small	151
CHIBA	Small	153
RIO HAINA	Small	155
CAGAYAN DE ORO	Small	158
HIBIKINADA	Small	159
SHUAIBA	Small	160
BARRANQUILLA	Small	161
PUERTO BOLIVAR (ECUADOR)	Small	162
LIMASSOL	Small	163
LIRQUEN	Small	164
SAGUNTO	Small	165
HELSINGBORG	Small	167
DUNKIRK	Small	169
BURGAS	Small	170
PUERTO PROGRESO	Small	171
TARRAGONA	Small	172
BAR	Small	173
MOGADISCIO	Small	176
NORRKOPING	Small	177
BASSETERRE	Small	178
GUSTAVIA	Small	179
LATAKIA	Small	180
QUY NHON	Small	181
ARRECIFE DE LANZAROTE	Small	182
GENERAL SAN MARTIN	Small	183
PECEM	Small	184
HUELVA	Small	189
PANJANG	Small	190
MUARA	Small	192
RAVENNA	Small	193
GIJON	Small	194
SHIBUSHI	Small	195
RAUMA	Small	196
CIVITAVECCHIA	Small	197
LARVIK	Small	198
PHILIPSBURG	Small	199
PLOCE	Small	200
LA GUAIRA	Small	202
COPENHAGEN	Small	203
BREST	Small	204
TARTOUS	Small	205
CADIZ	Small	206
FERROL	Small	207
CASTELLON	Small	209
POINT LISAS PORTS	Small	210
GAVLE	Small	211
SHUWAIKH	Small	212
PORT TAMPA BAY	Small	214

PORT NAME	REGION	OVERALL RANKING
BELL BAY	Small	215
KRISTIANSAND	Small	217
OITA	Small	218
NANTES-ST NAZAIRE	Small	221
ADEN	Small	222
APRA HARBOR	Small	223
TEESPORT	Small	224
CASTRIES	Small	225
NGHI SON	Small	226
HERAKLION	Small	227
SALERNO	Small	228
ANCONA	Small	229
BORDEAUX	Small	230
NEW MANGALORE	Small	231
BRIDGETOWN	Small	232
PALERMO	Small	233
PORT AU PRINCE	Small	234
BIG CREEK	Small	235
MALABO	Small	237
KUANTAN	Small	239
PAITA	Small	240
MARIEL	Small	241
VOLOS	Small	242
PARAMARIBO	Small	243
PUERTO QUETZAL	Small	247
RADES	Small	248
ALICANTE	Small	249
SEVILLE	Small	251
TRABZON	Small	253
BARI	Small	254
CALDERA (COSTA RICA)	Small	255
GHAZAOUET	Small	256
NASSAU	Small	259
BATUMI	Small	260
GENERAL SANTOS	Small	263
GRANGEMOUTH	Small	264
SAINT JOHN	Small	265
BLUFF	Small	266
ZARATE	Small	268
BATA	Small	269
NELSON	Small	271
PORT OF SPAIN	Small	272
TAKORADI	Small	273
TIMARU	Small	274

PORT NAME	REGION	OVERALL RANKING
NOUMEA	Small	276
HUENEME	Small	277
SEPETIBA	Small	279
PORT MORESBY	Small	280
AGADIR	Small	281
VILA DO CONDE	Small	283
VLISSINGEN	Small	285
SAMSUN	Small	286
GEORGETOWN (GUYANA)	Small	288
CATANIA	Small	289
KOTA KINABALU	Small	290
RIGA	Small	291
TOAMASINA	Small	294
KUCHING	Small	295
ENSENADA	Small	299
NAMIBE	Small	302
MAYOTTE	Small	303
PORT VICTORIA	Small	304
ONNE	Small	308
LAE	Small	311
ARICA	Small	312
MAZATLAN	Small	314
SAN VICENTE	Small	315
KHOMS	Small	316
MAPUTO	Small	317
SAN PEDRO (COTE D'IVOIRE)	Small	318
THESSALONIKI	Small	321
CORINTO	Small	325
TURBO	Small	326
CASABLANCA	Small	329
MEJILLONES	Small	331
VITORIA	Small	332
SETUBAL	Small	333
NAPIER	Small	336
DURRES	Small	338
GREENOCK	Small	346
BEIRA	Small	347
OWENDO	Small	354
NOUAKCHOTT	Small	355
IQUIQUE	Small	357
BENGHAZI	Small	362
NACALA	Small	366
KRIBI DEEP SEA PORT	Small	367
BRISTOL	Small	368

PORT NAME	REGION	OVERALL RANKING
BINTULU	Small	371
IMBITUBA	Small	374
QASR AHMED	Small	375
ACAJUTLA	Small	377
BEJAIA	Small	379
WALVIS BAY	Small	382

PORT NAME	REGION	OVERALL RANKING
LYTTELTON	Small	385
MATADI	Small	387
PORT SUDAN	Small	388
PORT ELIZABETH	Small	391
RIJEKA	Small	400

Source: Original table produced for this publication, based on CPPI 2023 data.

5. Conclusions and Next Steps

The primary objective of developing the CPPI by utilizing existing empirical data was to create an impartial benchmark to assess and compare container port performance across different ports, over time. This was done to facilitate the identification of gaps and opportunities for improvement in a standardized manner, which could ultimately benefit all stakeholders, including shipping lines, national governments, and consumers. The CPPI was intended to serve as a crucial point of reference for various stakeholders in the global economy, such as port authorities and operators, national governments, development agencies, supranational organizations, and other public and private entities involved in trade, logistics, and supply chain services.

In the future, the CPPI is expected to undergo further refinement in subsequent editions, incorporating stakeholder feedback, advancements in data scope and quality, and additional trend analysis. The World Bank-S&P Global Market Intelligence team will continue to improve the methodologies, expand the scope by potentially including more ports, and enhance the data. The next version, CPPI 2024, will be comparable to the current edition, facilitating trend analysis of container port performance across the aggregate index. Specifically, subsequent releases will also contain indices aggregated from the statistical and administrative approaches. CPPI 2023 considers the dissimilarities between the two approaches while simultaneously gaining a deeper understanding of the vital factors that affect container port performance. The goal remains to identify opportunities for improvement to benefit all stakeholders, including ports, shipping lines, governments, line agencies, businesses, and consumers.

Appendix A: The CPPI 2023

TABLE A.1 • Aggregated Rankings Using Borda-type Approach

PORT NAME	OVERALL RANKING
YANGSHAN	1
SALALAH	2
CARTAGENA (COLOMBIA)	3
TANGER-MEDITERRANEAN	4
TANJUNG PELEPAS	5
CHIWAN	6
CAI MEP	7
GUANGZHOU	8
YOKOHAMA	9
ALGECIRAS	10
HAMAD PORT	11
NINGBO	12
MAWAN	13
DALIAN	14
HONG KONG	15
PORT SAID	16
SINGAPORE	17
KAOHSIUNG	18

PORT NAME	OVERALL RANKING
VISAKHAPATNAM	19
YEOSU	20
TIANJIN	21
YANTIAN	22
TANJUNG PRIOK	23
LIANYUNGANG	24
SHEKOU	25
CALLAO	26
MUNDRA	27
PORT KLANG	28
KHALIFA PORT	29
KING ABDULLAH PORT	30
XIAMEN	31
BUSAN	32
GEMLIK	33
BARCELONA	34
DAMMAM	35
SAVONA-VADO	36

PORT NAME	OVERALL RANKING
POSORJA	37
FUZHOU	38
ZEEBRUGGE	39
COLOMBO	40
PIPAVAV	41
RIO DE JANEIRO	42
KHALIFA BIN SALMAN	43
BUENAVENTURA	44
LAEM CHABANG	45
SHIMIZU	46
KAMARAJAR	47
INCHEON	48
JEBEL ALI	49
LAZARO CARDENAS	50
AARHUS	51
DA CHAN BAY TERMINAL ONE	52
CHARLESTON	53
TOKYO	54
PHILADELPHIA	55
NAGOYA	56
KATTUPALLI	57
JEDDAH	58
JUBAIL	59
QINZHOU	60
KARACHI	61
KEELUNG	62
COCHIN	63
KOBE	64
PORT EVERGLADES	65
SOHAR	66
SALVADOR	67
HAZIRA	68
LONDON	69
HAIPHONG	70
KRISHNAPATNAM	71
WILHELMSHAVEN	72
BEIRUT	73
MIAMI	74
BOSTON (USA)	75
ANTWERP	76
DILISKELESI	77
ITAPOA	78
PUERTO LIMON	79
CHENNAI	80

PORT NAME	OVERALL RANKING
WILMINGTON (USA-N CAROLINA)	81
MARSAXLOKK	82
ZHOUSHAN	83
SOUTHAMPTON	84
OSAKA	85
HAIFA	86
AQABA	87
BREMERHAVEN	88
SANTA CRUZ DE TENERIFE	89
MALAGA	90
ROTTERDAM	91
NEW YORK & NEW JERSEY	92
JOHOR	93
POINTE-A-PITRE	94
YOKKAICHI	95
JAWAHARLAL NEHRU PORT	96
CORONEL	97
TRIPOLI (LEBANON)	98
JACKSONVILLE	99
ALTAMIRA	100
TANJUNG PERAK	101
COLON	102
PARANAGUA	103
PIRAEUS	104
OSLO	105
BERBERA	106
RIO GRANDE (BRAZIL)	107
HALIFAX	108
TALLINN	109
SAN ANTONIO	110
CAT LAI	111
WELLINGTON	112
SHANTOU	113
FORT-DE-FRANCE	114
DANANG	115
SHANGHAI	116
HAKATA	117
IZMIR	118
QINGDAO	119
SIAM SEAPORT	120
HAMBURG	121
SOKHNA	122
SHARJAH	123
VERACRUZ	124

PORT NAME	OVERALL RANKING
PUERTO BARRIOS	125
TAICHUNG	126
MOJI	127
VIGO	128
YARIMCA	129
NAHA	130
PORT AKDENIZ	131
SAIGON	132
BATANGAS	133
LISBON	134
SINES	135
LAS PALMAS	136
SAN JUAN	137
CHU LAI	138
KLAIPEDA	139
OMAEZAKI	140
SANTA MARTA	141
VALENCIA	142
CEBU	143
BORUSAN	144
SUAPE	145
MUHAMMAD BIN QASIM	146
RIO HAINA	147
QUANZHOU	148
CORK	149
TANJUNG EMAS	150
VALPARAISO	151
CAGAYAN DE ORO	152
BARRANQUILLA	153
MUUGA HARBOUR	154
CHIBA	155
FREDERICIA	156
LIMASSOL	157
AL DUQM	158
HIBIKINADA	159
LIRQUEN	160
SHUAIBA	161
BURGAS	162
HELSINGBORG	163
PUERTO BOLIVAR (ECUADOR)	164
SAGUNTO	165
MOGADISCIO	166
NEW ORLEANS	167
KOMPONG SOM	168

PORT NAME	OVERALL RANKING
BAR	169
SANTO TOMAS DE CASTILLA	170
DUNKIRK	171
ALEXANDRIA (EGYPT)	172
MOBILE	173
TARRAGONA	174
PUERTO PROGRESO	175
PAPEETE	176
NORRKOPING	177
PUERTO CORTES	178
PECEM	179
BASSETERRE	180
GUSTAVIA	181
FELIXSTOWE	182
GIOIA TAURO	183
PYEONG TAEK	184
ARRECIFE DE LANZAROTE	185
PANJANG	186
GENERAL SAN MARTIN	187
QUY NHON	188
BALTIMORE (USA)	189
RAUMA	190
RAVENNA	191
HUELVA	192
CAUCEDO	193
MUARA	194
LA GUAIRA	195
LATAKIA	196
CONAKRY	197
COPENHAGEN	198
SHIBUSHI	199
CIVITAVECCHIA	200
BELL BAY	201
LARVIK	202
BRIDGETOWN	203
GIJON	204
POINT LISAS PORTS	205
PLOCE	206
TARTOUS	207
SHUWAIKH	208
CADIZ	209
TEESPORT	210
FERROL	211
PHILIPSBURG	212

PORT NAME	OVERALL RANKING
CASTELLON	213
HELSINKI	214
BREST	215
KRISTIANSAND	216
BORDEAUX	217
SALERNO	218
PORT TAMPA BAY	219
PORT AU PRINCE	220
CASTRIES	221
OITA	222
HERAKLION	223
HONOLULU	224
VOLOS	225
FREETOWN	226
SUBIC BAY	227
SONGKHLA	228
PUERTO QUETZAL	229
BILBAO	230
PARAMARIBO	231
NGHI SON	232
RADES	233
APRA HARBOR	234
NEW MANGALORE	235
CRISTOBAL	236
ADEN	237
ALICANTE	238
BIG CREEK	239
VARNA	240
PALERMO	241
SYAMA PRASAD MOOKERJEE PORT	242
PAITA	243
MALABO	244
ANCONA	245
SEVILLE	246
MARIEL	247
TRABZON	248
GOTHENBURG	249
YANGON	250
GAVLE	251
GRANGEMOUTH	252
NASSAU	253
GHAZAOUET	254
BARI	255
MANAUS	256

PORT NAME	OVERALL RANKING
KOTKA	257
NOVOROSSIYSK	258
CALDERA (COSTA RICA)	259
BLUFF	260
SAINT JOHN	261
NANTES-ST NAZAIRE	262
BATUMI	263
TIMARU	264
ZARATE	265
PORT OF SPAIN	266
GENERAL SANTOS	267
NELSON	268
BUENOS AIRES	269
VENICE	270
BATA	271
GDYNIA	272
BANGKOK	273
TAKORADI	274
KUANTAN	275
AMBARLI	276
RIGA	277
HUENEME	278
DAVAO	279
NEMRUT BAY	280
KOTA KINABALU	281
UMM QASR	282
SEPETIBA	283
SAMSUN	284
NOUMEA	285
ENSENADA	286
VILA DO CONDE	287
AGADIR	288
PORT MORESBY	289
LEIXOES	290
KUCHING	291
OTAGO HARBOUR	292
VLISSINGEN	293
SANTOS	294
PUERTO CABELLO	295
LIVERPOOL (UNITED KINGDOM)	296
CATANIA	297
GEORGETOWN (GUYANA)	298
PENANG	299
TOAMASINA	300

PORT NAME	OVERALL RANKING
PORT OF VIRGINIA	301
DUBLIN	302
NAMIBE	303
PORT VICTORIA	304
ONNE	305
LIVORNO	306
MAYOTTE	307
BELAWAN	308
LAGOS (NIGERIA)	309
MANILA	310
MELBOURNE	311
HOUSTON	312
SAN VICENTE	313
BALBOA	314
GUAYAQUIL	315
ARICA	316
KHOMS	317
LOME	318
GENOA	319
PORT REUNION	320
SAN PEDRO (COTE D'IVOIRE)	321
MAZATLAN	322
TURBO	323
PORT BOTANY	324
MAPUTO	325
LAE	326
THESSALONIKI	327
MOMBASA	328
LA SPEZIA	329
CORINTO	330
MANZANILLO (MEXICO)	331
CASABLANCA	332
MEJILLONES	333
CHATTOGRAM	334
VITORIA	335
NAPIER	336
BRISBANE	337
GREENOCK	338
NAPLES	339
BEIRA	340
EL DEKHEILA	341
DURRES	342
GDANSK	343
MONROVIA	344

PORT NAME	OVERALL RANKING
ADELAIDE	345
ALGIERS	346
TAURANGA	347
MONTREAL	348
POTI	349
AUCKLAND	350
SETUBAL	351
IQUIQUE	352
ABIDJAN	353
MARSEILLE	354
CONSTANTZA	355
VANCOUVER (CANADA)	356
OWENDO	357
NOUAKCHOTT	358
FREEPORT (BAHAMAS)	359
SEATTLE	360
BENGHAZI	361
KOPER	362
NACALA	363
TIN CAN ISLAND	364
BRISTOL	365
KRIBI DEEP SEA PORT	366
DAR ES SALAAM	367
QASR AHMED	368
PORT LOUIS	369
DOUALA	370
BINTULU	371
LE HAVRE	372
LONG BEACH	373
FREMANTLE	374
LOS ANGELES	375
TEMA	376
IMBITUBA	377
KINGSTON (JAMAICA)	378
DJIBOUTI	379
WALVIS BAY	380
DAKAR	381
BEJAIA	382
ACAJUTLA	383
MONTEVIDEO	384
LYTTELTON	385
MATADI	386
DAMIETTA	387
PORT SUDAN	388

PORT NAME	OVERALL RANKING
LUANDA	389
ASHDOD	390
PORT ELIZABETH	391
ISKENDERUN	392
ITAJAI	393
POINTE-NOIRE	394
SAVANNAH	395
TRIESTE	396
OAKLAND	397

PORT NAME	OVERALL RANKING
DURBAN	398
PRINCE RUPERT	399
RIJEKA	400
TACOMA	401
COTONOU	402
MERSIN	403
NGQURA	404
CAPE TOWN	405

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE A.2 • The CPPI 2023 (the Administrative Approach)

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
YANGSHAN	1	177.90	3,509	24	3	6	3	3	1	0
SALALAH	2	164.72	1,146		42	7	1	4	2	0
TANGER-MEDITERRANEAN	3	159.56	3,150	142	59	12	7	2	5	2
TANJUNG PELEPAS	4	158.32	3,655	42	61	28	11	1	6	2
CHIWAN	5	158.17	948	51	24	15	6	12	23	18
CARTAGENA (COLOMBIA)	6	158.02	1,586	38	17	26	12	7	4	−2
GUANGZHOU	7	153.72	1,761	47	56	17	4	14	9	2
CAI MEP	8	150.81	924	16	6	5	46	13	13	5
YOKOHAMA	9	150.47	1,355	12	5	75	22	5	12	3
HAMAD PORT	10	149.78	291		12	4	16	16	8	−2
NINGBO	11	145.40	4,411	68	28	18	19	21	7	−4
ALGECIRAS	12	142.34	2,061	85	46	39	15	18	18	6
MAWAN	13	142.19	507	79	70	21	10	25	15	2
DALIAN	14	138.97	754	128	119	81	9	6	44	30
HONG KONG	15	134.05	3,849	36	40	44	18	28	10	−5
PORT SAID	16	131.17	1,132	104	112	66	32	10	11	−5
YEOSU	17	130.69	546	15	38	33	49	26	21	4
VISAKHAPATNAM	18	129.63	96		27	76	20	17	112	94
SINGAPORE	19	127.88	6,949	184	89	54	48	11	19	0
TANJUNG PRIOK	20	127.28	879	46	168	68	40	8	282	262
LIANYUNGANG	21	126.54	235		64	34	29	24	77	56
MUNDRA	22	124.83	827	33	90	97	23	22	50	28

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
KAOHSIUNG	23	123.05	2,742	53	43	24	30	36	26	3
YANTIAN	24	121.56	2,714	150	74	70	43	20	51	27
SHEKOU	25	121.06	939	86	93	56	13	34	14	–11
CALLAO	26	119.67	1,074	78	113	55	27	29	43	17
GEMLIK	27	119.08	803	87	53	35	21	37	130	103
TIANJIN	28	118.73	963	27	124	58	25	30	25	–3
PORT KLANG	29	116.43	3,054	134	84	45	35	31	36	7
KING ABDULLAH PORT	30	114.20	132	281	4	3		9	16	–14
XIAMEN	31	112.81	2,318	206	134	92	24	27	32	1
KHALIFA PORT	32	112.32	1,086	228	136	90	33	19	3	–29
SAVONA-VADO	33	107.76	248	125	73	106	75	15	59	26
PIPAVAV	34	106.00	276		2	1	2		31	–3
BUSAN	35	104.84	5,165	83	75	57	70	33	22	–13
FUZHOU	36	103.79	171		34	2	37	55	38	2
DAMMAM	37	103.62	341	26	36	49	58	41	33	–4
ZEEBRUGGE	38	103.21	166	130	100	89	8	42	68	30
POSORJA	39	103.06	232		16	20	53	43	17	–22
COLOMBO	40	102.57	2,009	185	137	60	39	35	29	–11
BARCELONA	41	101.11	1,571	110	78	25	42	46	35	–6
BUENAVENTURA	42	99.56	529		44	38	26	47	20	–22
KHALIFA BIN SALMAN	43	95.02	147	10	21	14	14		73	30
SHIMIZU	44	94.45	374	17	15	13	17		46	2
RIO DE JANEIRO	45	94.40	616	158	25	43	82	40	66	21
LAEM CHABANG	46	86.54	1,376	94	79	72	56	51	27	–19
KAMARAJAR	47	85.61	110		8	9	28		80	33
INCHEON	48	80.73	311	7	26	46	31		34	–14
DA CHAN BAY TERMINAL ONE	49	79.27	214	23	62	8	64		61	12
PHILADELPHIA	50	78.25	546	202	19	19	36		93	43
LAZARO CARDENAS	51	77.02	744	70	99	74	44	64	37	–14
QINZHOU	52	74.35	91	131	106	94	5		New	New
NAGOYA	53	74.04	1,201	25	11	48	60		48	–5
KATTUPALLI	54	74.04	157	22	10	50	59		82	28
COCHIN	55	74.00	42		58	23	34		84	29
KARACHI	56	73.27	306		122	83	57	54	85	29
JUBAIL	57	73.09	176		71	78	61	59	65	8
JEBEL ALI	58	72.29	2,143	4	186	77	66	60	40	–18
TOKYO	59	72.12	1,101	40	39	51	54		54	–5
CHARLESTON	60	70.58	1,174	122	102	91	86	49	341	281

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
KEELUNG	61	70.31	739	60	60	73	41		67	6
SALVADOR	62	70.14	406		68	29	38		115	53
PORT EVERGLADES	63	69.74	546	55	51	65	52		89	26
JEDDAH	64	64.91	1,579	274	237	107	62	39	28	–36
KOBE	65	63.75	1,182	5	13	52	87		47	–18
SOHAR	66	63.33	192		52	37	80	71	45	–21
HAIPHONG	67	62.31	733	136	148	53	45		138	71
BEIRUT	68	62.09	621	96	103	61	90	63	318	250
HAZIRA	69	61.96	140		18	40	73		86	17
AQABA	70	60.43	209	21	20	99	85	72	57	–13
AARHUS	71	60.40	174	82	35	161		32	96	25
WILMINGTON (USA-N CAROLINA)	72	60.38	189		125	114	51	62	41	–31
BOSTON (USA)	73	59.98	138		49	63	63		63	–10
DILISKELESI	74	59.50	145	63	48	93	69		74	250
KRISHNAPATNAM	75	58.11	69	100	7	10			71	–4
LONDON	76	56.84	1,476	141	72	96	77	70	289	213
MIAMI	77	55.99	427	59	23	104	76		207	130
CHENNAI	78	54.77	79	61	121	80	71		107	29
PUERTO LIMON	79	54.04	461	11	45	16			87	8
ITAPOA	80	53.38	484		80	67	72		69	–11
OSAKA	81	50.89	570	8	32	32			79	–2
ANTWERP	82	49.89	3,486	205	176	124	95	53	76	–6
JACKSONVILLE	83	49.63	112		67	98	98	66	83	0
SANTA CRUZ DE TENERIFE	84	47.35	279	14	41		68		75	–9
MALAGA	85	46.22	106	74	96	27			111	26
YOKKAICHI	86	45.93	260		22	22			98	12
ALTAMIRA	87	43.47	687	179	164	117	55		55	–32
JOHOR	88	43.25	183	91	98	36			90	2
POINTE-A-PITRE	89	43.18	251	112	57	47			97	8
JAWAHARLAL NEHRU PORT	90	42.79	991	326	141	59	47	23	91	1
CORONEL	91	42.65	185		55		103	58	30	–61
MARSAXLOKK	92	42.62	1,501	267	220	147	67	50	42	–50
SOUTHAMPTON	93	41.55	522	72	155	137	117	52	222	129
ZHOUSHAN	94	38.79	395		189	169	84	44	78	–16
HALIFAX	95	38.14	298	139	85	105	108	77	286	191
YARIMCA	96	38.13	571	99	129	119	102	74	39	191
ROTTERDAM	97	38.07	2,863	243	197	127	83	61	267	–57
WILHELMSHAVEN	98	37.65	285	198	110	102	149	38	145	170

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
NEW YORK & NEW JERSEY	99	36.45	1,335	180	140	79	94	82	309	47
WELLINGTON	100	36.02	101	98	128	62			148	210
TALLINN	101	35.93	91	58	179	41			185	48
TRIPOLI (LEBANON)	102	35.61	125	226	153		50		205	84
BERBERA	103	35.55	82	44	104	85			146	103
FORT-DE-FRANCE	104	35.49	182	191	144	31			94	43
TANJUNG PERAK	105	35.42	454	76	92	84			99	–10
SHANTOU	106	35.14	217	49	108	86			64	–6
COLON	107	33.36	1,365	169	123	64	99	83	95	–42
RIO GRANDE (BRAZIL)	108	32.81	401		118	88	109		52	–12
OSLO	109	32.50	98	56	1				160	–56
BREMERHAVEN	110	31.96	1,238	108	158	139	124	56	60	–50
NAHA	111	28.99	29			11			101	–10
CAT LAI	112	28.88	1,017	6	14				110	–2
IZMIR	113	28.69	251	159	131	87			149	36
SHANGHAI	114	28.01	2,672	90	187	113	105		218	104
VERACRUZ	115	27.96	508	157	107	103			104	–11
SAN ANTONIO	116	27.53	387		147	101	118	67	265	149
HAMBURG	117	27.42	2,122	196	190	121	107	69	328	211
DANANG	118	26.62	267	9	37				116	–2
HAIFA	119	26.62	764	148	195	131	100	75	58	–61
HAKATA	120	26.29	370	28	29				108	–12
LISBON	121	25.92	78	213	215	42			220	99
PUERTO BARRIOS	122	25.85	301	39	31				117	–5
MOJI	123	25.41	115	43	33				135	12
SIAM SEAPORT	124	25.12	356	19	50				72	–52
PIRAEUS	125	24.46	1,440	244	227	153	111	48	53	–72
SINES	126	24.05	49			118	101	68	202	76
VIGO	127	23.73	388	48	54				140	13
SHARJAH	128	23.60	59	30	63				120	–8
TAICHUNG	129	23.48	516	29	65				125	–4
PARANAGUA	130	23.33	778		150	167	126	45	70	–60
SUAPE	131	23.32	290		114	100	119		176	45
LAS PALMAS	132	22.79	155	20	82				New	New
NEW ORLEANS	133	22.41	412		232	138	74		137	4
ALEXANDRIA (EGYPT)	134	21.83	329	249	296	82	79		270	136
AL DUQM	135	21.58	30		66	123	120		New	New
PORT AKDENIZ	136	21.49	119	34	95				131	–5

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
BATANGAS	137	21.28	185	75	76				128	–9
SOKHNA	138	20.76	163	146	172	125	113	78	277	139
OMAEZAKI	139	20.61	45		9				126	–13
SAN JUAN	140	20.13	201	88	86				134	–6
SANTA MARTA	141	19.94	214	84	94				127	–14
CORK	142	19.84	52	92	88				New	New
KLAIPEDA	143	19.70	257	54	109				191	48
PORT AKDENIZ	136	21.49	119	34	95					131
HAIFA	119	26.62	764	148	195	131	100	75		58
HAKATA	120	26.29	370	28	29					108
LISBON	121	25.92	78	213	215	42				220
SAIGON	144	19.47	234	57	111				121	–23
BORUSAN	145	19.43	81	45	117				173	28
MUUGA HARBOUR	146	19.02	54	80	146	136			New	New
CHU LAI	147	18.40	92	71	120				163	16
CEBU	148	18.38	130	50	127				143	–5
QUANZHOU	149	18.35	45		30				New	New
QINGDAO	150	18.09	2,985	161	160	140	138	57	214	64
FREDERICIA	151	17.96	74	93	116				153	2
VALENCIA	152	17.60	945	160	194	141	104	76	302	150
CHIBA	153	17.22	38		47				New	New
VALPARAISO	154	16.77	272		77		114		189	35
RIO HAINA	155	16.63	141	95	130				159	4
TANJUNG EMAS	156	16.16	177	32	157				136	–20
MUHAMMAD BIN QASIM	157	15.70	524	77	87	95	143		88	–69
CAGAYAN DE ORO	158	15.38	180	69	152				165	7
HIBIKINADA	159	15.28	43	62	156				New	New
SHUAIBA	160	15.28	166	188	97				119	–41
BARRANQUILLA	161	15.20	85	116	132				169	8
PUERTO BOLIVAR (ECUADOR)	162	15.06	85		69				142	–20
LIMASSOL	163	14.90	198	106	142				100	–63
LIRQUEN	164	14.89	53		135	110	129		124	–40
SAGUNTO	165	14.62	32		81				New	New
PAPEETE	166	13.71	66	64	91	163			141	–25
HELSINGBORG	167	13.64	104	153	133				150	–17
KOMPONG SOM	168	13.46	181	154	138				New	New
DUNKIRK	169	13.02	298	114	101	126	96	90	308	139
BURGAS	170	12.82	109	109	162				174	4

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
PUERTO PROGRESO	171	12.39	70	129	159				157	–14
TARRAGONA	172	11.98	46	144	154				285	113
BAR	173	11.36	99	127	169				151	–22
FELIXSTOWE	174	11.20	545	277	292	108	89	79	262	88
PUERTO CORTES	175	11.19	461	149	163				92	–83
MOGADISCIO	176	11.05	78	101	182				225	49
NORRKOPING	177	10.81	89	232	126				182	5
BASSETERRE	178	10.39	32	1					New	New
GUSTAVIA	179	10.36	91	2					171	–8
LATAKIA	180	9.84	86	162	170				180	0
QUY NHON	181	9.76	135	263	105				139	–42
ARRECIFE DE LANZAROTE	182	9.68	33	3					New	New
GENERAL SAN MARTIN	183	9.52	45		143				New	New
PECEM	184	9.39	325	271	225	69	130		105	–79
PYEONG TAEK	185	8.98	84		149				New	New
MOBILE	186	8.92	416	234	145	132	127		245	59
SANTO TOMAS DE CASTILLA	187	8.87	161	176	173				250	63
GIOIA TAURO	188	8.80	75	37		175	91		133	–55
HUELVA	189	8.31	36	18					New	New
PANJANG	190	8.07	89	66	226				230	40
BALTIMORE (USA)	191	7.85	420		161	145	116		301	110
MUARA	192	7.53	29		167				New	New
RAVENNA	193	7.37	273	123	202				167	–26
GIJON	194	7.27	119	102	216				123	–71
SHIBUSHI	195	7.15	38	52					New	New
RAUMA	196	7.01	99	204	181				201	5
CIVITAVECCHIA	197	6.38	43	145	203				187	–10
LARVIK	198	6.21	59	81					183	–15
PHILIPSBURG	199	6.17	107	117	223				162	–37
PLOCE	200	6.12	49	97	239				New	New
NEMRUT BAY	201	5.86	1,069	111	139	109	144	80	103	–98
LA GUAIRA	202	5.74	122	135	218				215	13
COPENHAGEN	203	5.24	68	105					186	–17
BREST	204	5.12	50	133	230				177	–27
TARTOUS	205	4.83	25	115					New	New
CADIZ	206	4.62	62	119					161	–45
FERROL	207	4.54	85	121					New	New
CONAKRY	208	4.40	213	168	221				196	–12

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
CASTELLON	209	4.21	30		193				New	New
POINT LISAS PORTS	210	4.19	50	132					244	34
GAVLE	211	4.05	104	164	228				249	38
SHUWAIKH	212	4.03	209		196				152	−60
HELSINKI	213	3.92	124	166	229				223	10
PORT TAMPA BAY	214	3.82	126		83	142	136		129	−85
BELL BAY	215	3.58	29	107	247				192	−23
GOTHENBURG	216	3.49	272	171	180	134	65	93	113	−103
KRISTIANSAND	217	3.38	35	151					200	−17
OITA	218	3.36	38	152					New	New
HONOLULU	219	3.21	41	288	185	130			New	New
SUBIC BAY	220	3.00	138	223	206				198	−22
NANTES-ST NAZAIRE	221	2.97	161	220	260	129			147	−74
ADEN	222	2.84	34	73	307	122			266	44
APRA HARBOR	223	2.63	37		208				188	−35
TEESPORT	224	2.46	221	138	244				240	16
CASTRIES	225	2.46	29	173					New	New
NGHI SON	226	2.23	34		211				New	New
HERAKLION	227	2.20	30	177					195	−32
SALERNO	228	1.93	235	156	207	157			156	−72
ANCONA	229	1.89	153	200	238				166	−63
BORDEAUX	230	1.72	31	190					212	−18
NEW MANGALORE	231	1.50	25		222				New	New
BRIDGETOWN	232	1.48	52	199					New	New
PALERMO	233	1.44	39	216	235				194	−39
PORT AU PRINCE	234	0.87	34	212					New	New
BIG CREEK	235	0.65	24	140	256				New	New
SONGKHLA	236	0.52	46	194	243				New	New
MALABO	237	0.45	33		236				New	New
YANGON	238	0.31	213	189	246				New	New
KUANTAN	239	0.29	52	258	201				New	New
PAITA	240	0.14	220	41	115	30	166		102	−138
MARIEL	241	0.09	45	225					208	−33
VOLOS	242	0.03	24	227					New	New
PARAMARIBO	243	(0.08)	30	229					New	New
BILBAO	244	(0.18)	325	181	231	156			206	−38
VARNA	245	(0.62)	66	187	251				237	−8
BUENOS AIRES	246	(0.64)	266		166	143	139	73	168	−78

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
PUERTO QUETZAL	247	(0.83)	327	35	174	173	123		118	–129
RADES	248	(0.94)	177	236					209	–39
ALICANTE	249	(0.98)	54	172	262				227	–22
NOVOROSSIYSK	250	(1.00)	68	207	249				181	–69
SEVILLE	251	(1.16)	38	241					New	New
FREETOWN	252	(1.44)	161	113	277				221	–31
TRABZON	253	(1.85)	24	250					New	New
BARI	254	(2.18)	47	203	261				179	–75
CALDERA (COSTA RICA)	255	(2.19)	155	273	213				213	–42
GHAZAOUET	256	(3.22)	41	264					New	New
CAUCEDO	257	(3.29)	799	245	177	133	106	87	158	–99
SYAMA PRASAD MOOKERJEE PORT	258	(3.37)	59	266					New	New
NASSAU	259	(3.48)	152	167	278				224	–35
BATUMI	260	(3.77)	61	175	276				236	–24
CRISTOBAL	261	(3.79)	762	302	240	154	93		306	45
KOTKA	262	(3.84)	81	183	275				226	–36
GENERAL SANTOS	263	(4.01)	69	118	295				New	New
GRANGEMOUTH	264	(4.02)	72	270					New	New
SAINT JOHN	265	(4.07)	181		264				233	–32
BLUFF	266	(4.16)	38		266				190	–76
MANAUS	267	(4.99)	150	186	285				234	–33
ZARATE	268	(5.65)	45		273				New	New
BATA	269	(5.70)	35	215	283				New	New
GDYNIA	270	(6.54)	360	163	165	135	88	95	235	–35
NELSON	271	(6.67)	85	193	294				204	–67
PORT OF SPAIN	272	(6.90)	185	253	270				242	–30
TAKORADI	273	(8.03)	41	296	219				239	–34
TIMARU	274	(8.27)	48	278	253				247	–27
VENICE	275	(8.92)	191	211	298				254	–21
NOUMEA	276	(9.93)	105	89	325				122	–154
HUENEME	277	(10.38)	42		301				243	–34
BANGKOK	278	(10.62)	341	143	314				246	–32
SEPETIBA	279	(11.21)	102		175		142		197	–82
PORT MORESBY	280	(11.71)	57	284	268				New	New
AGADIR	281	(12.12)	98	285	267				256	–25
ALICANTE	249	(0.98)	54	172	262				227	–22
NOVOROSSIYSK	250	(1.00)	68	207	249				181	–69
SEVILLE	251	(1.16)	38	241					New	New

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
FREETOWN	252	(1.44)	161	113	277				221	–31
TRABZON	253	(1.85)	24	250					New	New
UMM QASR	282	(12.29)	201		272	162			170	–112
VILA DO CONDE	283	(13.02)	178	295	263				199	–84
DAVAO	284	(13.04)	300	170	323				253	–31
VLISSINGEN	285	(13.33)	24	13	281	181			New	New
SAMSUN	286	(13.57)	41	259	303				New	New
AMBARLI	287	(13.87)	817	247	198	146	110	86	56	–231
GEORGETOWN (GUYANA)	288	(14.67)	93	257	308				New	New
CATANIA	289	(14.78)	60	233	315				193	–96
KOTA KINABALU	290	(14.87)	37	230	317				New	New
RIGA	291	(15.04)	198	126	279	177			248	–43
LEIXOES	292	(15.14)	239	256	311				172	–120
LIVERPOOL (UNITED KINGDOM)	293	(15.19)	169	155	224	186			New	New
TOAMASINA	294	(16.08)	138	137	335				231	–63
KUCHING	295	(16.41)	46	246	320				New	New
OTAGO HARBOUR	296	(17.18)	186	67	242	194			278	–18
PENANG	297	(17.45)	258	293	191	179			81	–216
PUERTO CABELLO	298	(17.70)	104	235	330				261	–37
ENSENADA	299	(18.41)	149		300	158	125		109	–190
BELAWAN	300	(18.41)	159	269	319				217	–83
DUBLIN	301	(19.01)	132	217	334				258	–43
NAMIBE	302	(19.10)	30	201	339				New	New
MAYOTTE	303	(19.60)	66	272	322				269	–34
PORT VICTORIA	304	(20.08)	75		336				251	–53
BALBOA	305	(21.80)	1,593	311	178	191	112	65	62	–243
PORT OF VIRGINIA	306	(24.02)	1,436		184	149	132	85	49	–257
MANILA	307	(25.48)	1,063	237	305	178			333	26
ONNE	308	(25.66)	105	197	280	188			304	–4
LAGOS (NIGERIA)	309	(26.83)	241		289	185			263	–46
LIVORNO	310	(27.36)	350	147	183	148	159		311	1
LAE	311	(28.52)	54	275	344				272	–39
ARICA	312	(29.76)	134		205		156		232	–80
MELBOURNE	313	(30.86)	773	240	199	195	133		276	–37
MAZATLAN	314	(30.97)	43	222	350				New	New
SAN VICENTE	315	(31.64)	75		271		151		260	–55
KHOMS	316	(32.34)	85	251	349				New	New
MAPUTO	317	(33.24)	87	291	345				252	–65

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
SAN PEDRO (COTE D'IVOIRE)	318	(33.73)	76	289	346				296	–22
LOME	319	(34.21)	182		284	200			319	0
GUAYAQUIL	320	(34.39)	667	31	204	172	157	81	280	–40
THESSALONIKI	321	(34.90)	317	308	299	170			320	–1
GENOA	322	(35.00)	867	209	257	152	134	88	321	–1
MANZANILLO (MEXICO)	323	(35.41)	1,067	305	209	111	115	94	264	–59
PORT REUNION	324	(35.48)	299	238	214	155	158		300	–24
CORINTO	325	(35.62)	134		353				257	–68
TURBO	326	(37.29)	46	283	348				New	New
HOUSTON	327	(37.49)	904	120	192	171	162		338	11
EL DEKHEILA	328	(38.66)	260	210	293	187	137		144	–184
CASABLANCA	329	(39.80)	253	239	306	199			155	–174
LA SPEZIA	330	(40.02)	153	306	255	120	122	92	334	4
MEJILLONES	331	(40.12)	111		321		150		273	–58
VITORIA	332	(40.48)	56	103	358				175	–157
SETUBAL	333	(41.45)	82	309	347				New	New
SANTOS	334	(41.91)	1,189	279	234	176	128	84	114	–220
MOMBASA	335	(44.11)	445	294	309	193			325	–10
NAPIER	336	(44.14)	172	248	313	202			322	–14
DJIBOUTI	337	(44.20)	293	165	210	150	81	105	24	–313
DURRES	338	(44.58)	72	252	356				255	–83
CHATTOGRAM	339	(44.85)	402	301	351				310	–29
MONROVIA	340	(48.90)	82	300	354				271	–69
POTI	341	(49.55)	161	280	357				287	–54
ABIDJAN	342	(51.05)	471	319	297	182			335	–7
TAURANGA	343	(51.91)	489	261	324	204	121		324	–19
NAPLES	344	(52.11)	120	124	200	203	154		274	–70
GDANSK	345	(52.30)	366	195	265	71	97	106	292	–53
GREENOCK	346	(53.24)	104	178	269	212			New	New
BEIRA	347	(55.09)	159	182	217	217			229	–118
BRISBANE	348	(57.38)	657	231	212	151	170		288	–60
ALGIERS	349	(57.64)	66	292	361				New	New
PORT BOTANY	350	(60.79)	807	276	258	192	152		303	–47
MONTREAL	351	(61.38)	184		328	207			295	–56
ADELAIDE	352	(61.86)	229		241	183	167		279	–73
AUCKLAND	353	(63.31)	252	297	318	205			323	–30
OWENDO	354	(63.87)	125	290	365				275	–79
NOUAKCHOTT	355	(67.48)	154	310	362				331	–24

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
SEATTLE	356	(70.74)	145		259	166	155	91	293	–63
IQUIQUE	357	(71.15)	194		252		175		281	–76
KOPER	358	(71.84)	462	218	291	116	140	102	346	–12
FREEPORT (BAHAMAS)	359	(72.23)	145	65	286	206	153		317	–42
MARSEILLE	360	(75.41)	552	221	171	160	164	96	228	–132
CONSTANTZA	361	(76.47)	256	286	254		173		299	–62
BENGHAZI	362	(77.03)	36	282	367				New	New
VANCOUVER (CANADA)	363	(77.93)	302		250	159	169	89	349	–14
TIN CAN ISLAND	364	(80.99)	160	298	338	211			312	–52
MONTEVIDEO	365	(84.20)	472	316	245	112	78	107	305	–60
NACALA	366	(84.93)	27	321	363				New	New
KRIBI DEEP SEA PORT	367	(87.52)	189	303	342	213			326	–41
BRISTOL	368	(90.96)	76	174	316	220			New	New
PORTLOUIS	369	(93.36)	464	287	326	144	146	98	330	–39
ASHDOD	370	(95.97)	445	208	282	165	145	104	307	–63
BINTULU	371	(98.50)	33	323	364				New	New
DOUALA	372	(98.50)	215	318	369				297	–75
DAR ES SALAAM	373	(101.93)	180	260	372				316	–57
IMBITUBA	374	(103.88)	106		151	115	185		106	–268
QASR AHMED	375	(106.97)	174	265	343	221			298	–77
LONG BEACH	376	(109.28)	224	214	304	214	92	101	348	–28
ACAJUTLA	377	(110.97)	134	325	359				284	–93
LOS ANGELES	378	(113.92)	675		274	168	163	103	337	–41
BEJAIA	379	(114.13)	64	315	370				259	–120
TEMA	380	(116.09)	651	312	310	174	148	97	219	–161
DAKAR	381	(116.78)	437	314	360	208			184	–197
WALVIS BAY	382	(124.73)	128		340	215	168		294	–88
LE HAVRE	383	(127.64)	960	224	188	189	171	99	329	–54
FREMANTLE	384	(129.16)	295		333	198	178		313	–71
LYTTELTON	385	(130.07)	232	320	312	222			314	–71
KINGSTON (JAMAICA)	386	(130.25)	1,108	262	290	164	135	108	268	–118
MATADI	387	(138.31)	165	313	374				178	–209
PORT SUDAN	388	(143.70)	26	322	371				New	New
DAMIETTA	389	(145.98)	535	307	329	197	161	100	154	–235
ISKENDERUN	390	(152.74)	166	317	302	225	131		290	–100
PORT ELIZABETH	391	(178.48)	105		331	218	180		291	–100
LUANDA	392	(183.22)	340	242	341	209	184		339	–53
ITAJAI	393	(206.07)	312	219	337	201	160	110	238	–155

PORT NAME	RANK PER SHIP SIZE RANGE									
	RANK	INDEX POINTS	TOTAL CALLS	<1,500	1,501–5,000	5,001–8,500	8,501–13,500	>13,500	2022	CHANGE
TRIESTE	394	(210.60)	380	192	233	128	183	109	342	−52
POINTE-NOIRE	395	(216.26)	489	304	352	219	181		315	−80
OAKLAND	396	(221.87)	595	254	248	190	172	111	345	−51
PRINCE RUPERT	397	(225.43)	117		327	180	147	114	344	−53
SAVANNAH	398	(231.20)	1,305	255	288	184	174	112	350	−48
DURBAN	399	(278.01)	499	299	366	226	177		343	−56
RIJEKA	400	(302.92)	214	268	287	216	165	115	336	−64
COTONOU	401	(325.70)	313	327	355	223	182		332	−69
TACOMA	402	(330.92)	121			224	176	113	327	−75
MERSIN	403	(354.42)	673	324	368	196	141	116	132	−271
NGQURA	404	(573.28)	252		332	210	179	117	340	−64
CAPE TOWN	405	(716.62)	196		373	227	186		347	−58

Source: Original table produced for this publication, based on CPPI 2023 data.

TABLE A.3 • The CPPI 2023 (the Statistical Approach)

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
YANGSHAN	1	85.04	1	0
CARTAGENA (COLOMBIA)	2	78.61	6	−4
TANGER-MEDITERRANEAN	3	77.78	4	−1
TANJUNG PELEPAS	4	77.14	5	−1
CHIWAN	5	76.88	24	−19
SALALAH	6	76.84	2	4
CAI MEP	7	74.83	12	−5
GUANGZHOU	8	73.15	9	−1
ALGECIRAS	9	71.62	13	−4
YOKOHAMA	10	70.16	17	−7
MAWAN	11	69.45	14	−3
NINGBO	12	69.17	8	4
DALIAN	13	68.52	42	−29
HONG KONG	14	67.71	11	3
HAMAD PORT	15	67.37	7	8
KAOHSIUNG	16	65.28	23	−7
SINGAPORE	17	64.06	18	−1
TIANJIN	18	63.70	16	2
PORT SAID	19	63.21	10	9
VISAKHAPATNAM	20	62.29	122	−102

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
YANTIAN	21	60.63	56	−35
YOSU	22	59.28		
CALLAO	23	85.04	29	−6
SHEKOU	24	58.01	15	9
LIANYUNGANG	25	57.21	92	−67
TANJUNG PRIOK	26	57.03	281	−255
KHALIFA PORT	27	55.28	3	24
PORT KLANG	28	54.68	35	−7
MUNDRA	29	53.50	46	−17
BARCELONA	30	53.45	33	−3
BUSAN	31	52.74	22	9
KING ABDULLAH PORT	32	51.87	19	13
DAMMAM	33	51.59	32	1
XIAMEN	34	50.84	34	0
POSORJA	35	49.85	20	15
SAVONA-VADO	36	49.43	74	−38
FUZHOU	37	48.63	38	−1
ZEEBRUGGE	38	48.11	59	−21
COLOMBO	39	47.54	27	12
GEMLIK	40	46.50	97	−57
PIPAVAV	41	43.18	31	10
AARHUS	42	40.38	91	−49
LAEM CHABANG	43	40.25	28	15
RIO DE JANEIRO	44	39.54	68	−24
KHALIFA BIN SALMAN	45	38.77	76	−31
JEBEL ALI	46	37.59	37	9
BUENAVENTURA	47	36.41	21	26
LAZARO CARDENAS	48	35.49	47	1
SHIMIZU	49	35.24	50	−1
CHARLESTON	50	35.24	341	−291
JEDDAH	51	34.62	30	21
WILHELMSHAVEN	52	34.55	110	−58
INCHEON	53	34.49	39	14
KAMARAJAR	54	34.07	75	−21
TOKYO	55	33.90	53	2
NAGOYA	56	31.95	44	12
DA CHAN BAY TERMINAL ONE	57	31.74	63	−6
KATTUPALLI	58	31.19	69	−11
KOBE	59	30.82	41	18
PHILADELPHIA	60	30.48	105	−45
HAIFA	61	30.27	51	10
JUBAIL	62	29.95	52	10
KEELUNG	63	29.85	73	−10
KARACHI	64	29.28	84	−20

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
QINZHOU	65	29.27		
SOHAR	66	29.11	65	1
HAZIRA	67	28.75	81	−14
PORT EVERGLADES	68	27.79	85	−17
LONDON	69	27.78	184	−115
ANTWERP	70	26.92	62	8
ZHOUSHAN	71	26.88	60	11
COCHIN	72	26.78	90	−18
MIAMI	73	26.36	230	−157
MARSAXLOKK	74	26.31	40	34
KRISHNAPATNAM	75	26.23	64	11
BREMERHAVEN	76	26.02	61	15
SALVADOR	77	25.88	124	−47
SOUTHAMPTON	78	25.56	247	−169
HAIPHONG	79	25.42	140	−61
ITAPOA	80	24.13	58	22
BEIRUT	81	23.82	323	−242
BOSTON (USA)	82	23.79	70	12
PUERTO LIMON	83	23.65	83	0
CHENNAI	84	22.51	114	−30
PARANAGUA	85	22.28	77	8
DILISKELESI	86	22.12	78	8
OSAKA	87	21.29	80	7
PIRAEUS	88	21.08	49	39
NEW YORK & NEW JERSEY	89	20.28	304	−215
ROTTERDAM	90	19.76	264	−174
SANTA CRUZ DE TENERIFE	91	19.16	72	19
WILMINGTON (USA-N CAROLINA)	92	19.14	45	47
MALAGA	93	18.71	102	−9
SAN ANTONIO	94	18.39	246	−152
COLON	95	18.11	66	29
TRIPOLI (LEBANON)	96	17.73	233	−137
OSLO	97	17.52	171	−74
TANJUNG PERAK	98	17.43	94	4
JOHOR	99	17.25	89	10
POINTE-A-PITRE	100	17.22	95	5
RIO GRANDE (BRAZIL)	101	17.08	48	53
QINGDAO	102	16.98	129	−27
CAT LAI	103	16.65	108	−5
JAWAHARLAL NEHRU PORT	104	16.63	71	33
BERBERA	105	16.16	143	−38
YOKKAICHI	106	15.73	107	−1
SOKHNA	107	15.51	258	−151
DANANG	108	15.45	117	−9

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
AQABA	109	15.41	67	42
CORONEL	110	15.29	36	74
TALLINN	111	15.06		
SHANGHAI	112	14.72	215	–103
HALIFAX	113	14.58	276	–163
HAKATA	114	14.12	109	5
ALTAMIRA	115	14.05	54	61
SIAM SEAPORT	116	14.00	79	37
SHARJAH	117	13.61	130	–13
TAICHUNG	118	13.26	123	–5
SHANTOU	119	13.00	86	33
WELLINGTON	120	12.94	161	–41
IZMIR	121	12.91	127	–6
VIGO	122	12.90	135	–13
SAIGON	123	12.80	119	4
HAMBURG	124	12.74	325	–201
FORT-DE-FRANCE	125	12.62	96	29
PUERTO BARRIOS	126	12.37	121	5
PORT AKDENIZ	127	12.29	120	7
MOJI	128	12.26	137	–9
SAN JUAN	129	11.75	125	4
VERACRUZ	130	11.60	98	32
JACKSONVILLE	131	11.59	82	49
BATANGAS	132	11.50		
CHU LAI	133	11.49	153	–20
MUHAMMAD BIN QASIM	134	11.25	87	47
VALENCIA	135	11.18	303	–168
KLAIPEDA	136	10.85	193	–57
CEBU	137	10.77	142	–5
SANTA MARTA	138	10.73	131	7
LAS PALMAS	139	10.66		
OMAEZAKI	140	10.47	134	6
RIO HAINA	141	10.32	158	–17
SINES	142	10.20	176	–34
BORUSAN	143	10.08	163	–20
TANJUNG EMAS	144	9.73	128	16
NAHA	145	9.66	112	33
CAGAYAN DE ORO	146	9.58	151	–5
QUANZHOU	147	9.56		
LISBON	148	9.41	219	–71
VALPARAISO	149	9.31	188	–39
BARRANQUILLA	150	9.30	166	–16
CAUCEDO	151	9.07	148	3
CORK	152	8.82		

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
LIMASSOL	153	8.43	111	42
MOGADISCIO	154	8.41	225	−71
SUAPE	155	8.34	185	−30
CHIBA	156	8.33		
BURGAS	157	8.20	196	−39
FREDERICIA	158	7.99	152	6
HELSINGBORG	159	7.84	157	2
LIRQUEN	160	7.75	154	6
HIBIKINADA	161	7.71		
MUUGA HARBOUR	162	7.63		
SANTO TOMAS DE CASTILLA	163	7.57	271	−108
SHUAIBA	164	7.42	118	46
PUERTO BOLIVAR (ECUADOR)	165	7.22	145	20
SAGUNTO	166	7.01		
MOBILE	167	6.74	235	−68
BAR	168	6.70	167	1
KOMPONG SOM	169	6.37		
YARIMCA	170	6.06	43	127
DUNKIRK	171	5.79	320	−149
PECEM	172	5.69	144	28
TARRAGONA	173	5.43	287	−114
RAUMA	174	5.27	192	−18
AL DUQM	175	5.27		
NORRKOPING	176	5.23	180	−4
PANJANG	177	5.09	228	−51
CONAKRY	178	5.08	181	−3
PUERTO PROGRESO	179	5.05	168	11
BALTIMORE (USA)	180	5.05	301	−121
RAVENNA	181	4.99	155	26
GIOIA TAURO	182	4.96	115	67
PUERTO CORTES	183	4.94	93	90
BASSETERRE	184	4.88		
PYEONG TAEK	185	4.88		
GUSTAVIA	186	4.86	165	21
LA GUAIRA	187	4.79	212	−25
BRIDGETOWN	188	4.73		
ARRECIFE DE LANZAROTE	189	4.53		
HUELVA	190	4.50		
GENERAL SAN MARTIN	191	4.46		
COPENHAGEN	192	4.42	189	3
PAPEETE	193	4.37	136	57
QUY NHON	194	4.34	146	48
FELIXSTOWE	195	4.24	268	−73
MUARA	196	4.22		

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
BELL BAY	197	4.09	190	7
TEESPORT	198	3.18	234	−36
SHIBUSHI	199	3.15		
NEW ORLEANS	200	3.13	104	96
POINT LISAS PORTS	201	3.12	223	−22
SANTOS	202	3.11	116	86
LATAKIA	203	3.06	174	29
CIVITAVECCHIA	204	3.01	186	18
LARVIK	205	2.91	175	30
SHUWAIKH	206	2.62	133	73
BORDEAUX	207	2.38	213	−6
TARTOUS	208	2.35		
PORT AU PRINCE	209	2.31		
CADIZ	210	2.29	149	61
SALERNO	211	2.21	169	42
GIJON	212	2.18	138	74
PLOCE	213	2.09		
CRISTOBAL	214	2.02	308	−94
FREETOWN	215	1.98	231	−16
FERROL	216	1.93		
HELSINKI	217	1.82	222	−5
CASTELLON	218	1.80		
KRISTIANSAND	219	1.74	201	18
ALEXANDRIA (EGYPT)	220	1.50	266	−46
CASTRIES	221	1.38		
VOLOS	222	1.37		
PUERTO QUETZAL	223	1.37	141	82
HERAKLION	224	1.29	200	24
RADES	225	1.20	207	18
PHILIPSBURG	226	1.19	172	54
PORT TAMPA BAY	227	1.12	156	71
BREST	228	1.05		
SYAMA PRASAD MOOKERJEE PORT	229	1.04		
BILBAO	230	1.03	209	21
SONGKHLA	231	1.00		
PARAMARIBO	232	0.87		
OITA	233	0.85		
ALICANTE	234	0.67	226	8
HONOLULU	235	0.24		
VARNA	236	0.12	244	−8
GRANGEMOUTH	237	0.10		
NEW MANGALORE	238	0.08		
SUBIC BAY	239	−0.01	187	52
NGHI SON	240	−0.12		

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
NASSAU	241	−0.21	232	9
BIG CREEK	242	−0.28		
APRA HARBOR	243	−0.35	205	38
MANAUS	244	−0.44	238	6
PAITA	245	−0.46	101	144
SEVILLE	246	−0.50		
GHAZAOUET	247	−0.56		
MALABO	248	−0.68		
TRABZON	249	−0.68		
ADEN	250	−0.82	262	−12
PALERMO	251	−0.96	197	54
MARIEL	252	−1.05	208	44
KOTKA	253	−1.06	224	29
BARI	254	−1.36	199	55
ANCONA	255	−1.60	150	105
YANGON	256	−1.63		
TIMARU	257	−1.88	255	2
BLUFF	258	−1.98	191	67
SAINT JOHN	259	−2.07	236	23
VENICE	260	−2.29	242	18
PORT OF SPAIN	261	−2.60	237	24
CALDERA (COSTA RICA)	262	−2.63	211	51
NOVOROSSIYSK	263	−2.93	206	57
GOTHENBURG	264	−2.95	132	132
NELSON	265	−3.01	202	63
ZARATE	266	−3.05		
GAVLE	267	−3.24	251	16
BATUMI	268	−3.59	229	39
RIGA	269	−3.70	218	51
GENERAL SANTOS	270	−3.90		
AMBARLI	271	−3.92	57	214
ENSENADA	272	−4.11	100	172
BANGKOK	273	−4.13	243	30
GDYNIA	274	−4.30	217	57
KOTA KINABALU	275	−4.31		
BATA	276	−4.55		
PORT BOTANY	277	−4.62	295	−18
DAVAO	278	−4.95	254	24
TAKORADI	279	−5.43	249	30
UMM QASR	280	−5.46	160	120
NANTES-ST NAZAIRE	281	−5.66	162	119
SAMSUN	282	−5.67		
BUENOS AIRES	283	−5.71	177	106
SEPETIBA	284	−5.95	170	114

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
HUENEME	285	−5.95	239	46
HOUSTON	286	−6.33	334	−48
PORT OF VIRGINIA	287	−6.51	55	232
OTAGO HARBOUR	288	−6.77	279	9
LEIXOES	289	−6.92	173	116
KUCHING	290	−7.00		
PUERTO CABELLO	291	−7.21	252	39
LIVORNO	292	−7.26	311	−19
NOUMEA	293	−7.49	126	167
VILA DO CONDE	294	−7.53	183	111
ONNE	295	−7.74	299	−4
AGADIR	296	−7.96	253	43
LIVERPOOL (UNITED KINGDOM)	297	−8.32		
PORT MORESBY	298	−8.34		
VLISSINGEN	299	−8.63		
DUBLIN	300	−8.67	260	40
CATANIA	301	−8.70	195	106
PENANG	302	−8.79	103	199
MELBOURNE	303	−8.82	273	30
GEORGETOWN (GUYANA)	304	−9.21		
KUANTAN	305	−9.23		
NAMIBE	306	−9.57		
TOAMASINA	307	−9.79	227	80
PORT VICTORIA	308	−9.80	250	58
LAGOS (NIGERIA)	309	−9.97	261	48
SAN VICENTE	310	−10.24	256	54
MANILA	311	−10.66	329	−18
MAYOTTE	312	−11.78	267	45
GUAYAQUIL	313	−11.81	286	27
BELAWAN	314	−12.31	216	98
GENOA	315	−12.74	313	2
PORT REUNION	316	−12.78	297	19
LOME	317	−12.85	316	1
NEMRUT BAY	318	−12.95	99	219
KHOMS	319	−13.14		
ARICA	320	−13.92	241	79
SAN PEDRO (COTE D'IVOIRE)	321	−14.22	300	21
TURBO	322	−14.26		
MOMBASA	323	−14.42	328	−5
MAZATLAN	324	−15.57		
LA SPEZIA	325	−16.28	333	−8
BALBOA	326	−16.34	88	238
BRISBANE	327	−16.34	283	44
MAPUTO	328	−16.79	245	83

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
THESSALONIKI	329	–17.65	321	8
ADELAIDE	330	–18.35	280	50
CASABLANCA	331	–18.46	159	172
MEJILLONES	332	–18.53	274	58
BEIRA	333	–18.56	221	112
GREENOCK	334	–18.84		
LAE	335	–19.22	277	58
NAPLES	336	–19.51	270	66
CHATTOGRAM	337	–19.54	306	31
CORINTO	338	–19.55	263	75
MANZANILLO (MEXICO)	339	–19.77	296	43
NAPIER	340	–20.24	322	18
GDANSK	341	–21.13	282	59
VITORIA	342	–21.72	164	178
ALGIERS	343	–22.17		
MONTREAL	344	–22.25	289	55
DURRES	345	–23.42	259	86
IQUIQUE	346	–23.54	284	62
MONROVIA	347	–23.63		
MARSEILLE	348	–23.75	220	128
AUCKLAND	349	–24.29	326	23
CONSTANTZA	350	–24.63	294	56
TAURANGA	351	–24.70	327	24
VANCOUVER (CANADA)	352	–25.61	347	5
EL DEKHEILA	353	–25.77	198	155
POTI	354	–29.63	293	61
FREEPORT (BAHAMAS)	355	–32.19	318	37
ABIDJAN	356	–33.36	332	24
NOUAKCHOTT	357	–33.93	331	26
OWENDO	358	–34.76	278	80
SETUBAL	359	–35.79		
BRISTOL	360	–36.07		
NACALA	361	–36.23		
SEATTLE	362	–37.12	269	93
BENGHAZI	363	–37.91		
TIN CAN ISLAND	364	–39.36	305	59
KOPER	365	–41.03	345	20
KRIBI DEEP SEA PORT	366	–43.79	324	42
QASR AHMED	367	–44.44	307	60
DAR ES SALAAM	368	–46.11	312	56
LE HAVRE	369	–46.18	314	55
FREMANTLE	370	–47.47	310	60
KINGSTON (JAMAICA)	371	–49.82	265	106
PORT LOUIS	372	–50.27	319	53

PORT NAME	2023 RANK	INDEX POINTS	2022 RANK	CHANGE
DOUALA	373	−51.29	298	75
TEMA	374	−54.14	182	192
BINTULU	375	−54.36		
LOS ANGELES	376	−54.78	336	40
LONG BEACH	377	−55.13	346	31
WALVIS BAY	378	−56.42	292	86
IMBITUBA	379	−59.75	113	266
DAKAR	380	−60.70	204	176
LUANDA	381	−62.04	337	44
BEJAIA	382	−63.63	257	125
LYTTELTON	383	−65.16	315	68
DAMIETTA	384	−67.40	194	190
ACAJUTLA	385	−68.15	290	95
MATADI	386	−70.05	210	176
PORT ELIZABETH	387	−70.37	291	96
PORT SUDAN	388	−70.84		
ITAJAI	389	−79.94	240	149
ISKENDERUN	390	−81.49	272	118
MONTEVIDEO	391	−82.21	302	89
POINTE−NOIRE	392	−83.82	317	75
SAVANNAH	393	−84.91	348	45
DJIBOUTI	394	−86.33	26	368
TRIESTE	395	−94.47	340	55
ASHDOD	396	−103.02	285	111
OAKLAND	397	−107.22	343	54
DURBAN	398	−120.48	339	59
TACOMA	399	−139.77	309	90
RIJEKA	400	−143.14	335	65
PRINCE RUPERT	401	−153.28	342	59
COTONOU	402	−163.93	330	72
MERSIN	403	−181.10	106	297
CAPE TOWN	404	−280.99	344	60
NGQURA	405	−291.61	338	67
	389	(145.98)		

Source: Original table produced for this publication, based on CPPI 2023 data.

Notes

1 International Maritime Organization (IMO) Resolution MSC.74(69) Annex 3.

2 See the International Maritime Organization's website on "International Convention for the Safety of Life at Sea (SOLAS), 1974," (accessed March 2022), at https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx.

3 International Convention for the Safety of Life at Sea (SOLAS), under the revised SOLAS 1974 Chapter V (as amended)—Safety of Navigation, section 19.2.415, carriage requirements for shipborne navigational systems and equipment.

4 See ITU's website on "Technical Characteristics for an Automatic Identification System Using Time Division Multiple Access in the VHF Maritime Mobile Frequency Band," (accessed November 2021), at https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1371-5-201402-I!!PDF-E.pdf.

5 It may be a conventional land-based port or a stretch of water designated as an area for transferring cargo or passengers from ship to ship.

6 The precise approach to produce a robust data set is detailed in appendix B.

7 The actual equation is: (Group Average Port Hours/Example Port Hours) x Call Size Group Weight.

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