



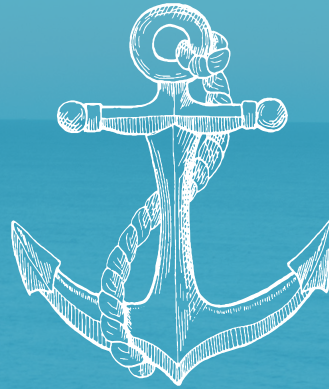
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XINHUA-BALTIC
INTERNATIONAL SHIPPING
CENTRE DEVELOPMENT
INDEX REPORT

2018



XINHUA-BALTIC 2018

INTERNATIONAL SHIPPING CENTRE
DEVELOPMENT INDEX REPORT



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This index research has received great support and enthusiastic help from several professionals in the shipping industries around the world. Their insights allow us to gain in-depth and multi-faceted knowledge of the natural orders of shipping centres, as well as understanding of the many aspects of global shipping development. Their input has played a crucial role in forming the viewpoints of this report.

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Preface

An international shipping centre is an important port city that has the fundamental elements of excellent port facilities, advanced logistics systems and key geopolitical location; it also has highly-efficient shipping services as its core driver, as well as global shipping resources.

In 2014, Xinhua News Agency, in collaboration with the Baltic Exchange, introduced the “Xinhua-Baltic International Shipping Centre Development Index” to the world for the first time.

In recent years, fluid economic situations have necessitated changes in the shipping sector which saw emerging new technologies, new services, and a gamut of new business models. Concepts such as big data, automated terminals, intelligent ports and green ports have been gaining popularity. There has also been a growing emphasis on the development of port cities, especially in the areas of environment, education and shipping finance services.

Having been scrutinised by industrial experts from around the world in a round-table discussion, the research team has taken into consideration feedback on index development from the global community in the past four years and further improved the model and index hierarchy.

We have innovatively added special research contents such as “Intelligent Shipping”, the “Guangdong-Hong Kong-Macau Greater Bay Area” and “The Impact of Widening of the Panama Canal”, as well as promoted discussions on subjects such as green shipping and shipping alliances.

It is to be considered an innovative initiative to conduct in-depth quantitative analysis of the development of international shipping centres globally. Innovation entails breakthrough; and breakthrough means update and iteration of traditional concepts. We hope the evaluation results can be reinforced with such iteration to be more objective and impartial.

There will inevitably be inadequacies in this research report, of which we will constantly amend and update. In this respect, readers’ comments will be much appreciated.

Comprehensive Environmental Index can reflect, as accurately as possible, the differences in the comprehensive environment amongst domestic shipping cities within a large country.

Due to the importance of the development of land transport logistics to the construction of an international shipping centre, the report will place greater emphasis on land logistics of shipping centres.

We shall continue to improve on data collection network to maximise the collection of the most up-to-date data and information and enhance their availability and reliability.

We sincerely welcome other ports to contact us and join us in a collaborative effort to explore rules and rhythm of development of international shipping centres, and to help promote the rational allocation of global shipping resources, enhance circulation efficiency of world commodity, as well as promote the scientific development of international shipping centres.

Editorial Board, Xinhua-Baltic International Shipping Centre
Development Index
July 2018



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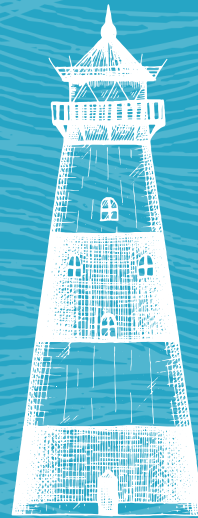


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Chapter 1 New Understanding in Global Shipping

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01



Emerging markets remain the key engine for global economic growth

In 2017, the world economy, on the whole, has been improving with increasing growth rate.

Data from the IMF (International Monetary Fund) shows that global economic growth in 2017 was 3.8%, buoyed by positive factors such as continued rebound in global investments and trade. The year saw the fastest economic growth since 2011.

At the same time, differentiation in trends of economic growth for different regions of the world was becoming more pronounced.

The Americas are still an important buffer for world economy, while Europe has achieved passive growth through exporting technology and services. Meanwhile, the economic growth of emerging economies represented by the BRICS countries has clearly rebounded; and their economic development has stabilised.

The global economy is expected to maintain its recovery trend in 2018 with a slow and steady growth.

The IMF forecasts that the global economic growth rate will rise to 3.9% in the next two years.

The economic growth of developed economies and the Euro zone economies will be stable in the short term and decline slightly in the long term. However, the economic growth of emerging markets and developing economies will strengthen

further; a high growth rate of 6% over the long term is expected for emerging markets and developing economies in Asia.

The emerging markets and developing countries remain the key engine for global economic growth

The emerging economies still possess core factors such as abundant foreign reserves, lower labour costs, vast market space, advantageous industrial bases and vibrant financial markets. Such factors will form the basis for supporting continued development in the economic landscape, as well as promoting the orderly shifting of financial elements towards these countries and regions.

The developed countries remain the backbone of world economy.

Although developed countries such as the United States, Europe (Great Britain, Germany) and Japan have suffered serious national debt issues brought about by their financial and debt crises, subsequent economic recovery in the United States and Japan, the return of credit market and rising US dollar index have played important roles in the returning of capital markets to developed countries.

The Euro zone markets are still facing low growth and low inflation risk over the long term.

Since 2011, although some results were achieved through unrelenting efforts in managing the European debt crisis by international organisations including various mediation and coordination by the European Commission, the IMF and the European Central Bank, it is generally believed external demand in Europe is still weak, and economic slowdown [1]will continue over the long term.

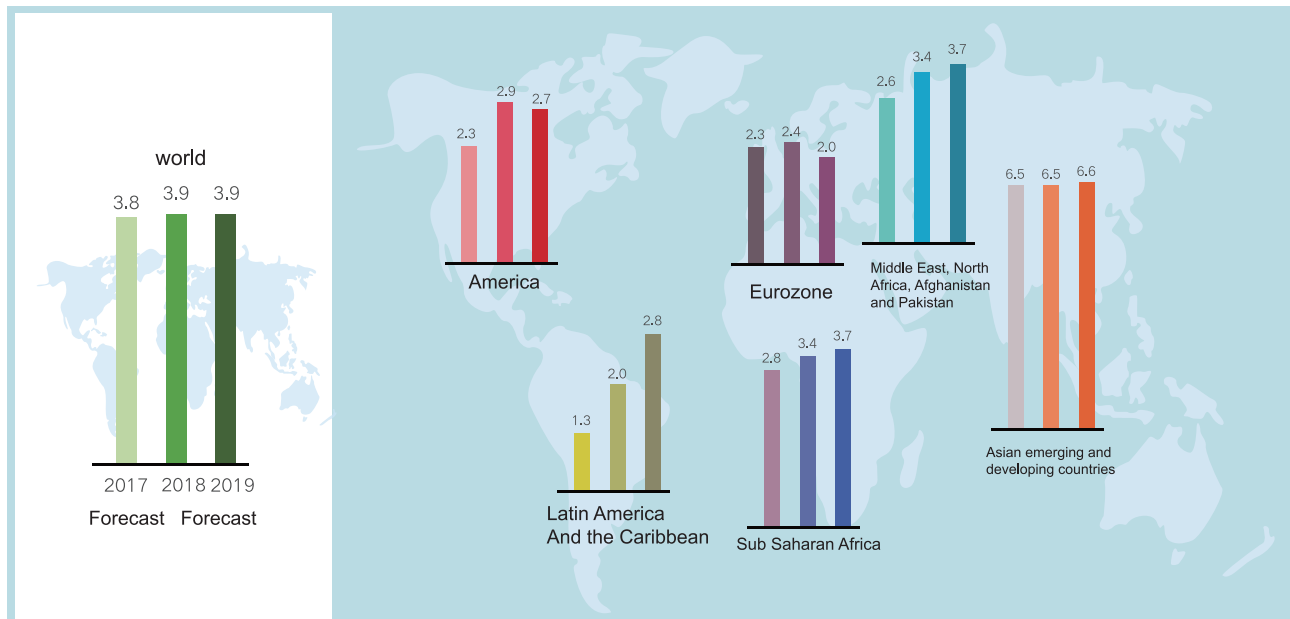
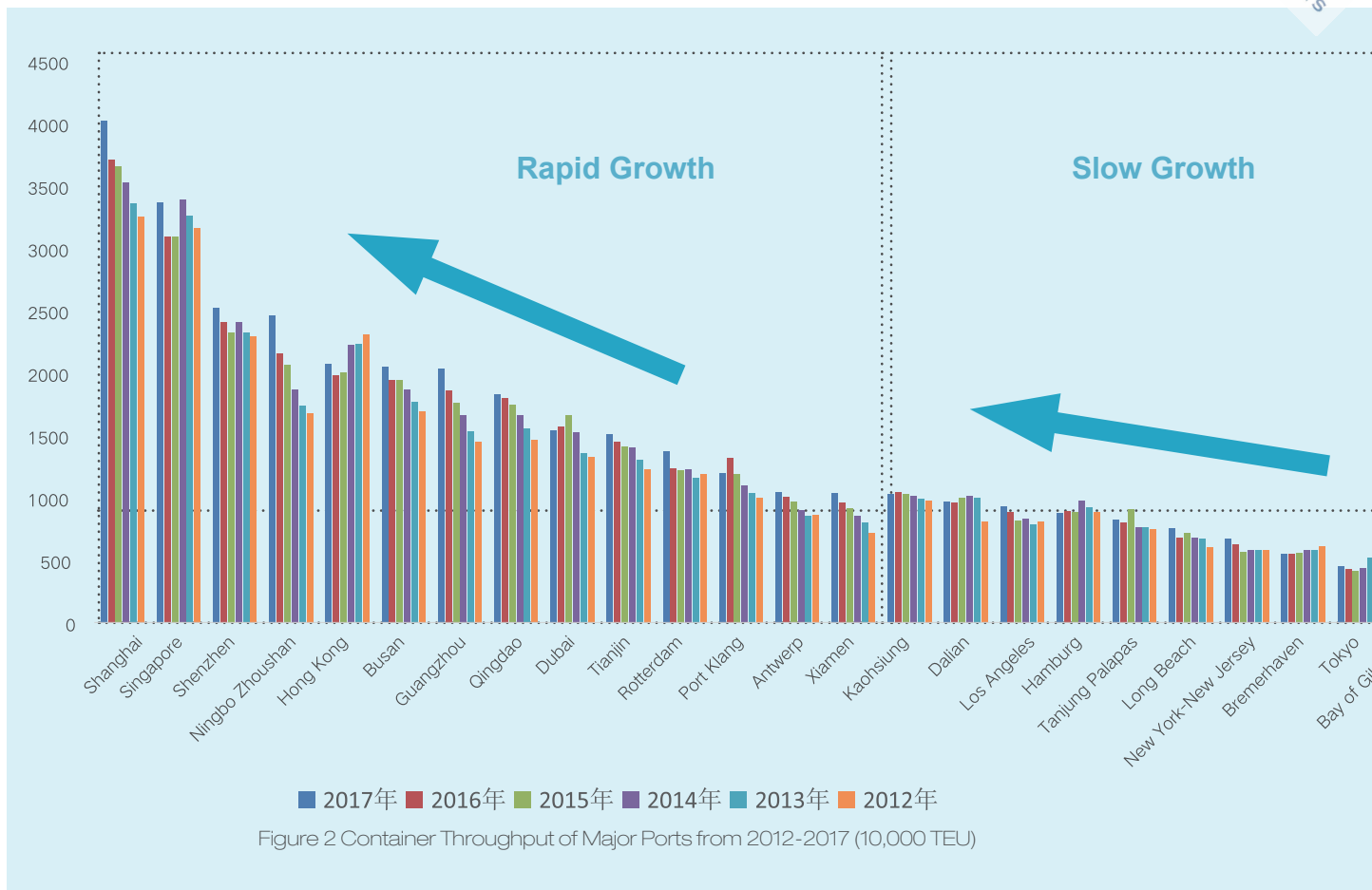


Figure 1 Forecast of Global Economic Growth

Source of data:
International Monetary Fund, "World Economic Outlook", April 2018.
Each group of bar chart, from left to right, represents
2017, 2018 forecast and 2019 forecast.

New Trends in Global Shipping



A new paradigm of efficient decision-making with intelligent shipping

Intelligent shipping is more than just simple technology application; it is a re-engineering of business models in exploiting resource endowment for value creation.

The objective of intelligent ports is to realise smart collection and distribution systems through innovative business models, supported by information technology so as to promote efficient operation of logistical flow, information flow and capital flow in the trade ecosystem.

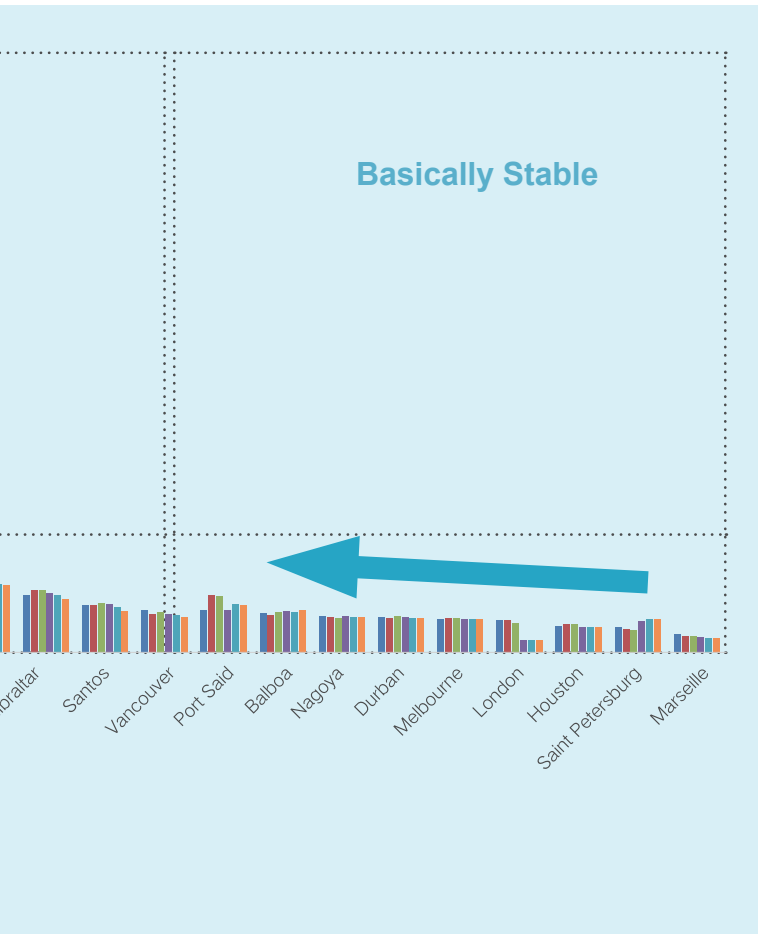
In future, intelligent ports will become the key driving force of the shipping industry to improve efficiency, reduce costs and enhance core competitiveness.^{3}

New development in transformation to green ecology

In April 2018, the Ministry of Transport of the People's Republic of China announced the "Action Plan for Promotion of Green Ports (2018-2022): Request for Comments" paper. This is a clear directive in the application of green policies throughout the process of port planning, construction and operation, including the conservation of construction resources, and incorporation of environmentally-friendly elements in port design. It places higher demand, wider scope and deeper level of green requirements for port development and thus provides strong support for high-quality green shipping development.

European and American countries have recognised the negative impact of pollution from shipping ports, and have implemented policies to promote the use of low-sulphur fuels and cleaning technologies in order to reduce emissions of sulphur dioxide, particulates and nitrogen oxide.

Green development and ecological protection will surely become the new trend in transformation and development of the international shipping industry.



Accelerated development in Asia-Pacific Shipping

The shifting of world economic cycles in the positive direction due to China’s “Belt and Road” initiative and “the return from virtual to real economy” policies by various countries, and the increasing trading activities and rising economic strength of the Asia-Pacific region are the driving forces in shifting the international shipping centre eastward. Shipping resources are thus further concentrated in Asia.

Buoyed by the “Belt and Road” initiative, development opportunities abound in the Guangdong-Hong Kong-Macau Greater Bay Area, Hainan Free Trade Zone and Shanghai Free Trade Zone. The cluster of China’s shipping centres around Hong Kong and Shanghai achieved tremendous growth in the shipping industry through the offering of solid and high-quality port logistic services and enhanced level of modern shipping services. Such opportunities represent injection of new vitality into the development of the global shipping industry.

A new paradigm of stiffer port competition due to shipping alliances and growing ship sizes.

The alliance of shipping companies and increasingly larger ship sizes not only mean enhancement of hardware and consolidation of resources, but also mean higher bargaining power for additional demands, resulting in a new paradigm of stiffer competition among ports.

At present, major liner alliances account for more than 80% of total global shipping capacity; and more than 90% liner market share in Asia, Europe and North America.

Alliance of shipping companies will enhance the alliance’s bargaining power. Competition among ports will become more intense due to larger size of businesses afforded by larger number of fleets with shipping alliances.

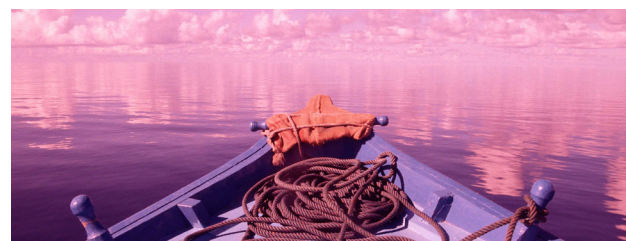
Growing sizes of ship will result in reduced number of berthing but increased loading and unloading capacity. This will exacerbate the gap between peak and low operation cycles, force the port to upgrade its infrastructures such as berthing, and loading/unloading facilities, and motivate the port to deploy more intelligent systems to consolidate various resources and ensure efficiency and productivity.

A new development paradigm in cross-border integration

“Internet + Shipping” is not only an improvement of efficiency in the shipping industry with Internet technology but also an economic platform that enables re-engineering of the traditional economic model of the shipping industry.

As at the end of 2017, there are more than 70 Chinese enterprises deploying new shipping platform models based on “Internet + Shipping” paradigm. Well-known Internet shipping platforms in the world include Youship from Denmark, INTTRA from the US, GT Nexus and Kn-freightnet from Germany, as well as Shipperserv from UK.

The development of big data and e-Commerce in shipping has promoted the trend of shifting the industrial chain to that of a cross-border integration.



The International Shipping Markets – Outlook Mid 2018

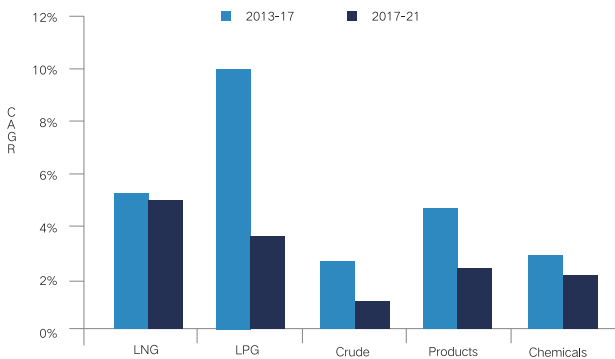
Nigel Gardiner

Executive Director, Drewry Maritime Services

In general terms, the outlook for the main shipping markets in mid-2018 is indeed more upbeat than it was in mid-2017. While trade and ship demand growth in the future is projected to be lower than in the last few years (see the chart below), growth in vessel supply is moderating as a result of reduced levels of new ordering and higher levels of demolition.

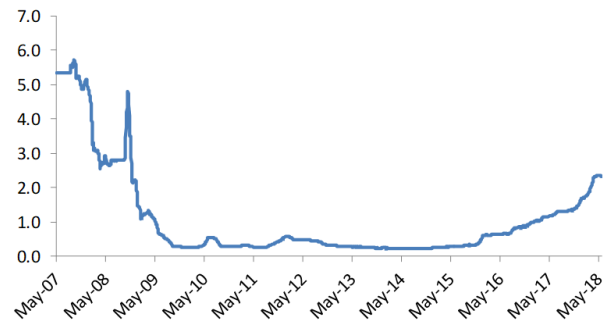
We expect to see a tightening of industry fundamentals in most sectors in the second half of 2018 and upward movement in freight rates. That said, possible trade wars, tariffs, and the rise in interest rates (see chart below) all pose a severe risk to the market recovery. Therefore, an element of uncertainty remains.

Seaborne Trade Growth (%)



Source: Drewry Maritime Research

USD 3 Month Libor Rate (%)



Source: Drewry Maritime Research

For each of the main sectors, our view on the market outlook is as follows:

Dry Bulk

We are positive about dry bulk charter rates, and we expect firm commodity trade and slow growth in vessel supply to result in improved earnings in the second half of 2018. Rising steel production will drive iron ore and coking coal trades, while the strengthening economic conditions globally will provide impetus to steel consumption. Among the major steel producers, India's production is likely to grow at the fastest pace on the back of a low consumption base and high investment in the infrastructure and construction sectors. The government's initiatives surrounding affordable housing, expansion of road and railway networks, as well as the rising demand for automobiles will stimulate steel consumption. Apart from India, the steel sector in South Korea and Taiwan

is also performing well. Even though China's steel output growth continues to slow down, overall production remains staggeringly high. However, the country's unprecedented attention to address the problem of pollution has forced steel mills to use high-grade ore that have to be imported from Brazil and Australia, which bodes well for iron ore trade. However, we are not optimistic about thermal coal trade as a high investment in renewable sources of energy, and enhanced use of LNG in electricity generation will gradually dampen the demand for thermal coal. Sluggish thermal coal trade will partially offset the gains from the increasing trade of other commodities. Therefore, the overall dry bulk commodity trade is likely to grow at a slower pace in 2018 and 2019, compared with 2016 and 2017. However, the dry bulk fleet growth is set to taper down as a result of a thin orderbook and low new ordering. Additionally, the upcoming IMO regulations on ballast water and bunker fuels will increase vessel operating costs, thereby stimulating the demolition of aged and outdated units.



Containers

In the container sector, stronger cargo growth, supported by re-stocking, pushed global demand to 6.3% in 2017, slowing to an expected 4.5% in 2018. However, for the second year in a row, all regions are expected to register positive results in 2018, with the fastest geographies expected to be the emerging markets of South Asia (6.3%) and Africa (5.8%). On the demand front, there is a significant risk in the form of a potential US-China trade war, which would spell a small downgrade in demand growth. New sanctions on Iran and Russia would not derail the recovery, but they have the potential to suppress growth. On the supply front, new containership orders have resumed, but contracting is likely to be in line with demand. Total supply is expected to grow by 4.2% in 2018 – the third year in a row that growth in supply has been below demand. The spot market softened in the early months of 2018, but the improving supply-demand fundamentals and rapidly escalating fuel costs are likely to lead to short-term rates increasing in the remainder of the year. The year 2017 marked a return to profitability for carriers, and 2018 is expected to provide similar returns. However, a fast-rising fuel price is likely to see a much diminished bottom line than initially predicted.

Oil Tankers

For crude oil tankers, we expect overall rates in 2018 to drop before staging a recovery in early 2019 on the back of continued stability in scrapping activity. Since the outlook for crude trade is not promising, our forecast of a market recovery is primarily hinged on the expectations of high scrapping. On the other hand, deliveries are expected to shrink in the remaining forecast period as we anticipate new ordering to decline in the current bearish environment. Overall, after increasing by more than 11% in 2016-17, the tanker fleet is expected to expand by a modest 0.7% to 386.9 mdwt in 2018. The fleet is expected to increase at a CAGR of 1.2% to reach 410 mdwt by 2023. Meanwhile, global oil demand is likely to decelerate significantly after 2018 as OECD demand will return to its long-term trend of decline. According to the IEA's forecast, oil demand will grow by a modest 1.1 mbpd per year on average during 2019-23, compared with around 1.6 mbpd growth in 2017 and 1.4 mbpd growth in 2018. Overall, we expect sluggish oil demand growth, a rising share of unconventional liquids and surging refinery runs in the Middle East to hurt crude trade growth in the future. Seaborne trade in crude oil is expected to increase at a modest pace of close to 1% during 2019-23. However, trade, in terms of tonne-miles, will grow by 1.6% per annum during this period because of a rise in long-haul exports from

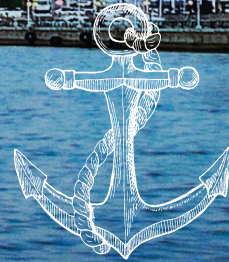
the US. In fact, we expect most of the growth in crude oil exports to come from the US, given the rise in US domestic oil production. We do not expect the recent withdrawal of the US from the nuclear deal with Iran to have any significant impact on the trade as Saudi Arabia and Russia are likely to fill the possible void created by Iran.

In the product tanker sector, supply-side economics are showing positive signs for product tanker owners as the orderbook for non-IMO coated tankers is low, with just 105 vessels on order. Furthermore, we expect the lack of clarity around the upcoming IMO regulations to inhibit the influx of new vessels and support demolitions. On the demand side, West African demand has supported Europe/Mediterranean-West Africa trade, and this is expected to continue as no major refinery additions are planned in Africa, and demand will outgrow supply in the region. Demand from Latin America and high refinery runs in the US have supported US exports to Latin America. Nearly 1.6 mbpd worth of refinery additions are planned in China and about 2 mbpd of additions in the rest of Asia. As a result, surplus production in Asia will support trade within Asia and also support long-haul exports of products such as jet fuel from Northeast Asia to the US. Meanwhile, product stocks in OECD countries are almost close to the five-year running average because of the production cuts enforced by OPEC and partner countries since January 2016. Amid low stocks, there will be increased arbitrage opportunities, which in turn will support trade. Overall, we expect the product tanker market to witness a cyclical upturn in 2019 on the back of reduced tonnage supply and steady demand.

LPG

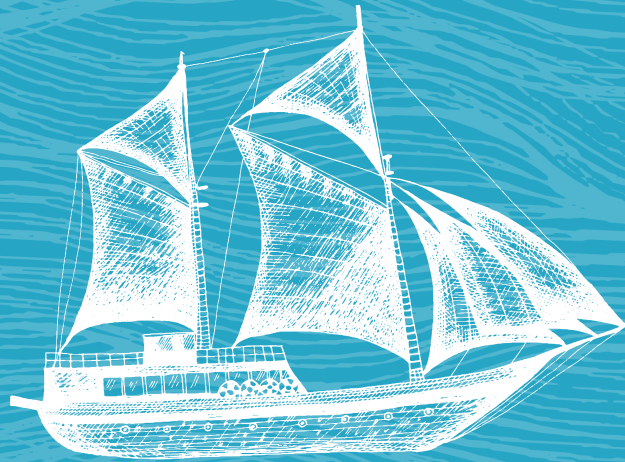
For LPG, global trade growth averaged 3% (year-on-year) in 2017, down from 10% (year-on-year) growth in 2016. The main reason for this drop was a slowdown in China's LPG import growth to 14% in 2017, compared with 33% in 2016. Imports were also down in the big traditional markets of Japan and South Korea. Asian countries, primarily China and India, hold the key for future trade growth, and we expect LPG trade to grow by 4% in 2018. After three years of strong fleet growth (averaging 14% per annum over 2015-17), fleet growth is set to slow down to average 4% annually over the next two years. As such, we believe the LPG shipping market has bottomed out and should start to recover in the second half of 2018 as countries commence winter stockpiling. Nevertheless, a major risk to this outlook is the possibility of the US-China trade war.





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Chapter 2

Fundamental Elements of International Shipping Development Index

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Functional Significance

Xinhua-Baltic International Shipping Development Index is a numeric grading of selected shipping centres, against certain set criteria. It is a systematic and comprehensive evaluation model that employs corresponding indexing methods to quantify assessment with the goal to measure the true reflection of a port city's general strength at a predefined time period. A simple, intuitive, objective and impartial measure of the level of development and state of international shipping centres, the index will be a valuable guide and reference for the development of international shipping centres. It will also have a role in promoting sustainable development and optimal allocation of resources in the world's maritime trades.

2018

Design Principles

Authentic:

Emphasis on using real operational data that can be tested and verified while minimising the use of synthetic indicators. Fundamental indicators that can be tested and are accessible will be utilised. The method allows for weighted computation with adjustment mechanism to prevent ambiguity while preserving traceability of the index. The analysis method for the index is objective and reproducible.

Comprehensive:

The index system comprises 3 primary indicators and 18 secondary indicators to comprehensively reflect the state of development of international shipping centres. The index has some extensibility to cater for future research and allows for maximum improvement by way of amendments and supplements in response to industry feedback and suggestions.

Scientific:

The index system's indicators have undergone several rounds of verification through feedback by both domestic and foreign experts and confirmed by an expert committee. Each indicator reflects a certain aspect of the city housing the international shipping centre. Taken together, all indicators will coalesce into an index system that meets the requirements of being logical, conforming, representative, relevant and that has relative independence.

Authoritative:

All the selected indices are derived from domestic or foreign authoritative statistics that are standardised and stable data sources. Such data are easy to compare and compute, and the assessment indicators are clear.

Having been put through several rounds of feedback and consideration, the weightage system is not only authoritative but also directive.

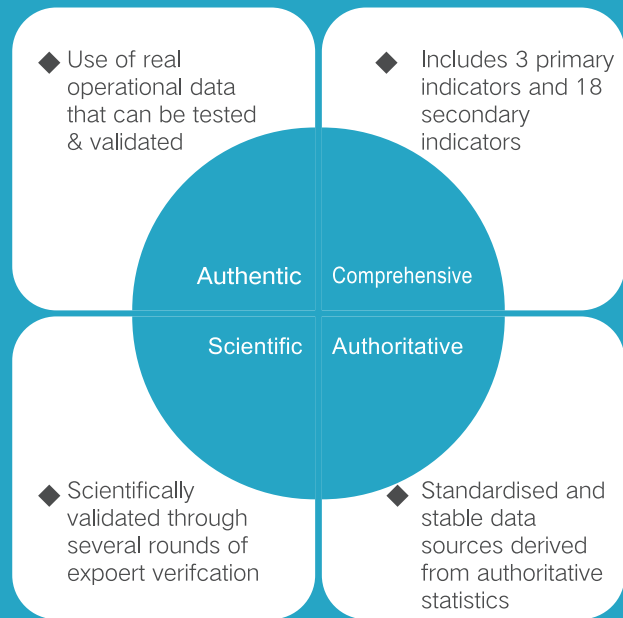
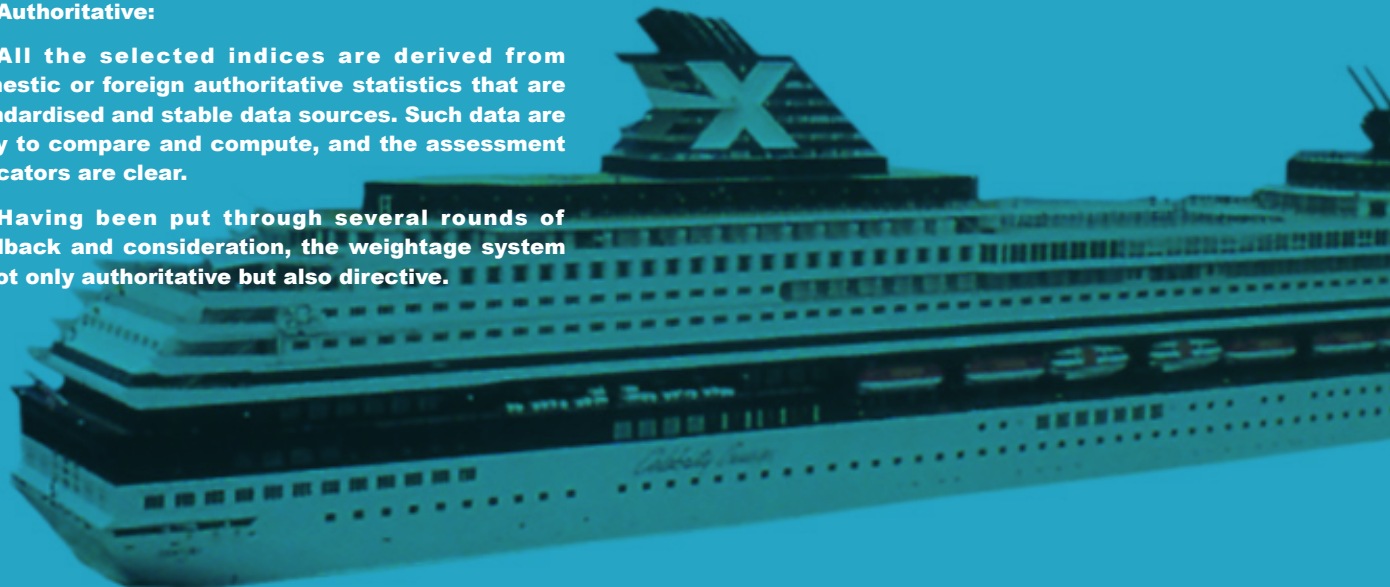


Figure 3 Design principles of Xinhua-Baltic International Shipping Centre Development Index





Framework of Indicators

Based on the indicator selection principles of Xinhua-Baltic International Shipping Centre Development Index, the index establishes an objective evaluation index system. All indicators come from authoritative agencies, whose raw data can be obtained from public sources, or computed systematically and scientifically. The indicators are maintained by a professional team that regularly updates the data sources.

The index system includes 3 primary indicators and 18 secondary indicators.

Of these, primary indicators characterise the inherent laws of urban development of an international shipping centre through 3 dimensions – namely, the port conditions, shipping services and the general environment. Secondary indicators are the expansion on specific functional attributes of the primary indicators. The various levels of indicators are weighted and combined progressively in consideration of their authenticity, comprehensiveness and availability of data

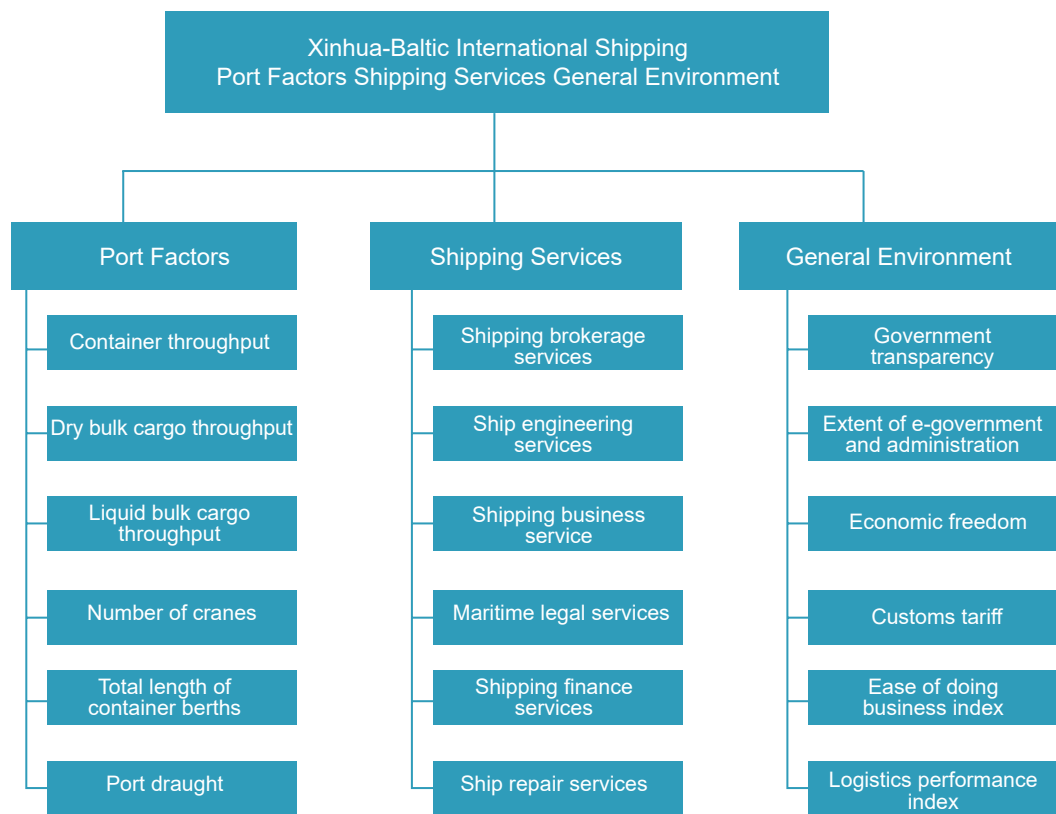


Figure 4 Framework of indicators for Xinhua-Baltic International Shipping Centre Development Index

Samples Selection



The selection of samples for the international shipping centre development index is based on a few basic principles:

It not only observes full compliance with data standards for port city core indicators but also takes full consideration of comments and opinions of the Global Shipping Experts Committee.

The synthesis of qualitative and quantitative analysis is primarily achieved through the use of data standard, and supplemented by a number of expert opinions.

Step 1 Basic sampling guidelines for international shipping centre

are based on the data standard of a port city's core indicators with focus accorded to container throughput, bulk cargo throughput, port draught, economic hinterland of the port and development of shipping services.

Step 2 Based on professional assessment and recommendations by members of the Global Shipping Experts Committee jointly formed by China Economic Information Service and the Baltic Exchange, the committee shall, by way of vote, select port cities shortlisted in the initial sampling pool that may satisfy the following port category conditions to form a refined sampling pool:

1) For some ports included in the initial sampling pool, even though their current throughput may be large, they may be weak in other shipping services. The expert committee shall, by way

of vote, decide if these ports should be eliminated. There are numerous such emerging port cities in the Asia Pacific region.

2) For some port cities not included in the initial sampling pool, even though their current throughput may be relatively small, they have a high standard of shipping services and good business operating environment. The expert committee shall, by way of vote, decide if these ports should be included in the sampling pool. There are such port cities in Europe and America that provide traditional shipping services.

Supplementary explanation of voting mechanism for inclusion of sample:

“Nomination – Research – Voting” process is adopted.

During the nomination process, emphasis must be put on general recognition of the port city's position in the world. The research process focuses on advanced integration of capital flow, information flow and goods flow, as well as the degree of contribution by the port function toward urban development. The voting phase focuses on fairness by drawing judgement from several experts.

Step 3 After the two selection processes above, a final sampling pool for international shipping centres is established. This sampling pool is adjusted dynamically according to changes in annual data. Only port cities that meet the screening requirements are eligible for global competitiveness assessment.

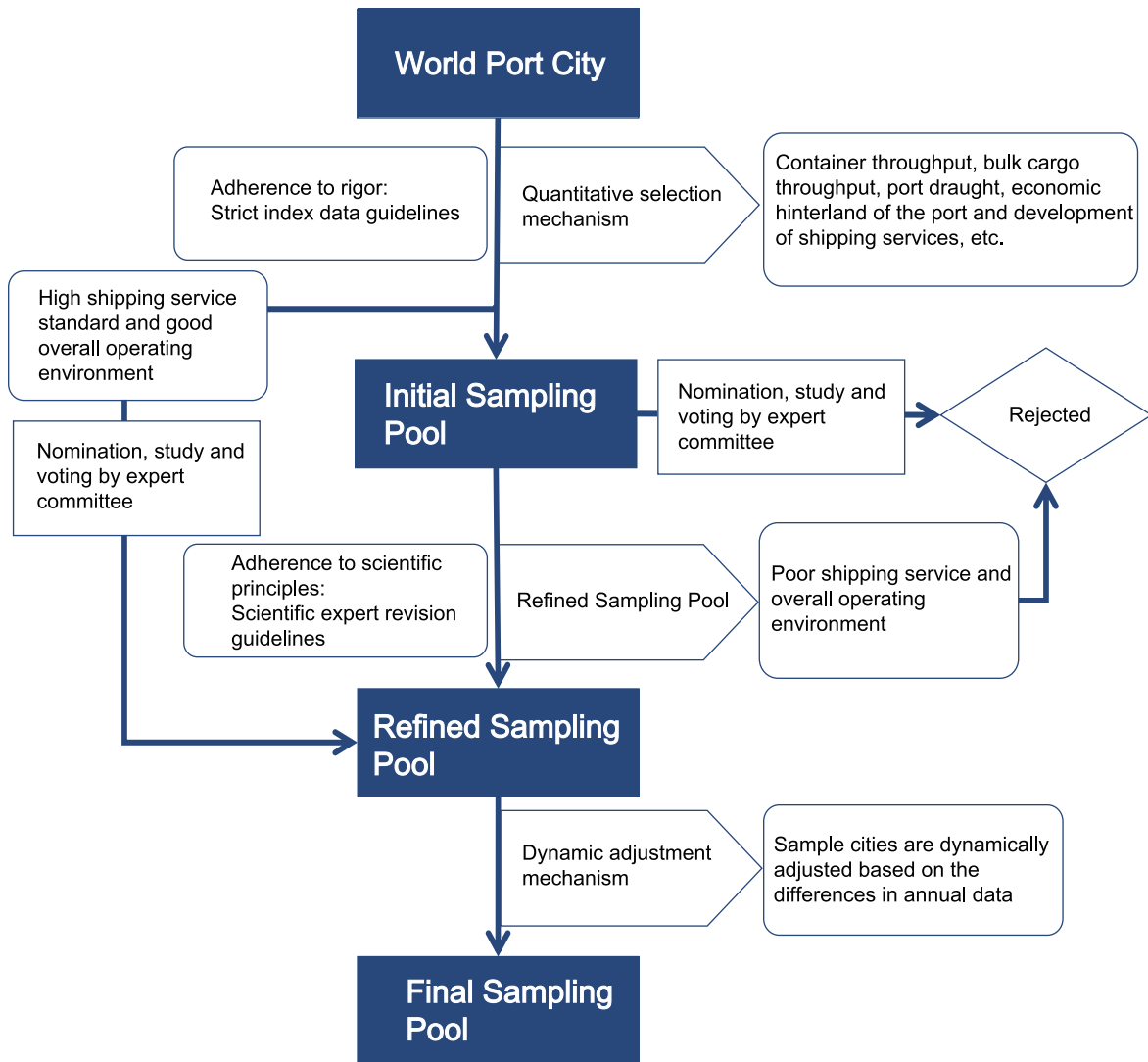


Figure 5 Sample selection process for Xinhua-Baltic International Shipping Centre Development Index





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Chapter 3

Evaluation Results of International Shipping Centre Development Index

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General evaluation

According to the results of the general evaluation of international shipping centres in 2018, the top ten international shipping centres in the world are Singapore, Hong Kong, London, Shanghai, Dubai, Rotterdam, Hamburg, New York, Tokyo and Busan respectively.

Comparing between 2014-2018, the overall evaluation results are relatively stable.

Emerging shipping centres in Asia-Pacific region still maintain a strong growth trend.

Singapore maintains its leading position for four consecutive years. Thanks to strategic opportunities brought about by the “Belt and Road” initiative, Guangdong-Hong Kong-Macau Greater Bay Area overtook London – for the first time in five years – to take the second place.

Supported by its rapidly developing modern shipping logistics system and shipping services system, and coordinated development of its regional shipping counterparts, Shanghai advanced to the fourth place, right after London.

Driven by its innovative free-trade zone and improvement in trade environment, Dubai’s ranking was stable at the fifth place.

Busan made its return to the top ten by virtue of its strategy of vigorously developing its transshipment ports.

European and American traditional international shipping centres remain low in ranking.

Impacted by the overall weak economy in the European region, London’s overall shipping development was behind that of Hong Kong, while Hamburg has dropped to seventh place.

Rotterdam has improved its operating efficiency with new technology applications such as Internet of Things, big data, and artificial intelligence, as well as smart port construction. It has leaped to the sixth place.

Ranking	2018	2017	2016	2015	2014
1	Singapore	Singapore	Singapore	Singapore	Singapore
2	Hong Kong	London	London	London	London
3	London	Hong Kong	Hong Kong	Hong Kong	Hong Kong
4	Shanghai	Hamburg	Hamburg	Rotterdam	Rotterdam
5	Dubai	Shanghai	Rotterdam	Hamburg	Hamburg
6	Rotterdam	Dubai	Shanghai	Shanghai	Dubai
7	Hamburg	New York	New York	Dubai	Shanghai
8	New York	Rotterdam	Dubai	New York	Tokyo
9	Tokyo	Tokyo	Tokyo	Busan	New York
10	Busan	Athens	Athens	Athens	Busan

Table 1 Top 10 port cities of Xinhua-Baltic International Shipping Centre Development Index



Tier Evaluation

With the application of new technology and contemporary concepts such as big data, automated terminals, intelligent ports and green ecology, various new forms of businesses and services are beginning to emerge in the shipping industry. Thus, there has been growing emphasis on the development of port cities, especially in areas of environment, education and shipping finance services.

In particular, shipping services have gradually broken the boundary of spatial geography and are beginning to realise resource optimisation on a global scale.

As such, there is a need for iterative update of knowledge related to shipping centres.

Three tiers were identified: namely the traditionally-renowned tier, the innovation-leader tier, and potential-for-development tier.

The traditionally-renowned tier of shipping centres is represented by traditionally well-known international shipping centres such as Singapore, Hong Kong and London.

The trio were in the leading pack with evaluation scores greater than 80 points; with Singapore in the absolute leading pole position at 97 points and leading the second place Hong Kong by more than 10 points.

These shipping centres capitalise on their locations in developed shipping markets to provide comprehensive shipping services with abundant logistics and transportation support. Playing the role of international shipping hubs servicing a myriad of maritime trade routes and air flights, their development is buoyed by financial momentum from international economies and trades.

Even under the backdrop of continuously emerging new capitals, new technologies and new services, the traditionally-

renowned shipping centres remained the backbone of global shipping development.

The innovation-leader tier includes international shipping centres around the Asia-Pacific such as Shanghai, Dubai, Guangzhou, and Ningbo-Zhoushan.

With evaluation scores above 60, these shipping centres are followers. Compared to the traditionally-renowned tier, these shipping centres play catch-up with the cumulative experience of being a late-comer.

In recent years, Shanghai has initiated an in-depth integrated strategy encompassing "Belt and Road + Free Trade Zone + Shipping Centres" components.

Shanghai is an important intersection point for both the "Belt and Road" initiative and the Yangtze River Economic Zone. It is also the world's largest port by container throughput as well as the world's third largest airport by cargo throughput. As one of the most important international shipping centres today, the development of Shanghai will be an impetus to promote the development of China's, or even the world's shipping industry.

The potential-for-development tier of shipping centres includes developing ports such as Newcastle, Tanjung Pelepas and Port Klang.

With evaluation scores generally below 60, these port cities may be prominent in some aspects and exhibit distinctive characteristics. With an overall advancement in trade, shipping, finance and technology in the Asia-Pacific region, these port cities should exploit interconnectivity with the world's first tier shipping centres to improve their overall strength and development potential.

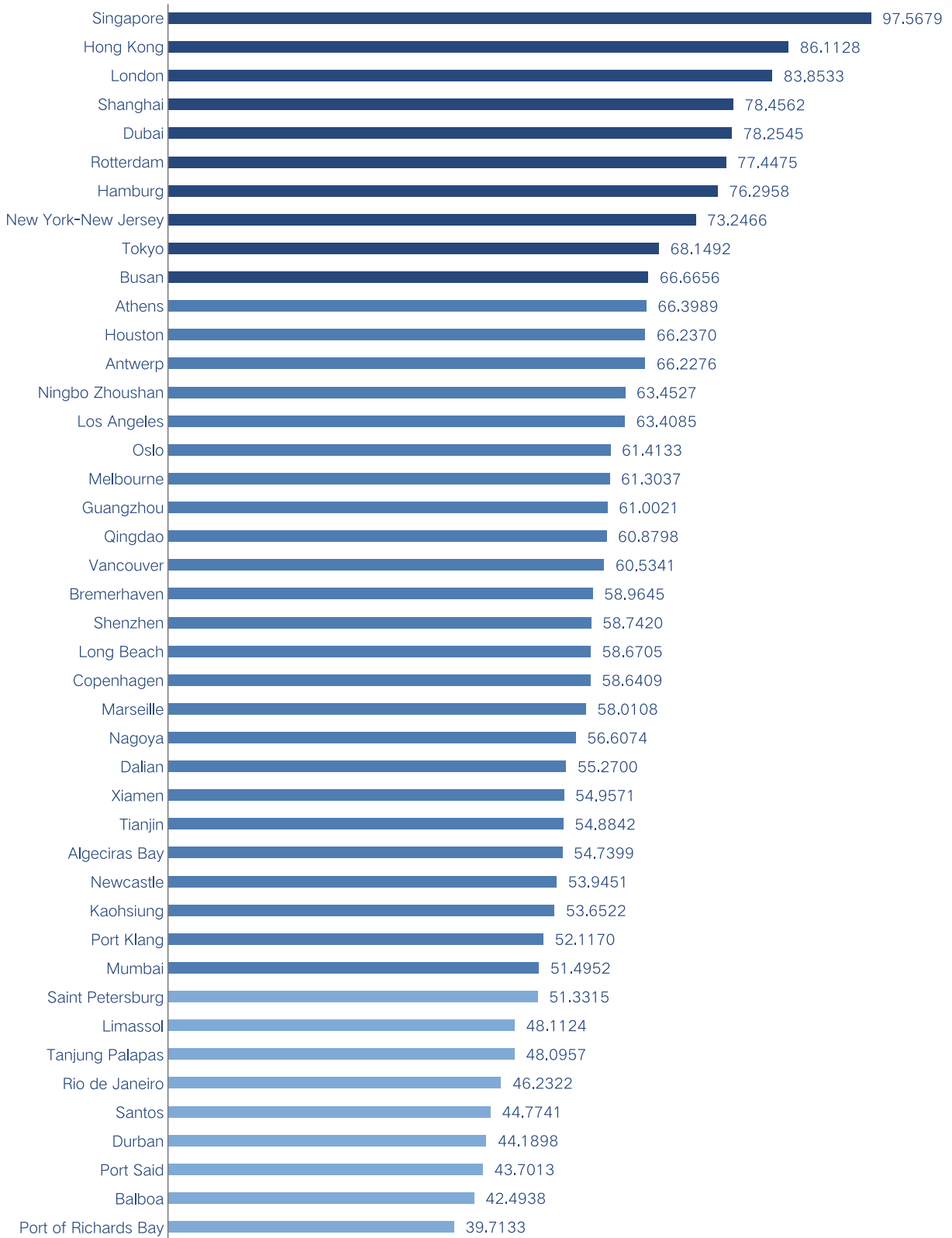


Figure 6 Evaluation result of Xinhua-Baltic International Shipping Centre Development Index by tier

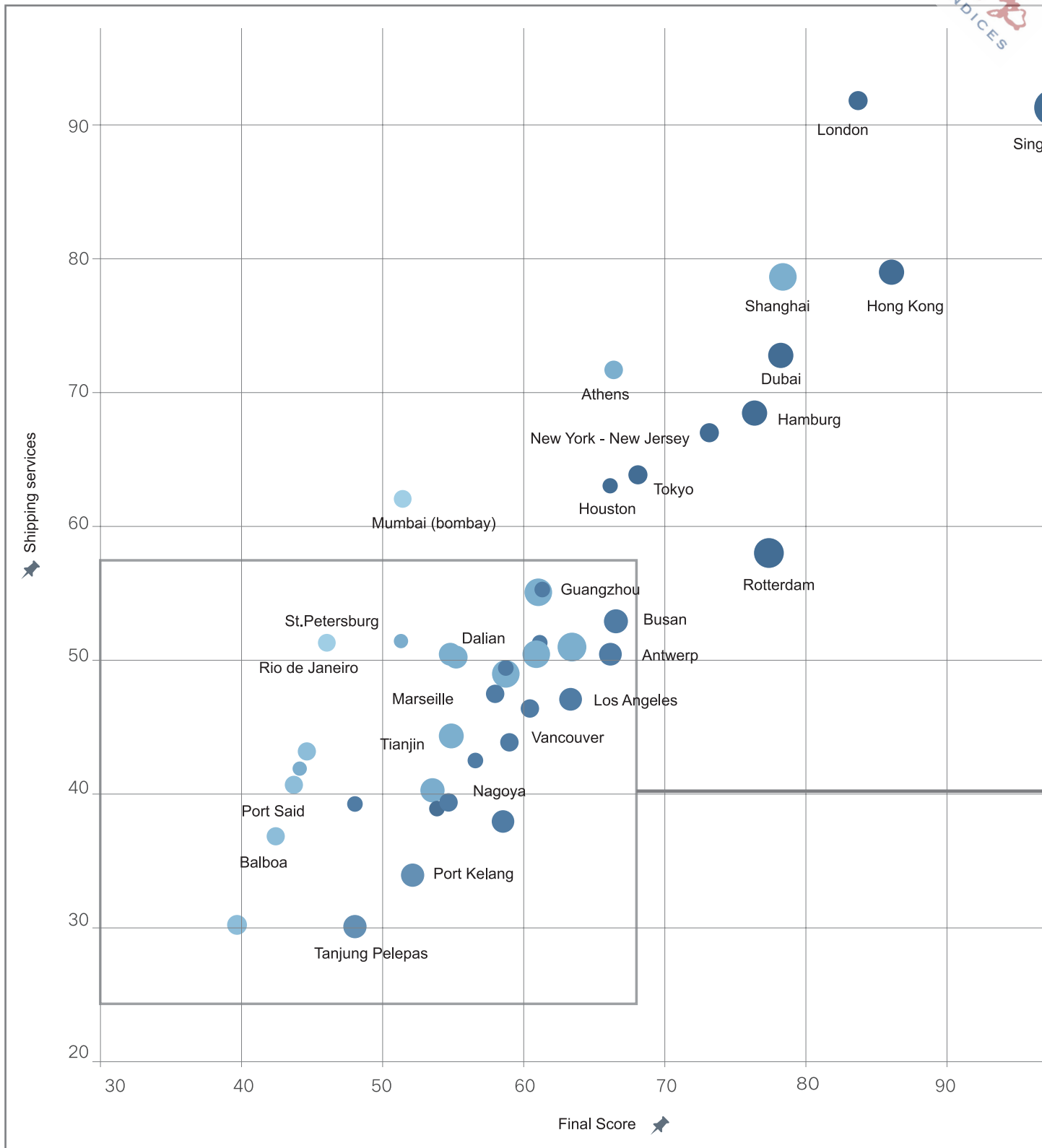
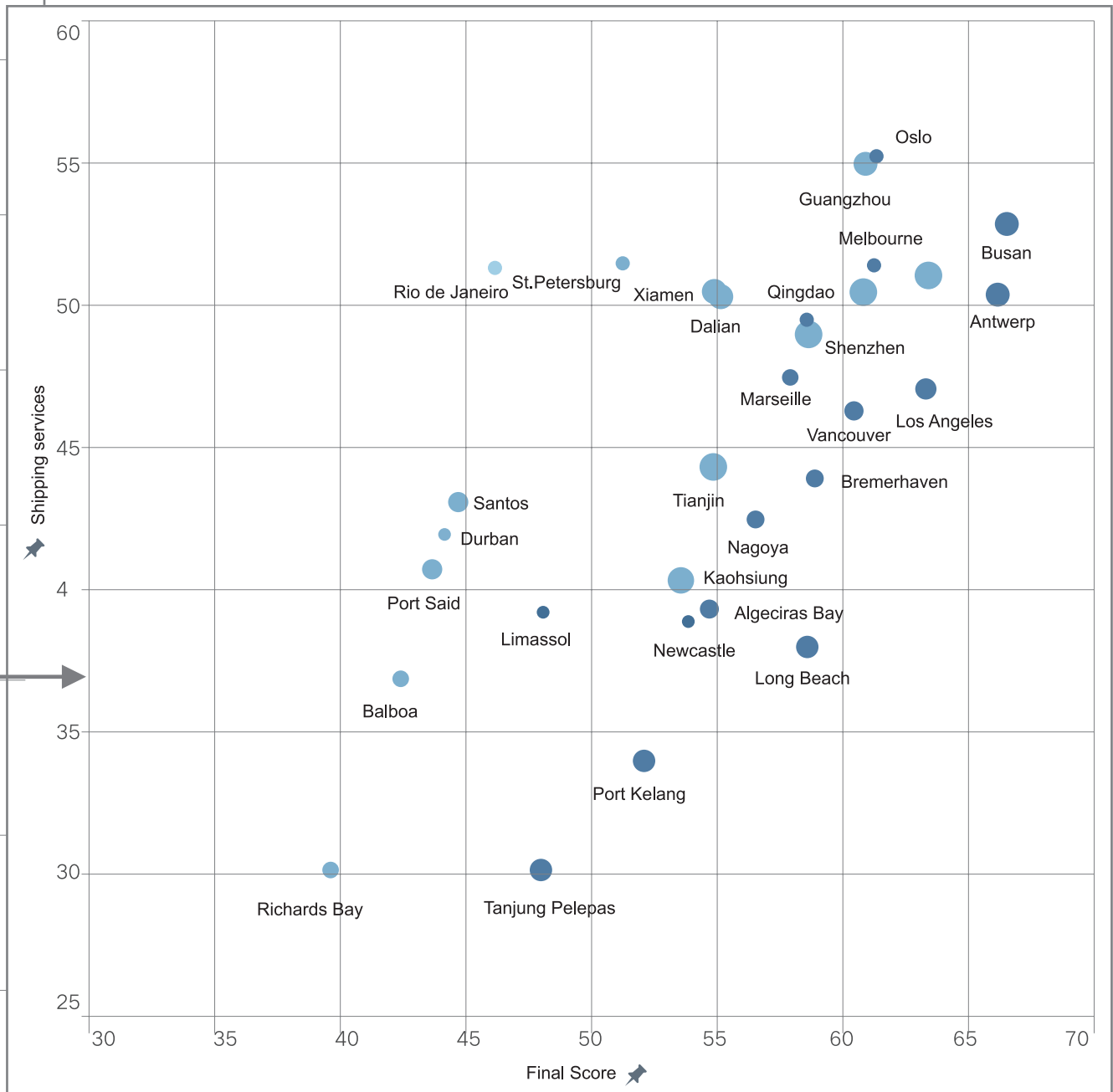
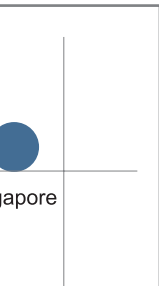


Figure 7 Xinhua-Baltic International Shipping Centre Development Index by tier



Note:

The horizontal axis represents the final score attributed to the sample port city in 2018. The vertical axis represents the primary tier indicator Shipping Service level. Areas of the bubble represent primary tier indicator Port Factors (bigger area means higher score). The colour hue represents the General Environment score (darker hue means higher score).



Stability Evaluation



The ranking of international shipping centres in 2018 showed only small changes, which bespeaks stability of the system.

Of these, there were 33 international shipping centres with stable or relative stable ranking. This accounted for 76.74% of the total sample count. Five shipping centres saw relatively volatile ranking shift, accounting for 11.63% of the total sample count. Five shipping centres saw abnormally volatile ranking shift, accounting for 11.63% of the total sample count.

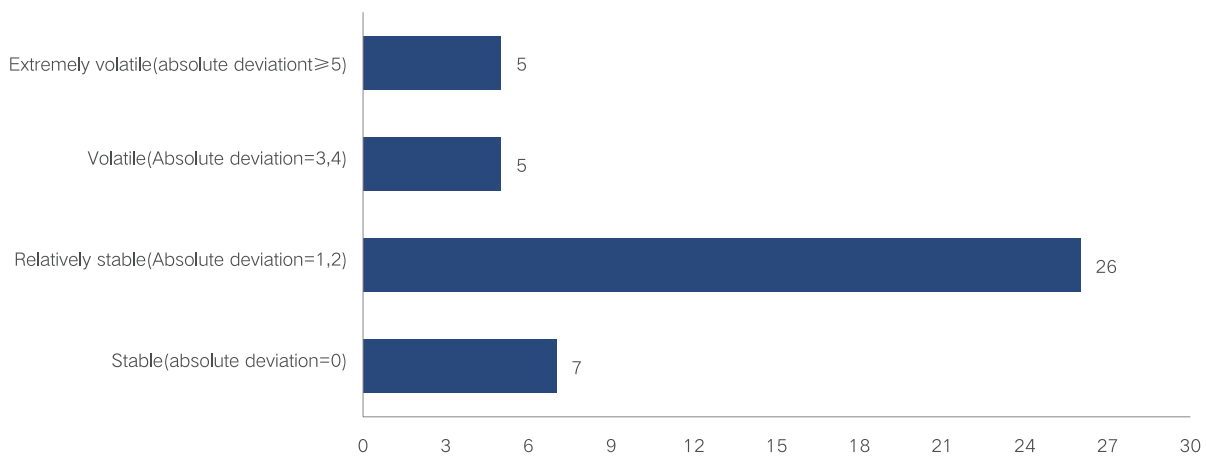


Figure 8 Absolute difference analysis of Xinhua-Baltic International Shipping Centre Development Index

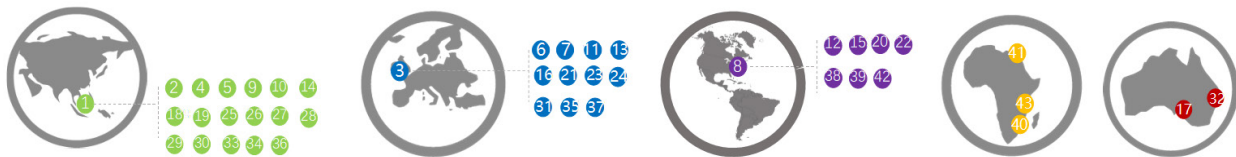


Regional Evaluation

Evaluation results of the 2018 index show that of the top ten shipping centres in the world, six are located in Asia, three in Europe and only one in America.

All the sample cities cited in the shipping centre index are located in Asia and Europe; 18 in Asia and 12 in Europe.

On the whole, there is rapid development in shipping centres in both Asia and Europe, but the rising trend of shipping centres in Asia is becoming increasingly evident.



2018 Ranking	Continent	Shipping Centre	Final Score	2018 Ranking	Continent	Shipping Centre	Final Score
1	Asia	Singapore	97.56787117	23	Europe	Copenhagen	58.60516002
2	Asia	Hong Kong	86.11277229	24	Europe	Marseille	57.99319807
3	Europe	London	83.85327622	25	Asia	Nagoya	56.64277306
4	Asia	Shanghai	78.45621335	26	Asia	Mumbai	55.38538257
5	Asia	Dubai	78.25445322	27	Asia	Shenzhen	55.36860652
6	Europe	Rotterdam	77.44753135	28	Asia	Dalian	55.28120662
7	Europe	Hamburg	76.29575285	29	Asia	Xiamen	54.95862574
8	America	New York-New Jersey	73.24658997	30	Asia	Tianjin	54.88725134
9	Asia	Tokyo	68.14915612	31	Europe	Algeciras Bay	54.72927976
10	Asia	Busan	66.66561857	32	Oceania	Newcastle	53.94755555
11	Europe	Athens	66.39894252	33	Asia	Kaohsiung	53.69121423
12	America	Houston	66.23698822	34	Asia	Port Klang	52.17115523
13	Europe	Antwerp	66.22758081	35	Europe	St. Petersburg	51.32142369
14	Asia	Ningbo - Zhoushan	63.45265916	36	Asia	Tanjung Pelepas	48.13734941
15	America	Los Angeles	63.40846004	37	Europe	Limassol	48.08501492
16	Europe	Oslo	61.41334843	38	America	Rio de Janeiro	46.21897329
17	Oceania	Melbourne	61.30367508	39	America	Santos	44.77818377
18	Asia	Guangzhou	61.002097	40	Africa	Durban	44.18676456
19	Asia	Qingdao	60.87983638	41	Africa	Port Said	43.73702917
20	America	Vancouver	60.53408636	42	America	Balboa	42.53226074
21	Europe	Bremerhaven	58.96446113	43	Africa	Port of Richards Bay	39.7583835
22	America	Long Beach	58.67046341				

Figure 9 Scores of Various International Shipping Centres and Their Distribution Across the Different Continents

Note: Different colours represent different continents in which the shipping centres are located. Asia is coloured green; Europe blue; America purple; Africa yellow; and Oceania red.

Big data perspective: New shipping trends after the expansion of Panama Canal

Elane

Connecting the Pacific Ocean and the Atlantic Ocean, the Panama Canal is one of the most important shipping channels in the world. With about 6% of the world's trade transported through the canal each year, the canal's usage situation can be regarded as the barometer for global trade.

By now, it has been 20 months since the opening of the expanded Panama Canal on 27 June 2016. What new changes or trends have been brought about by the expansion of this golden waterway in the past 20 months?

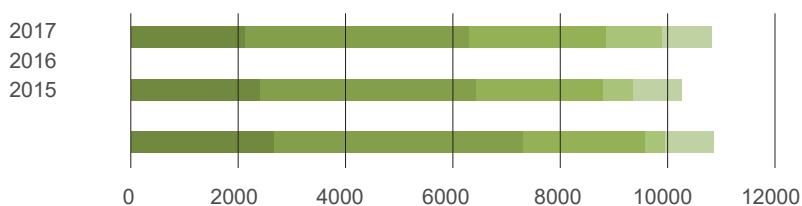
We will present answers to the above question from a big data perspective.

Rising Recovery of Vessel Throughput

In 2016, the number of vessels with capacity above 5,000 DWT transiting the Panama Canal was 10,272, down 5.34% compared to 10,852 in 2015. However, the number in 2017 increased by 5.18% to 10,804.

On a monthly basis, the number of vessel trips transiting the Panama Canal was maintained at about 900 ships per month for the recent three years. Although the monthly transit number in 2016 and 2017 was more volatile than that of 2015, it remained within the 800-1,000 range. However, since its opening after the expansion in June 2016, there has been some degree of increase in monthly ship tonnage that transited the canal. The value was mostly 30-40 million tons before the expansion, and 40-50 million tons after the expansion.

This showed that after the expansion, the capacity of the Panama Canal has improved, which is more conducive for connecting trades between the Pacific Ocean and the Atlantic Ocean.



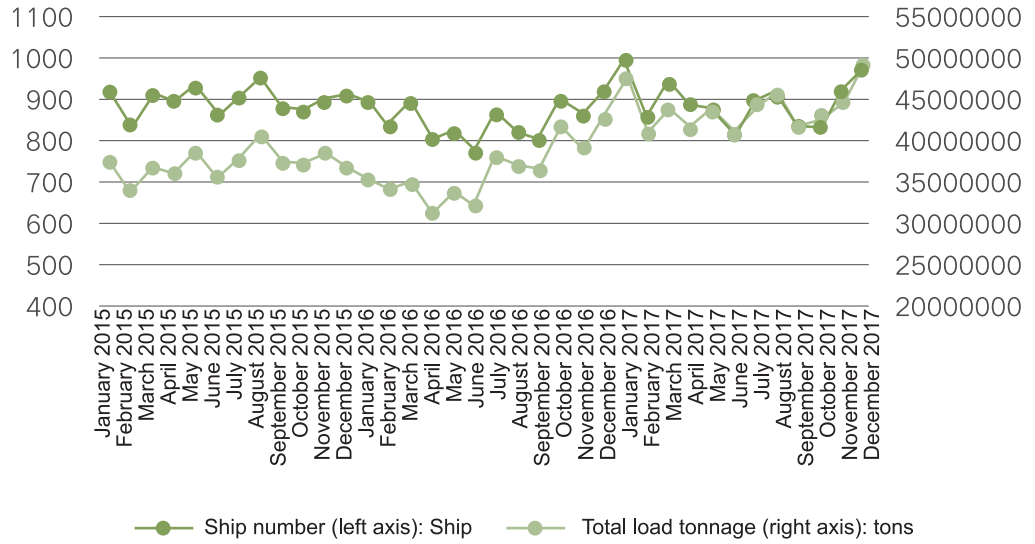
	2015	2016	2017
■ Container ships	2695	2421	2163
■ Bulk cargo ships	4615	4036	4180
■ Oil tankers and chemical tankers	2290	2343	2532
■ LNG and LPG carriers	350	562	1037
■ Other ship types	915	913	906

Source of data: Big Data from Elane





The Panama Canal pass



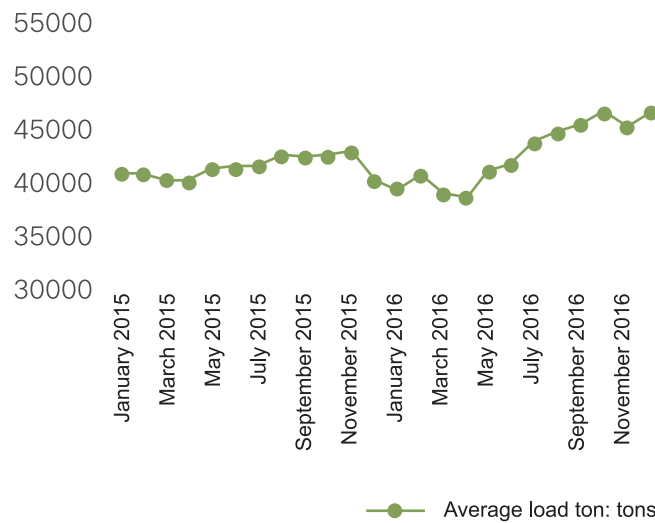
Source of data: Big Data from Elane

Clear Trend of Larger-Size Ships Transiting the Canal

From the size of ships transiting through the Panama Canal, in terms of dimensions and tonnage, there has been a clear trend that ships of growing sizes are passing through the canal after the expansion.

In 2015, the average DWT of ship transiting the Panama Canal was 41,538 tons. In 2016, it was 42,900 tons, up 3.28% or 1,362 tons; while in 2017, the increase was even more significant at 49,260 tons, up 14.83% or 6,360 tons.

Average load tonnes of ships through the Panama Canal



Source of data: Big Data from Elane

Based on the average monthly DWT that transits the Panama Canal, the volume was mostly 40,000-45,000 tons before the expansion, and 45,000-50,000 tons after the expansion. Thus, there is a clear trend of larger-size ships passing through the canal, especially after the formal opening of the expanded canal after June 2016.

The Largest Vessels Passing Through the Panama Canal Before and After its Expansion

Vessel type	1 January 2015 - 27 June 2016				28 June 2016 – 31 March 2018			
	Vessel name	Total length	Width	DWT / container volume	Vessel name	Total length	Width	DWT / container volume
Container ships					OOCL MALAYSIA	366.47	48.2M	144044DWT-144342
	HYUNDAI	294.9	32.22M	4648TEU	Sister ships	M		DWT/13208TEU
	GLORY	M			CMA CGM	366M	48.2M	148992DWT/14414T
					G.WASHINGTON			EU
Bulk cargo ship	CAROLINE	245			GOLDEN			
	OLDENDOR	M	32.2M	77549DWT	SURABAYA	292M	45M	181046DWT
	FF							
	MYNIKA	M	32.2M	84108DWT				
Oil tankers and chemical tankers	OVERSEAS	229.2	32.2M	74192	BEOTHUK SPIRIT	293M	49M	155000
	SAMAR	M			DA LI HU	274.7M	48M	159549
LNG and LPG carriers					CASTILLOSANTI	299.9M	45.8M	93796
	CLIPPER	227.2	32.2M	54048	STEBAN			
	SIRIUS	M			HYUNDAI	295.5M	46.4M	98344
					PRINCEPIA			

Source of data: Big Data from Elane

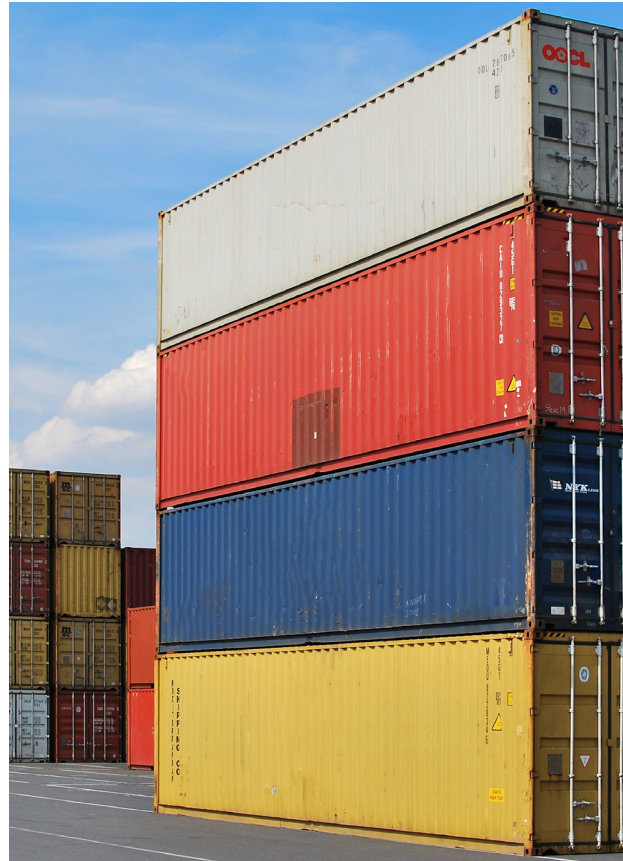


From container ship perspective, before the expansion in 2015, the largest container ship that passed through the canal was the 4,648TEU HYUNDAI GLORY which had a total length of 294.9M and width of 32.22M. Since the expansion, the largest container ships that passed through the canal include a group of sister ships named OOCL MALAYSIA, OOCL KOREA, OCL POLAND, OOCL KOREA, OOCL FRANCE, OOCL CHONGQING and OOCAL BERLIN. At a capacity of 13,208TEU, each of these ships had a total length of 366.47M and width of 48.2M. However, based on another benchmark – the DWT – these ships are relatively smaller compared to CMA CGM G.WASHINGTON, which has a DWT of 148,992 tons and capacity of 14,414TEU; although it measures only 366M in length and 48.2M in width. The seven sister OOCL ships have DWT of between 144,044 to 144,342 tons.

From bulk cargo ship perspective, before the expansion in 2015, the largest ship by dimension is CAROLINE OLDENDORFF measuring 245M in length and 32.2M in width but its DWT of 77,549 tons is smaller than MYNIKA at 84,108 tons; the MYNIKA has a length of 235M and width of 32.2M. Since the expansion, the largest bulk cargo ship that passed through the canal was DEN SURABAYA with a total length of 292M, width of 45M and DWT of 181,046 tons.

From oil and chemical tanker perspective, before the expansion in 2015, the largest ship by dimension is OVERSEAS SAMAR measuring 229.2M in length and 32.2M in width but its DWT of 74,192 tons is smaller than BW RHINE at 76,578 tons; the BW RHINE has a length of 228.6M and width of 32.2M. Since the expansion, the largest tanker by dimension that passed through the canal was BEOTHUK SPIRIT measuring 293M in length and 49M in width but its DWT of 155,000 tons is smaller than DA LI at 159,549 tons; the DA LI has a length of 274.7M and width of 48M.

From LNG and LPG carrier perspective, before the expansion in 2015, the largest ship that passed through the canal was CLIPPER SIRIUS which had a total length of 227.2M, width of 32.2M and DWT of 54,048 tons. Since the expansion, the largest ship by dimension that passed through the canal was CASTILLOSANTISEBAN measuring 299.9M in length and 45.8M in width but its DWT of 93,796 tons is smaller than HYUNDAI PRINCEPIA at 98,344 tons; the HYUNDAI PRINCEPIA has a length of 295.5M and width of 46.4M.

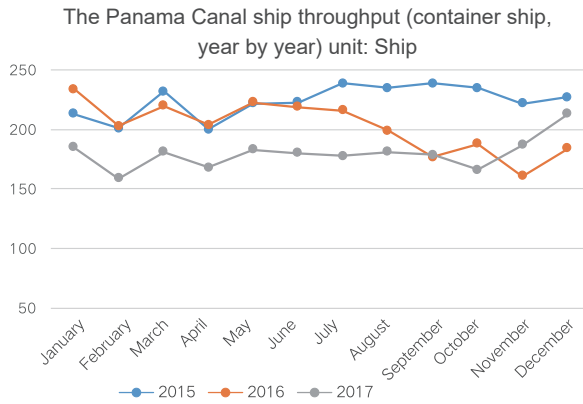


Impact of Canal Expansion on Different Types of Vessels

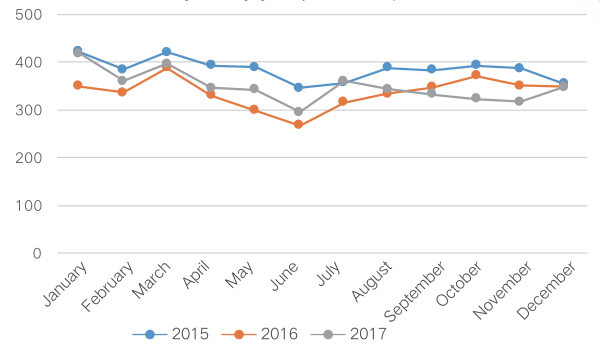
On the whole, the monthly number of vessel trips and total tonnage transiting the Panama Canal after its expansion had increased to a certain extent; but the differences are significant for different types of vessels. We have analysed these differences in terms of the four types of vessels, namely container ship, bulk cargo ship, oil and chemical tanker, as well as LNG and LPG carrier. We looked at three dimensions pertaining to ship transit through the Panama Canal – including number of ships, total DWT and average DWT – on a monthly basis, and produced the 12 charts shown below.



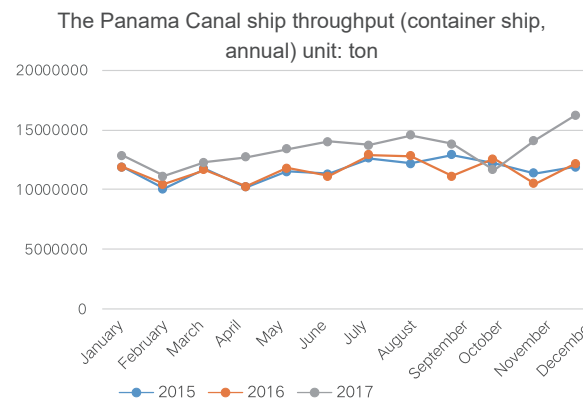
Number of vessel trips passing through the Panama Canal each month



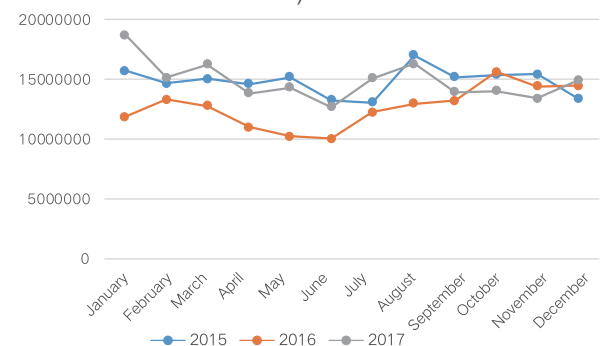
The Panama Canal ship throughput (bulk cargo ship, year by year) unit: Ship



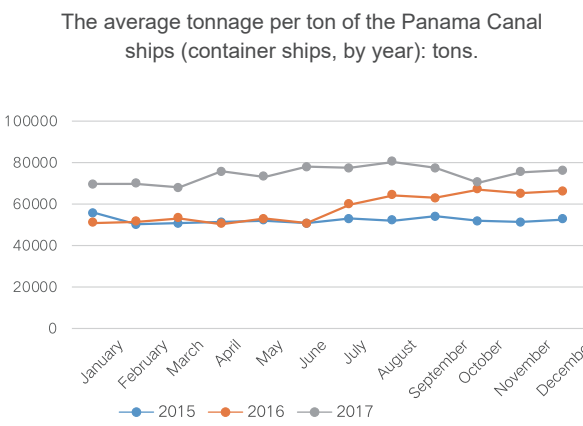
Total DWT of vessels passing through the Panama Canal each month



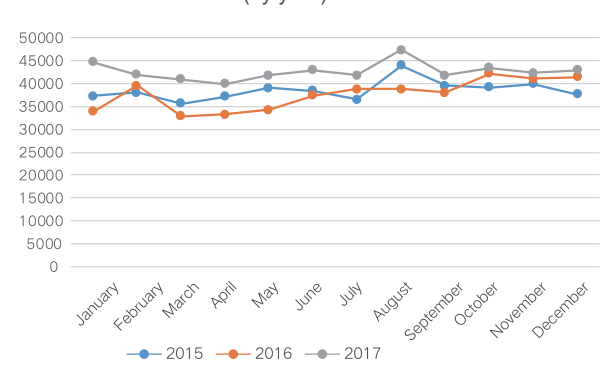
The Panama Canal ship throughput (bulk cargo ship, annual) unit: ton



Average DWT of vessels passing through the Panama Canal each month

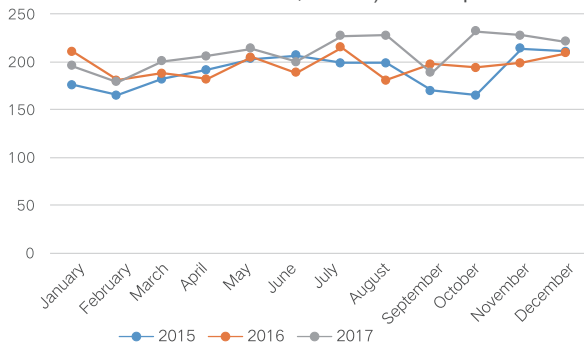


The average tonnage of ships in the Panama Canal (by year): tons.

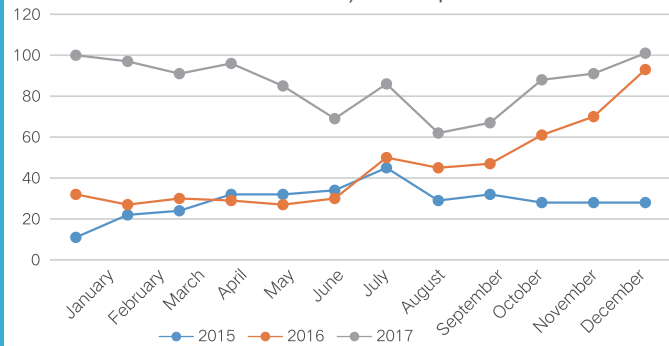




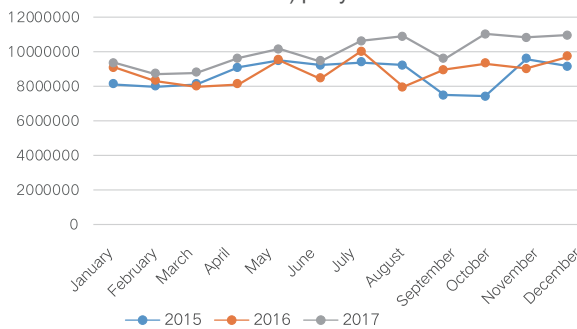
The Panama Canal ship throughput (tanker and chemical vessel, annual) unit: Ship



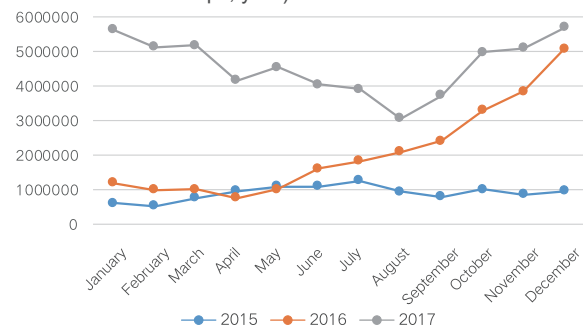
The Panama Canal ship throughput (LNG and LPG, annualized) unit: Ship



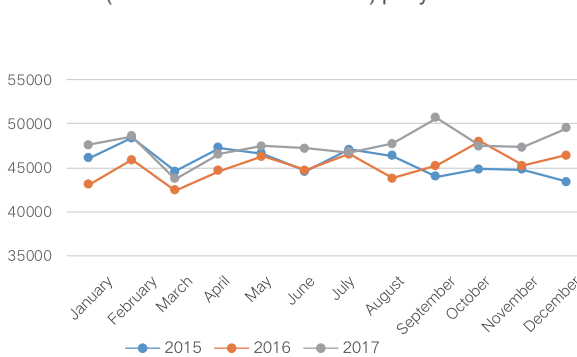
The Panama Canal ship throughput (tanker and chemical tanker) per year: unit: ton



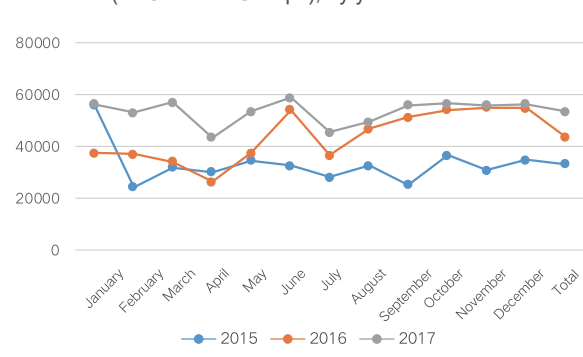
The Panama Canal ship throughput (LNG and LPG ships, year) units: tonnes



The average tonnage of ships in the Panama Canal (tanker and chemical tanker) per year: ton



The average tonnage of ships in the Panama Canal (LNG and LPG ships), by year: unit: ton



From the above 12 charts, we can quickly obtain the following matrix and draw relevant conclusions:

Clearly, LNG and LPG vessels benefited most from the expansion of the Panama Canal with significant increase in vessel trips and total DWT tonnage, which reflected relatively strong market demand. There was a slight increase in market demand for oil tankers and chemical tankers, but the demand was generally stable. The container ship vessel type is most affected by the trend of growing ship size, with a slight increase in market demand. There was rising recovery of market demand for bulk cargo ships.

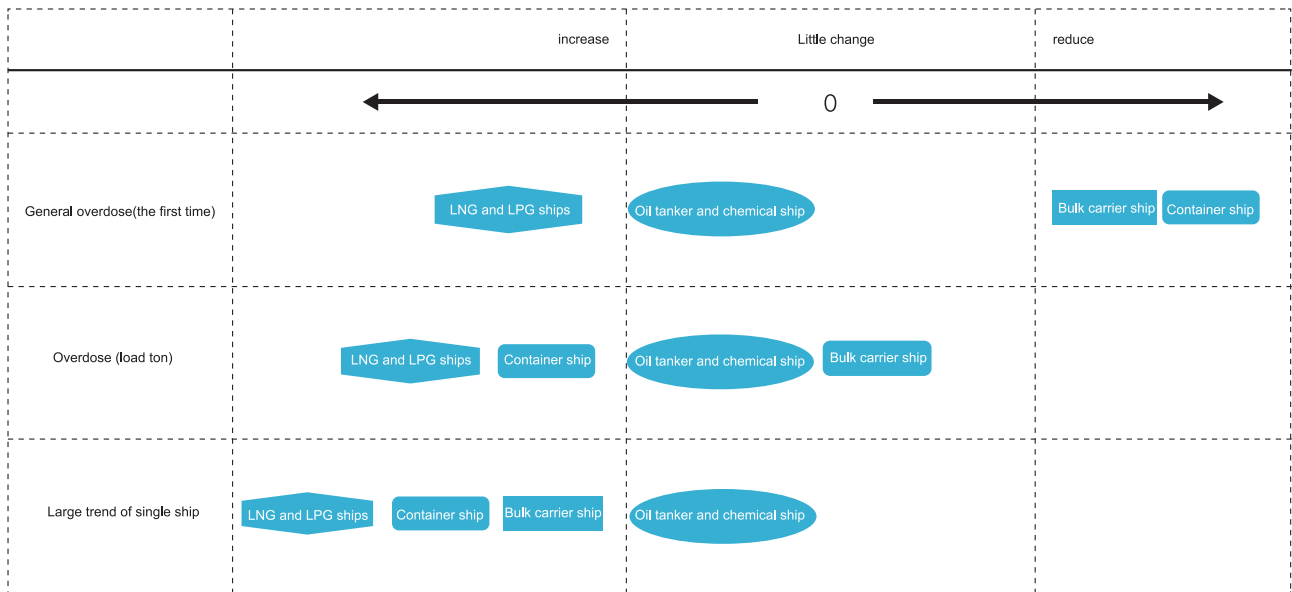
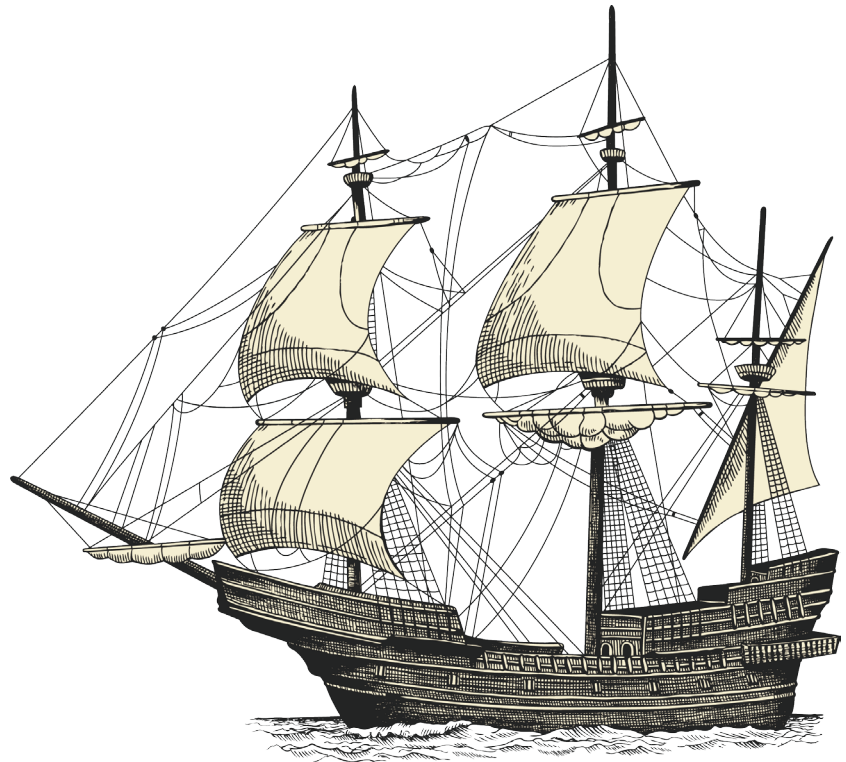


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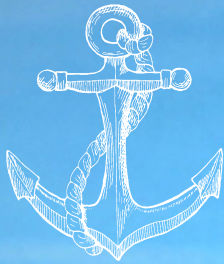


Reduction in average transit time through the canal, but the difference is significant between different vessel types.

After the expansion of the Panama Canal, there is a significant reduction in average transit time through the canal. Using data collected 18 months before and after July 2016, the average transit time has reduced by about 70 minutes.



Source of data: Big Data from Elane

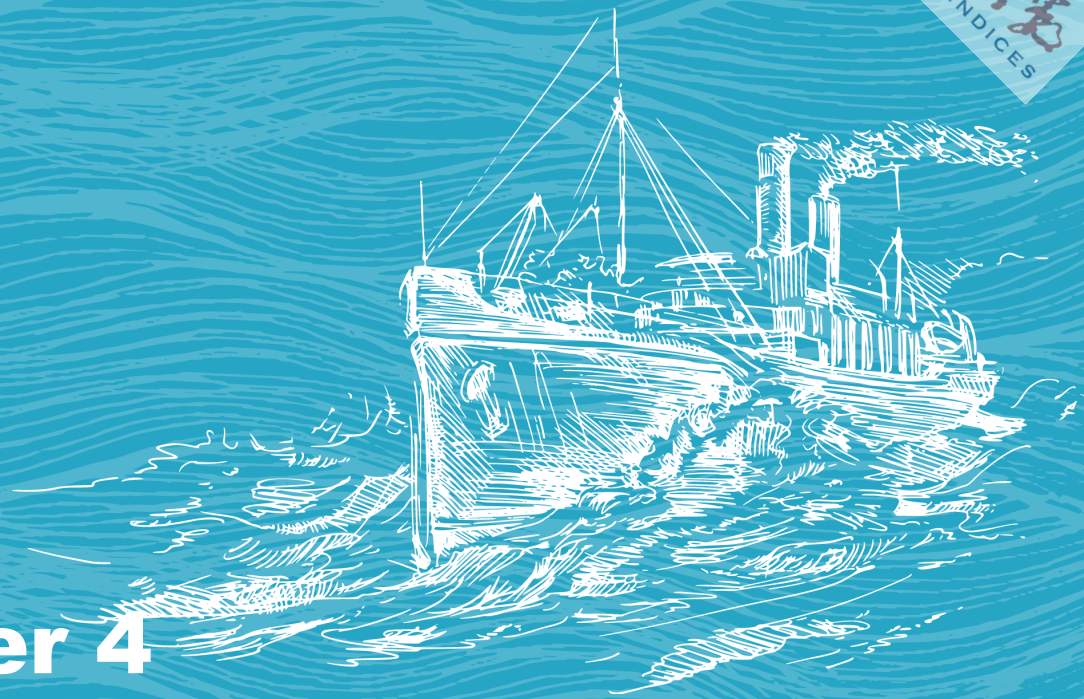


XINHUA-BALTIC
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2018







Chapter 4

Featured Topic Research: Global Shipping Services

XINHUA-BALTIC
INTERNATIONAL SHIPPING
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04



Shipping services are the core factors for assessing the competitiveness of international shipping centres.

Shipping services are generally evaluated in six aspects: namely ship broking service, ship engineering service, shipping business service, maritime legal service, shipping finance service and ship repair service.

Evaluation of international shipping centres in 2018 shows the top ten port cities with the best shipping services are, by order of ranking: London, Singapore, Hong Kong, Shanghai, Dubai, Athens, Hamburg, New York-New Jersey, Tokyo, and Houston.

Of these, London, Singapore, Hong Kong and Shanghai have been occupying the top four places for four consecutive years; thus indicating their stability as shipping centres.

Houston's shipping services have gained significant momentum in development and attained the top ten places for the first time in five years.

Ranking	2018	2017	2016	2015	2014
1	London	London	London	London	London
2	Singapore	Singapore	Singapore	Singapore	Singapore
3	Hong Kong	Hong Kong	Hong Kong	Hong Kong	Hong Kong
4	Shanghai	Shanghai	Shanghai	Shanghai	Dubai
5	Dubai	Athens	Athens	Athens	Shanghai
6	Athens	Dubai	Dubai	Dubai	Hamburg
7	Hamburg	Hamburg	New York	Hamburg	Tokyo
8	New York-New Jersey	New York	Tokyo	New York	Mumbai
9	Tokyo	Mumbai	Hamburg	Tokyo	Athens
10	Houston	Tokyo	Mumbai	Mumbai	New York

Table 2 TOP10 Shipping Services of Xinhua-Baltic International Shipping Centre Development Index



Shipping Finance Service

As a capital-intensive industry, the shipping industry requires significant capital investment in infrastructure and shipbuilding. Hence, shipping finance service plays a vital role in shipping industry and construction of international shipping centres. Its scope encompasses four areas: namely ship financing, maritime insurance, capital settlement, and shipping derivatives.

Ship financing

Data from Marine Money shows that over the ten years between 2007-2017, global ship financing has been volatile and trending downwards.

Syndicated loans still account for majority of the traditional shipping financing method. However, with gradual improvement of the shipping financing market, debt capital market (DCM) and equity capital market (ECM) are progressively becoming important financing channels for enterprises.

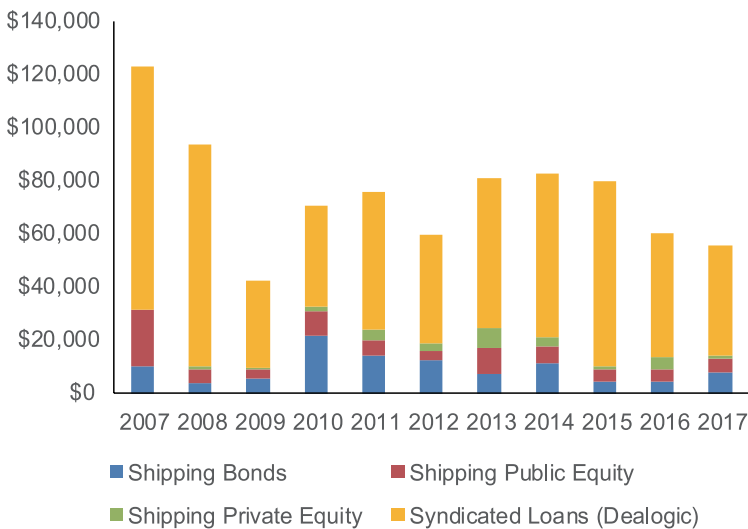


Figure 10 2007-2017 Volume of Global Shipping Finance (million USD)

Source of data:
Marine Money





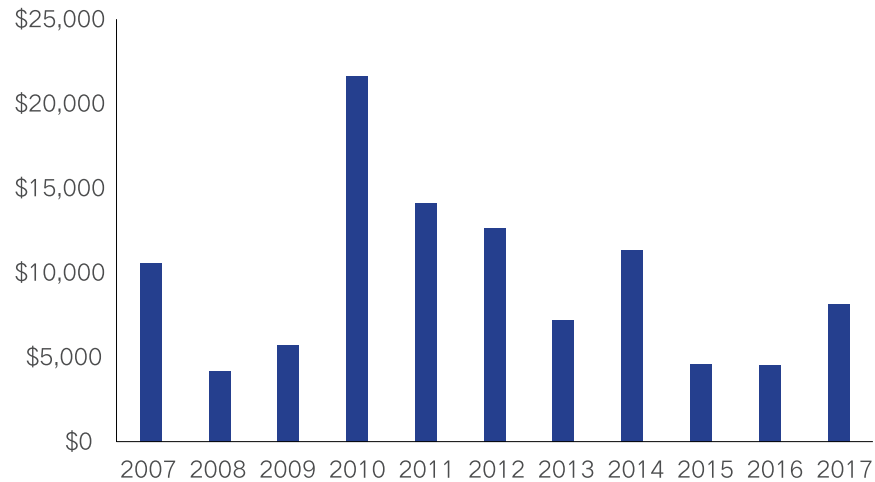
Shipping Debt Capital Market (DCM)

The shipping debt capital market has stabilised and recovered.

Data from Marine Money shows that debt capital market increased significantly in 2017 with a total financing value of USD 8,146.55 million, up 79.39% compared to 2016.

Figure 11 2010-2017
Volume of Bond
Financing (million
USD)

Source of data:
Marine Money



Shipping Equity Capital Market (ECM)

The volatility of shipping equity capital market has weakened.

As can be seen from the 2007-2017 global shipping equity market data, financing quantum for year 2007, at USD 21,029.76 million, was the peak for the past ten years.

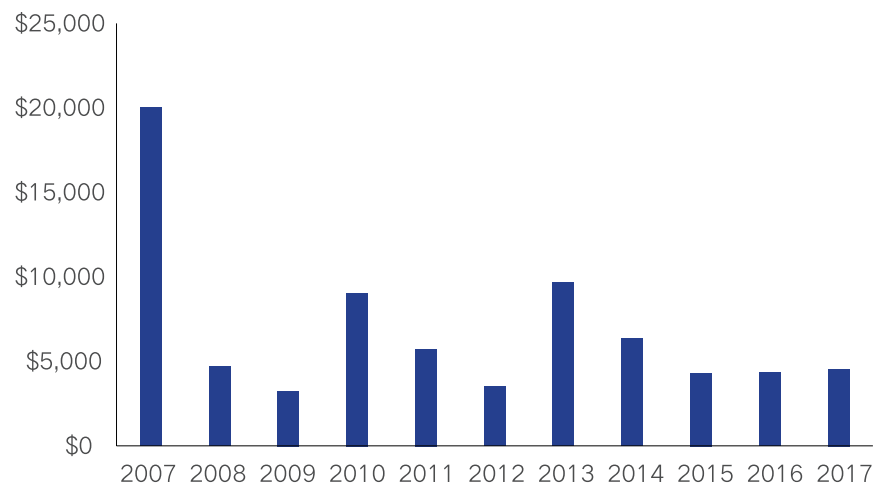
However, since the global financial crisis in 2008, the shipping market has entered a cycle of weakness which saw significantly reduced financing.

At present, with gradual improvement of the economic situation, shipping market is picking up progressively.

The size of financing in 2017 was USD 4,792.49 million, up 5.1% compared to 2016.

Figure 12 2007-
2017 Volume of
Global Shipping
Public Equity
Investment (million
USD)

Source of data:
Marine Money



Data from Marine Money show over the ten years between 2007-2017, global shipping financing through private equity investment has been contracting.

In 2017, the scale of financing diminished significantly at only USD 1,301.82 million, down 70.49% compared to 2016.

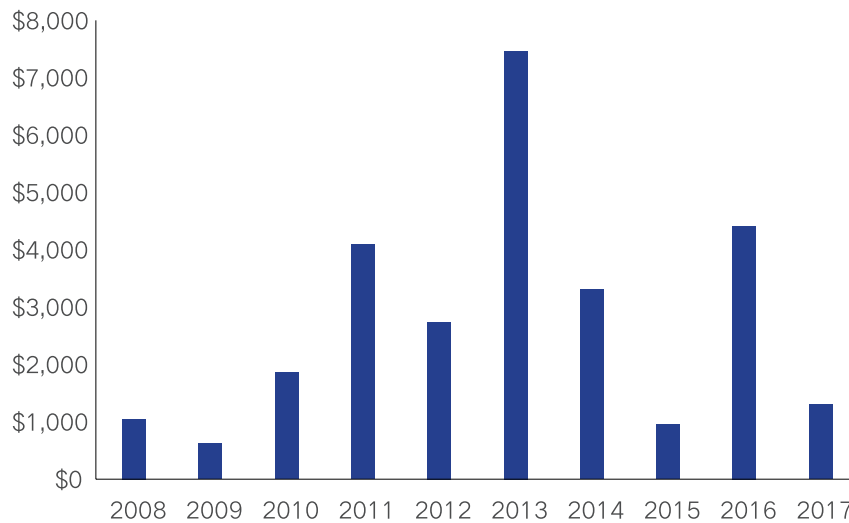


Figure 13 2008-2017 Volume of Global Shipping Private Equity Investment (million USD)

Source of data:
Marine Money

Syndicated loan financing

All along, syndicated loan, as the main mode of shipping financing, has been providing key support for the development of the shipping industry.

However, with the shipping market in the doldrums these years, interest of bank investment in the shipping industry has seen a gradual decline.

With continuous decline in the size of shipping financing, the size of global syndicated loan financing for 2017 was only USD 41,451 million, down 11.33% compared to 2016.

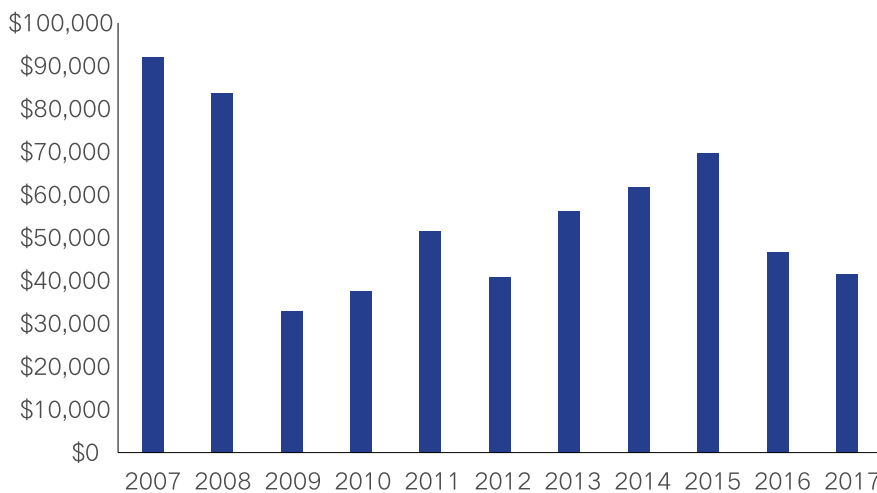


Figure 14 2007-2017 Size of Global Syndicated Loan Financing (million USD)

Source of data:
Marine Money



Global Viewpoint:

The Impact of Chinese Leasing on Ship Finance

Campbell Houston

Research Analyst, Marine Money International

As the maritime industry faces a persistent scarcity of capital, Chinese leasing has expanded to fill a critical gap.

Chinese leasing provided an estimated \$12.5 billion to the shipping industry in 2017, approximately 17 percent of the industry's total financing. According to Dealogic, global syndicated loan volume for the marine industry totaled \$40.5 billion in 2017, a steep decline from the \$61.8 billion in 2015. Equity and debt capital markets meanwhile have stagnated, raising \$7.4 billion and \$10.0 billion, respectively, globally in 2017. Equity capital markets have been largely closed; there hasn't been a true shipping IPO since 2015. Norwegian bonds, preferred equity, and other products have come and gone, providing important capital to the industry, but they have not become lasting pillars of ship finance. These trends have many causes that have been well covered by industry analysts and publications like Marine Money. Unlike other financial products, Chinese leasing may become a permanent fixture in the maritime industry and become a capital structure component for all shipping companies, as bank debt is today.

Lease finance has predominantly been used to refinance existing tonnage, rather than support newbuildings. This is widely welcomed by the industry, which has long been hampered by overbuilding and an oversupply of vessels. Leasing providers are not limited to any particular sectors and have financed a variety of vessels, including bulkers, product tankers, and high specification gas carriers. There is an ability to finance vessel en bloc and five and six vessel deals are common. Shipowners that have successfully arranged

Chinese lease finance, often return to the sector for further deals. Scorpio Tankers announced three Chinese leasing deals in the last 30 days, covering a total of 17 vessels. Over the last 12 months, the company has leased 25 of its ships in five deals, each with a different lessor.

The Chinese leasing market is supplemented by Japanese leasing and commercial leasing. Japanese leasing features a taxation benefit for investors, however there is a limited pool of investors which can benefit from such a transaction, limiting the overall size of this market. Dorian LPG Ltd. has arranged leases for three Large Petroleum Gas Carriers since November 2017 with three separate undisclosed Japanese financial institutions. Commercial leasing companies have a well-established role in the industry. The lessor Ship Finance International Ltd. owns 69 vessels worth \$2.3 billion while another, Seaspan Corporation, owns 61 vessels worth \$1.5 billion. The relative newcomer Ocean Yield ASA has a fleet of 38 vessels worth \$1.5 billion. Ocean Yield has a fast-growing portfolio, providing leases for 15 vessels worth an aggregate of \$667 million during 2017 and 2018 year-to-date. These companies and others provide important financing to the industry but are dwarfed by the scale that the Chinese leasing market has achieved.

As legacy forms of capital and finance retrench, leasing companies have been the primary funding source to fill the financing gap. Chinese leasing has entered the shipping industry at a critical time. As shipowners and financial institutions continue to meet and build relationships, leasing will continue to grow and become a permanent component of ship finance.



Maritime Insurance

In 2016, the global maritime insurance gross premium income declined for five consecutive years; a sign of continued weakness in the maritime insurance market.

In 2016, the global maritime insurance gross premium income was USD 27.5bn, down 9.1% compared to 2016.

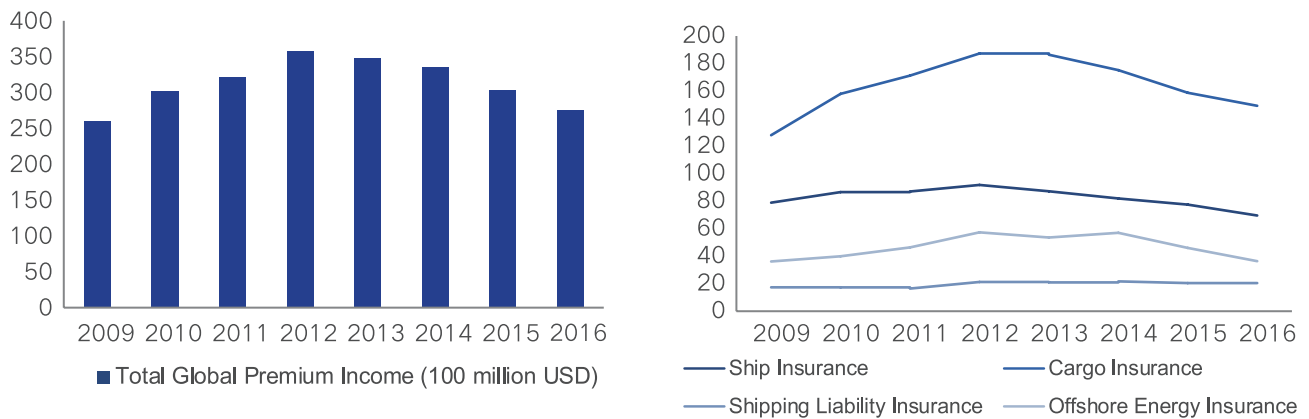


Figure 15 2009-2016 Global Maritime Insurance Gross Premium Income by Region (100million USD) and Trends by Insurance Category

Analysis in terms of different insurance category, premium income from transport/cargo insurance accounts for 54% in 2016;

while offshore energy insurance, marine liability insurance and global hull insurance account for 13%, 7% and 25% respectively.

The proportion of premium income from transport/cargo insurance rose slightly.

Geographically, Europe, being a veteran shipping centre with significant competitive edge, still accounts for more than half of the maritime insurance services market.

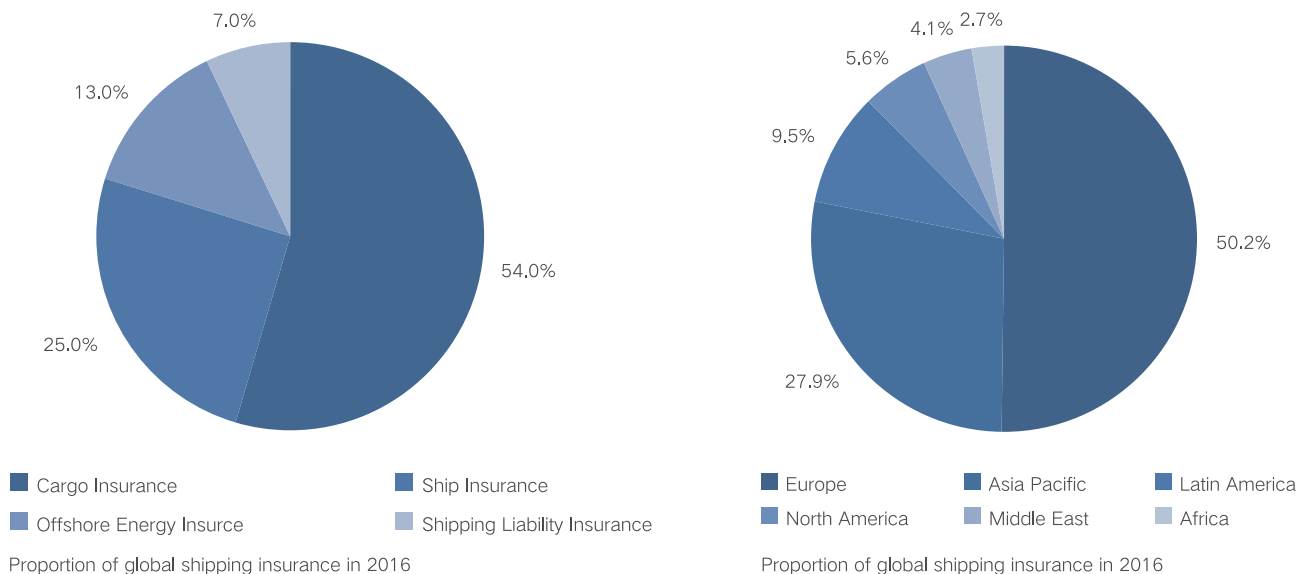


Figure 16 2016 Global Shipping Insurance Premiums by Category and by Region



Global Viewpoint:



Freight Derivatives 101

Will Chin

Head of Metals and Bulks, Derivatives, Singapore Exchange

We are constantly reminded that over 90% of the world's trade is carried by sea, and that with current technological and engineering limitations, still remain the most cost-effective way to transport the bulk of raw materials and goods around the world.

What is less known, and certainly less practised, is that there have been financial instruments available since 2004 that mirror the movement of freight rates for bulkers, and allow exposure to freight prices for risk management.

What are freight derivatives?

The provision of derivatives products to manage price volatility is arguably one of the most important economic functions of an Exchange. In its most basic form, buying a contract results in a 'long' trade positioned for rising prices, while participants can sell and put on a 'short' trade to benefit from falling prices.

Forward Freight Agreements (FFAs) are derivatives that reference key Baltic indices on specific voyage routes (on a \$/mt basis), or a basket of routes (\$/day basis). For example, a miner in Australia selling iron ore to China will be interested in the Baltic-assessed C5 route (covering Western Australia to Qingdao). An SGX contract on the C5 FFA (of 1,000 metric tonnes of cargo) will allow the miner to take a view on this route going out to 2 years.

All dry bulk freight contracts settle to the Baltic indices.

Getting started in hedging

The starting point in any risk management programme is a clear understanding of the direction of physical price risk. A ship owner is a 'natural long' exposed to falling freight rates (since the ship will be chartered out at lower prices), while a cargo owner is a 'natural short' exposed to rising freight rates (as it will cost more to charter a vessel to transport the cargo).

Once it is clear which direction of price move has a

negative impact, freight derivatives can be utilised to 'offset' this risk. In the case of a ship owner, selling an FFA will produce positive returns should prices fall, offsetting the lower price that the ship can be chartered out for. Conversely, the cargo owner can purchase an FFA to protect against rising shipping costs.

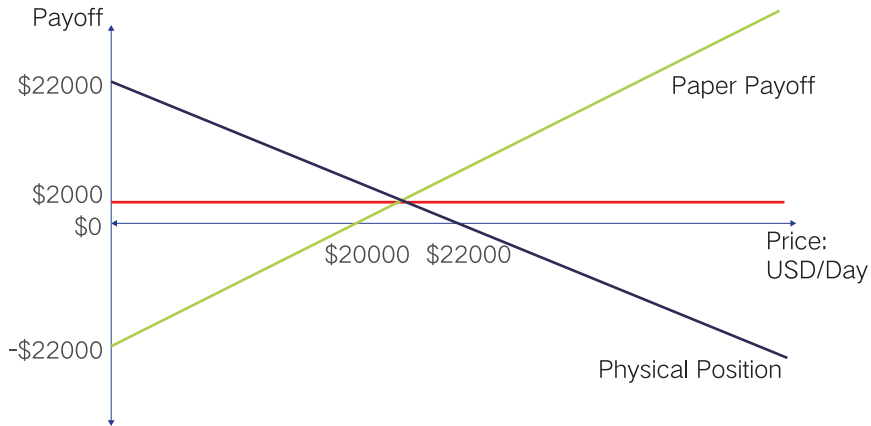
It is important to recognise that hedging locks in a (combined physical and paper) price, such that an underlying physical price move is cancelled out by an equal and opposite price move in the 'paper' position. This means that there is no such things as a 'good hedge' or a 'bad hedge', but rather the company has eradicated price uncertainty and achieved a 'fixed' price regardless of whether prices subsequently rises or falls. This allows the company to focus on its core operations of production and sales, without subjecting its profitability to market price swings. Put another way, not hedging is akin to speculating on future price moves!

Why is shipping price risk management important?

The need for risk management and hedging in the shipping world is often understated. Compared to a wide range of other commodity products, freight is one of the most volatile of commodity products, and displays significant volatility in the movement of prices. This means that not properly managing price risk can lead to serious consequences on the bottom line, and potentially survival issues for the company.

This is especially so in an industry that has been battered the past few years by overcapacity and weak market demand, where low carriage rates are only starting to recover –improving but still razor thin margins mean that anyone caught wrong-footed when volatility spikes will likely get into trouble. We have witnessed this first-hand with mining companies, and the consolidation trend we are seen and are still seeing in the shipping industry.

On Jan-18, A ship owner goes into a time charter for his Capesize in Dec-18 for \$22000/Day. He buys a Dec-18 paper contract at \$20000/Day in Jan-18 to lock in his payout



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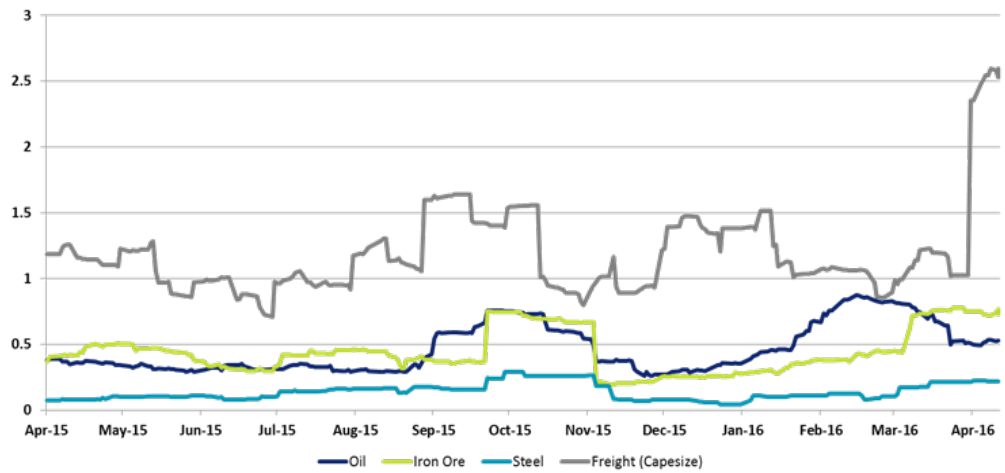


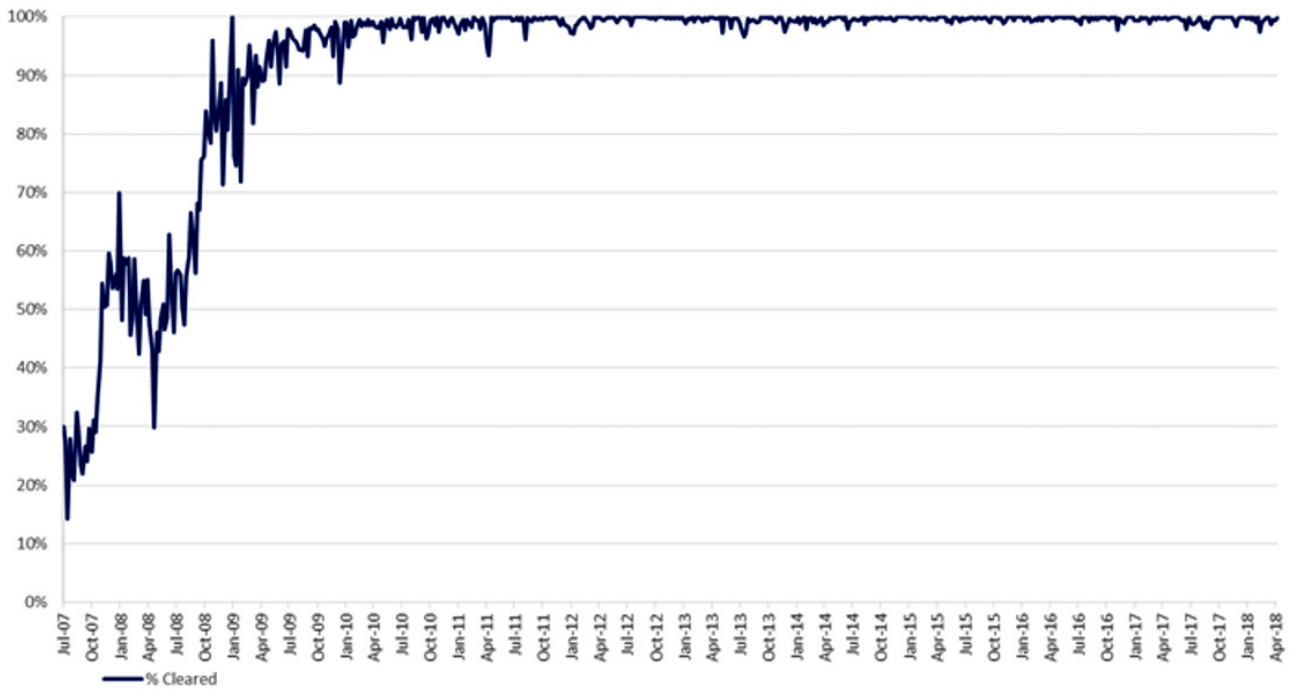
What is clearing?

While the crash in freight prices in 2008 brought about much media focus on the hardship for the shipping industry, it surfaced a less-reported but crucial transition in the market - the migration of bilateral un-cleared OTC FFAs onto a centrally-cleared venue.

Prior to 2008, counterparties assumed each other's credit risk in that a financial default by either side resulted in a direct financial impact to the other party. The onslaught of the financial crisis and subsequent regulations mandating clearing to reduce systemic risk changed all of this - in a nutshell, the Clearing House performs the role of credit disintermediation by standing in the middle of two clearing members, guaranteeing financial performance in the event of a member default.

Annualized 30D Volatility against other commodities





This means that a client transacting FFAs no longer has to worry about counterparty credit-worthiness (since this is undertaken by the member), has access to a wider pool of counterparties to trade with, which results in better liquidity through better bid-offer spreads. Effectively, clearing has broadened the pool of participants, and increased liquidity and transparency in the market.



Uncleared OTC Trades

- Various parties trade FFA directly with each other
- Counterparty risk builds up as direct multilateral transactions between parties get complicated



Cleared Trades

- Various parties trade FFA with each other and register their trades with a Central Counterparty (CCP)
- The CCP takes over as the counterparty, eliminating counterparty risk



What are some of the considerations in a hedging framework?

The success of a hedging programme is in many ways shaped by the risk management framework put in place. While there are ultimately many firm-specific factors to consider, some of the key considerations include clarity on the board's risk appetite, definition and benchmark of 'success'. This will drive the execution of how the hedges are structured, whether exposures are managed in full or in part, as well as when the trades are executed taking into account an internal view of where prices are headed.

The Singapore Exchange (SGX) celebrated a decade-long relationship with the Baltic Exchange in 2016, and following the acquisition of the Baltic that year, the first anniversary of the Baltic as a subsidiary earlier this year. We continue to prioritise ongoing efforts to educate on the benefits of FFA hedging, as well as grow the pool of FFA liquidity. Our position in Asia has provided us with front row seats to the explosive growth and development of physical shipping activity in the Asia region - this insight, coupled with a push to bridge freight and cargo participation, as well as geographical liquidity pools in Europe and Asia, is why SGX clears over half of the global dry bulk FFA market today.

As we emerge from the shipping doldrums of recent memory, this year's Singapore Maritime week reminds us

of the constant challenges the shipping industry is facing, not least from the fintech revolution wind currently blowing across all markets. While the shipping industry will no doubt find opportunities to propel ahead, our belief is that increasing FFA adoption as part of a push toward risk management best practice will most certainly help the industry to sleep better at night.

SGX is authorised by the CFTC as Asia's first Derivatives Clearing Organisation (DCO) and is recognised by ESMA as an equivalent third country CCP. This means that users of SGX's clearing service can rely on the SGX service as meeting clearing and regulatory requirements laid out by the CFTC and ESMA.



Shipping Brokerage Services

Shipping brokerage is the link between many facets of shipping transaction. Therefore, it possesses a huge amount of information related to ship sale transaction and can help in rapid delivery of ships.

For a long time, London, as a traditional shipping centre, still holds a leading position in shipping brokerage services. In particular, its information resources and the wide network of brokerage companies have exhibited strong competitiveness.

However, with the eastward shifting of the world's shipping centres, second-tier shipping services in the Asian region, led by Singapore have also taken shape and are beginning to close the gap with London in terms of services.

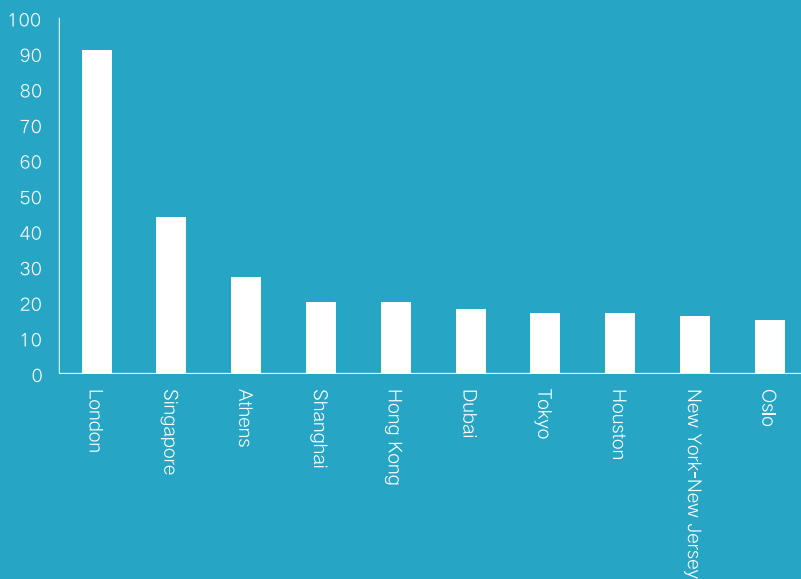


Figure 17
Top 10
Countries
With the Most
Number of
Shipbroker
Companies





Maritime Legal Services

Maritime legal service tackles legal issues related to ship or property losses or share of losses due to some specific relationship between parties where such losses occur at sea or along navigational waterways.

As a component of maritime legal service, international maritime arbitration is a high-end industry which portrays a country's soft power in maritime trade.

Maritime Arbitration

For a long time, Britain, as a veteran shipping centre, with its excellent geographical location and first-class service has become a spot where international maritime arbitration centres congregate, and has attracted a huge number of maritime arbitration practitioners.

With 428 maritime arbitrators in 2017, London remains a very strong centre for maritime arbitration services; a position that is hard to catch up by its competitors in the short term.

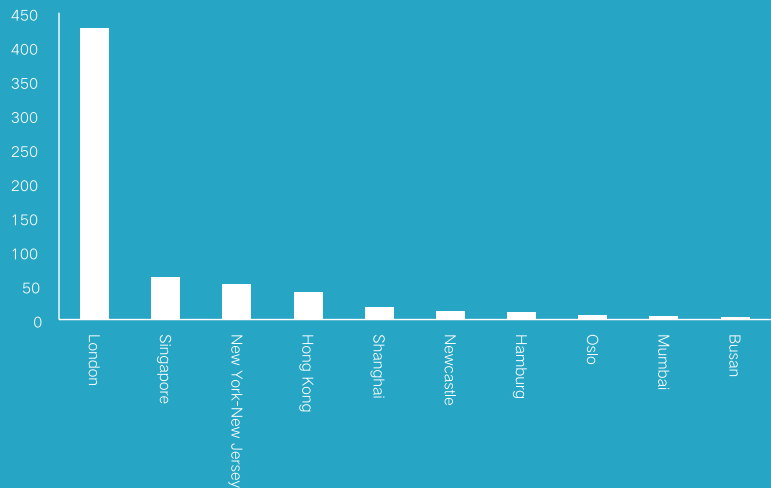


Figure 18 Top 10 Shipping Centres by Number of Maritime Arbitrators (Number)

Maritime-Related Law Firms

Apart from maritime arbitration, maritime-related law firms also form an important part of the maritime legal services.

The number of maritime-related law firms in 2016 shows that the top five cities with the most number of maritime-related law firms are London, New York-New Jersey, Shanghai, Singapore and Copenhagen respectively.

With a significant increase in number of maritime-related law firms, Shanghai has overtaken Singapore and Hong Kong to occupy the third place.

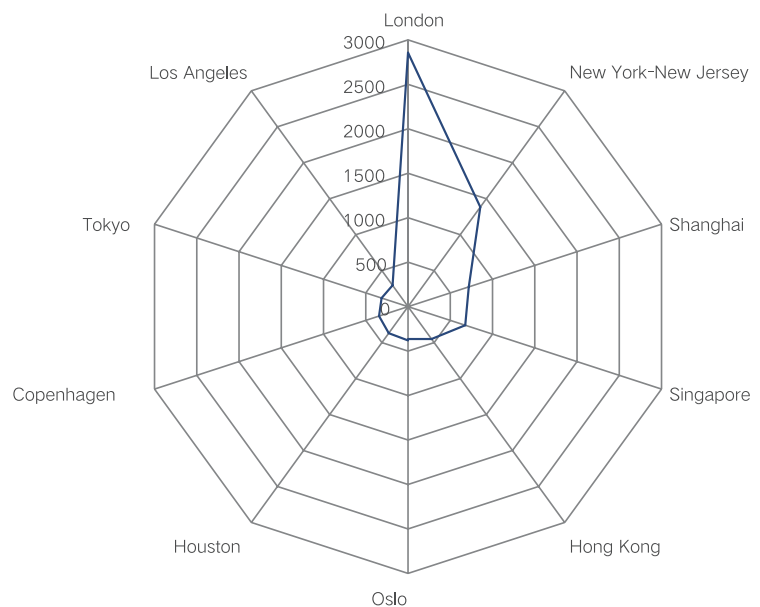


Figure 19 Top 10 Countries by Number of Maritime-Related Law Firms (Number)

Ship Engineering Service

Ship engineering service mainly includes shipbuilding, repair and quality inspection.

The ship classification society is the key organisation that oversees ship engineering services. Its main pursuit includes the devising of relevant technical standards for ship maintenance.

Judging from the number of shipping companies located in various ports in 2017, the eastward shifting of ship engineering service centres has become more significant. Shanghai, Singapore and Hong Kong leapt into top five in the world in terms of number of shipping companies, continued improvement in ship engineering services and management systems.

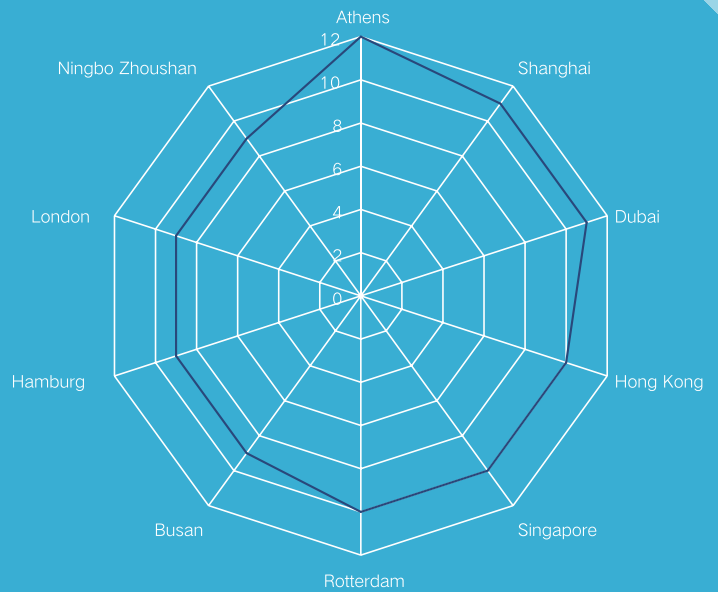


Figure 20 Top 10 Ports With Most Number Of Shipping Companies (Number)





Shipping Business Service

Shipping business service refers to ship operation and management services. A company may manage its own vessels or manage on behalf of 3rd party owners.

The main indicators include the number of ship management companies operating in the port and the number of branch offices of the top 100 container shipping companies or bulk carrier companies.

The top 20 companies named in the top 100 container shipping companies are mainly concentrated in Asia-Pacific.

Wherein, shipping centres with at least 40 branch offices of container shipping companies are mainly concentrated regions like Shanghai and Singapore.

Shipping centres with at least 20 branch offices of bulk carrier companies are mainly concentrated in Singapore and London.

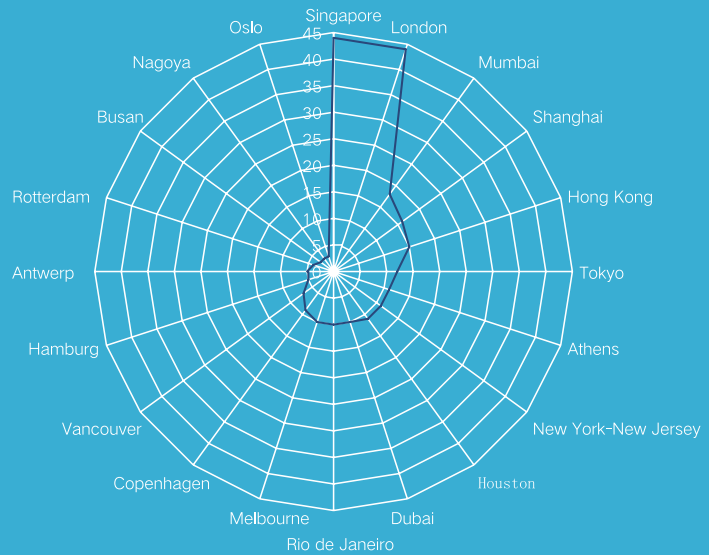


Figure 21 Top 20 Ports With the Most Number of Bulk Carrier Company Branches



Global Viewpoint:

The Path of Internationalisation of China's Shipping Logistics Enterprises

Mei Zanbing

Deputy Secretary General, China International Freight Forwarders Association; Adjunct Professor, School of Economics and Management, Beijing Jiaotong University

1. The internationalisation of China's shipping logistics enterprises

Shipping logistics is the first service industry to open up after China joined the WTO. Domestic shipping logistics enterprises began to actively participate in economic globalisation and quicken the pace of "Go Global" strategy. The development can be largely divided into three phases.

The First Phase: 1980s. COSCO Logistics and Sinotrans were the earliest to venture out to set up nodes (offices and branch companies) in Hong Kong, Japan and the European and American regions. The objective was to serve their respective shipping lines or to offer agency business.

The Second Phase: From 2001 to 2012. China's accession to the WTO in 2001 accelerated China's economic integration into the global economy with ensuing rapid growth in foreign project contracting and foreign investment. This prompted shipping logistics enterprises to jump onto the bandwagon and accelerate their overseas positioning. COSCO Group now operates Piraeus Port in Greece; China Merchant Group may participate – through equity acquisition – in the operation of ports and terminals located at Lagos in Nigeria, Colombo in Sri Lanka and Djibouti in East Africa; whereas private enterprise LinkGlobal Group acquired and operates Parchim International Airport in Germany. Sinotrans has accelerated its overseas network by developing logistics businesses in emerging markets in the Asian and African regions.

The Third Phase: Post 2013. China's proposal of the "Belt and Road" initiative catapulted the implementation of logistics infrastructure and service network nodes. This third phase is characterised by "Go Global" initiative by shipping logistics enterprise, either alone or in groups. For example, in December 2013, China Merchant Group and Djibouti Port affiliated to the Djibouti Government formed a joint venture to develop the Port of Djibouti. With 23% equity holding, China Merchant Group's investment projects include the construction of a multi-purpose terminal with

throughput capacity of 6 million tons, a container terminal with throughput capacity of 1.5 million tons and the Djibouti dry port covering an area of 170,000 square metres. The joint venture has an operating tenure of 99 years. Since 2015, COSCO Shipping Group has invested in nearly 30 ports globally; 11 of which are coastal ports identified in the "Belt and Road" initiative. These ports include Istanbul's Kumpart Terminal in Istanbul of Turkey; Piraeus Port, the largest port in Greece; and EUROMAX container terminal in Rotterdam, Holland. The company also has a joint venture with PSA to invest in a large-scale container terminal in Singapore and the Phase II container terminal construction in Khalifa Port in Abu Dhabi, UAE.

2. Three phases of internationalisation of China's shipping logistics enterprises

(i) Develop foreign network nodes with the "Go Global" concept

A network of logistics infrastructure is the basis and prerequisite for the efficient operation of a logistics network. Logistics information network is the key supporting technology in the operation of a logistics network; and logistics organisation network is the organisational assurance for the operation of a logistics network; of which, Internetworking of logistics is an inevitable trend in the development of logistics organisations.

Shipping logistics enterprises can include both asset-light freight-forwarding agency networks, and asset-heavy ports and terminal operators characterised by physical-resource networks. Their different nature demands different basic infrastructure setups. Freight-forwarding type of network focuses on number of networks and network coverage; whereas physical-resource type of network should take into account the quality of its assets and coverage. From logistics services perspective, the first priority should be to accelerate the pace of "Go Global" to build a global freight-forwarding network.



Viewed from the mode of network development, in earlier years, our domestic shipping logistics enterprises mostly adopted the method of establishing agency relationships with their foreign counterparts through contractual agreements. But in recent years, there has been a marked tendency for enterprises to build their own networks. As can be seen from the following table, most of the world's multinational logistics companies have achieved rapid global deployment through capital acquisitions, and thereby develop new overseas market and create new business areas. Worthy of special mention are CEVA and Agility. Both logistics enterprises have relatively short history, but grew from mere regional companies to the world's top ten shipping logistics enterprises, simply through acquisition. Such are examples that can be gleaned by our domestic large-sized shipping logistics enterprises. At present, the world economy is weak, but China has garnered a huge momentum in overseas investments.

(ii) Promote localised management with the “Go Into” concept

Localisation of management is a necessary development phase in the internationalisation of an enterprise's operation. Both domestic and foreign academics have conducted extensive research on the motivation for localisation of management. The key motivating factors include cost difference, market expansion, cultural conflict and employee development. These major factors will similarly constitute the motivation for localisation of management by shipping logistics enterprises. Under the backdrop of the “Belt and Road” initiative, the motivation for market expansion is even greater. With huge demand in the European and American markets, they have relatively advanced logistics services, but the markets are very competitive. On the whole, some regions covered by the “Belt and Road” initiative have huge market potential but their logistics services are relatively backward. Hence, it is a good opportunity for our domestic logistics enterprises to “Go Into” these regions to establish localised logistics services. To this end, Chinese enterprises should seize the capacity and capital export opportunities offered by the “Belt and Road” initiative. Using foreign industrial parks as the base, one could intensify the cultivation of foreign multidisciplinary talents and actively develop localised logistics services such as engineering logistics, trade logistics and other comprehensive freight-forwarding agency services. In this way, we can export our domestic logistics standards, technologies and services while improving transportation trade deficit by continuously increasing the proportion of overseas operations. This is the key phase of the “Three-Phase” overseas expansion strategy for shipping logistics enterprises. The three phases were aptly named, in order, “Go Global”, “Go Into” and “Go Up” phase.

Network research shows that emphasis should be placed on “nodes” and “relationship”. As such, coordination is the essential means for an orderly network operation. With expanding network sizes along with increase in trade frequency and types of businesses, there are issues on how to establish mechanisms, formulate rules, enable effective interconnectivity between domestic and foreign networks as well as efficient allocation among different logistics nodes and different types of logistics resources. These are the theoretical and practical issues that need to be addressed during the “Go Into” phase.

The network is a service portal and an open portal. During the “Go Into” phase, one must establish proper interconnectivity between the shipping logistics enterprise's internal network and the external networks of both the upstream and downstream partners such as the customers, shipping companies and foreign sub-contractors. Meanwhile, for practicality, one can seek civilian-military collaboration by providing overseas logistics support for the Chinese Army. This will allow our shipping logistics enterprises to expand the efficiency and scope of utilisation of their foreign networks.

(iii) Planning a multinational operation with the “Go Up” concept

The “Go Up” phase is the highest echelon of the internationalisation of operations. At present, except for COSCO Group and China Merchant Group whose port business have ascended to this phase of internationalisation, the other enterprises still remain largely in the first phase. To realise the “Go Up” phase of internationalisation, tangible resources like capital are certainly essential; but intangible resources including know-how and skills are even more important. Only with operational resources such as know-how and skills will an enterprise achieve competitive advantage; and it is these resources that form the fundamental foundation to cultivate core competitiveness.

Through the enterprise network, an enterprise can acquire new resources and capabilities by learning and collating from internal or external knowledge sources. The concept of service-dominant logic is similar to that of an enterprise's dynamic capability. There are two aspects for consideration in promoting the internationalisation of operations of shipping logistics enterprises. On the one hand, we must strengthen the development of overseas networks; and on the other, we must strengthen the learning process to exploit know-how and skills as well as other dynamic operational resources to maintain competitiveness. These two aspects are mutually supportive and complementary. The embedding of intangible dynamic resources such as know-how, skills and information into operative networks is fundamental for internationalisation of operations and building



of core competitiveness. The “Go Up” phase is the highest echelon of internationalisation of operation of shipping logistics enterprises; it is precisely the open ecosystem that is being sought after. As participants of the system including customers, shipping logistics enterprises who act as service integrators, and service sub-contractors of the whole supply chain, maximising individual interests is no longer their ultimate goal. On the contrary, enhancing the adaptability and sustainability of the entire service ecosystem will be their ultimate goal.

3. Countermeasures and suggestions on Internationalisation of China’s shipping logistics enterprises

(i) Be fully committed to the strategy; enterprises and their upstream enterprises should “huddle together to venture overseas”

Adopting a follower strategy is not only the theoretical basis for the operative service industry such as logistic services to “Go Global”, but are also successful practical experiences of multinational enterprises from developed countries in Europe, America and Japan. For example, when upstream industrial and commercial enterprises from the United States entered China, they were quickly followed by relevant domestic agencies such as financial, consultancy, and public relations to provide localised service assurance in China. In the case of Japan, when Japan tried to capture railroad projects in the Southeast Asian countries, several established enterprises formed a consortium to jointly bid for the projects. These include various railway companies with technical experience, Kawasaki Heavy industries which specialises in manufacturing rail cars, major contractors specialising in civil engineering works, financial institutions and coordinating agencies.

As we are still in the developmental phase with limited

understanding and awareness, our domestic enterprises have done poorly in this aspect, and there are serious internal frictions where low-end homogeneity competition is the industrial norm. It is evident that the “Belt and Road” construction projects are becoming more comprehensive, growing in size, and becoming increasingly high-tech. This development places much higher demand on various capabilities of our domestic enterprises, including resource consolidation capability, integrated management capability and industrial collaboration capability. Therefore, it is imperative for industries to “huddle together to venture overseas” so as to achieve an orderly global distribution of supply-chain networks that enables the entire industrial supply chain to “Go Global”. Indeed, this is the objective call by the central government to our domestic enterprises to “Go Global” under the new situation; and it should be the basic strategy for enhancing the “Go Global” stature of all enterprises within the entire supply chain. To this end, we should draw experience from international success stories and classic case studies, as well as adopt good practices learnt from the government’s experience in promoting interconnection between manufacturing and logistics in recent years. This include systematic research on key issues such as how upstream enterprises can improve global supply chain management, and how logistics enterprises can implement a good follower strategy.

(ii) A close interaction between the industry, academic and research institutions will enhance the enterprises’ ability to respond and manage risks.

There are many underdeveloped countries along the “Belt and Road”. These countries generally have political instability, protective trade and economic policies, unsound legal and social systems, and are usually ideologically biased. Conclusion drawn from unsuccessful cases of “Go Global” attempts by our domestic enterprises shows a common



failure characteristic: insufficient prior research or inadequate countermeasure response to risks. Therefore, logistics enterprises should strengthen their market research and due diligence processes to include risk factors based on political, economic, cultural, social, legal and ethnicity. By rational categorisation, assessment, protection and control of such risk factors, three main grades of investment can be determined: namely the Active, Cautious or Defer; and appropriate investment strategies may be instituted for different countries.

As the construction of the “Belt and Road” is an unprecedented exploratory and pioneering initiative, a tripartite effort by industrial, academic and research institutions in close interaction is needed to conduct relevant studies on the important subject of risk management. The think-tank should play an important role in capital advocacy, forward-looking research and guiding public opinions. The think-tank should provide true insights drawn from experiences of positive industry practices and effective government guiding principles. Such insights are made available to enterprises to help them enhance their risk and operative management ability during their “Go Global” phase.

(iii) Targeted guidance with actionable policy measures

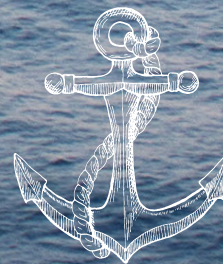
The government should gradually establish a sound policy support system and ensure that government agencies play the indispensable leadership role when pushing for a new wave of “Go Global” initiative by logistics enterprises. Government agencies such as the Commerce, Finance, Development and Reform Commission, and Transport authorities should jointly strengthen top-level design and collaboration under the premises of China’s “13th Five-Year Plan Outline” and State Documents of the above-mentioned agencies. The joint effort should take into account the current overseas network distribution, international logistics

corridors and development of strategic nodes as the basis for their research to formulate long-term policy measures that are visible and actionable. For industrial practicality, policy measures should take into account the following principles:

Firstly, guidance must be targeted at different recipients. The following targeted policy measures are formulated based on the principles of persistence in supplementing any short-comings or the ability to increase effective supply. For enterprises heavily weighted in assets and supported by backbone industries such as COSCO Shipping and China Merchant Group, support should be targeted in their reorganisation to provide the impetus in participating in the “Belt and Road” international logistics corridor, including investment and operations in the six major economic corridors and 15 strategic and pivotal maritime nodes, as well as in joint ventures to build port hinterland industrial clusters. For the majority of logistics service companies, the policy measures should support them in securing overseas projects to speed up the construction of operating networks, globally located within regions covered by the “Belt and Road” initiative; and to provide guidance in adoption of the supply chain management model for logistics services, as well as enhancing service efficiency and customer satisfaction.

Secondly, implement “Pioneer Movers” scheme to highlight the key objectives of policy measures. Network is of great importance to logistics operators, and we do have some pioneering enterprises with extensive experience – such as Sinotrans, CRCT, China Post and SF Express – which have played key logistics channel roles in foreign trade transportation, international rail transport, courier delivery and cross-border e-Commerce. We can formulate a policy measure to appoint these experienced enterprises as the “Pioneer Movers” to test out the policy. In return, they may be accorded some tax incentives or financing support.





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Chapter 5

Featured Topic Research: Shipping Environment along the 21st-Century Maritime Silk Road

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Maritime Silk Road Routes

Ever since the initial proposal of the “21st-Century Maritime Silk Road” global concept by China in October 2013, it has received positive responses from many countries around the world; and route network for the maritime silk road has become more distinct.

Table 3 Comparative Analysis of Critical Routes in Maritime Channels

	Growth of total import/export by China through the route	Total number of main calling ports	Total number of countries along the route
China-Southeast Asia route	5%~7%	13	9
China—South Africa Route	5%~7%	8	5
China—Middle East, East Africa Route	3%~5%	14	10
Mediterranean Route	5%~7%	24	15

Of which, the China-Middle East, North Africa route and Mediterranean route have relatively wide coverage with a higher number of main calling ports and more countries along the routes. On the other hand, the China-Southeast Asia route and China-South Asia route comprise of a smaller number of shipping routes and relatively lower growth in trade volumes compared to other regions.

According to statistics on shipping routes of various liner companies, the nine major liner companies have opened up more shipping routes between Asia-Southeast Asia and South Asia.

There is a huge potential for development of the China-Southeast Asia and China-South Asia routes in the future.

Table 4 Number of Shipping Routes Along the Maritime Silk Road by Nine Major Liner Companies in the World

Ranking	Liner Company	Asia - Southeast Asia, South Asia routes	Asia - Middle East and North Africa Routes	Asia - Mediterranean routes	Asia-Europe routes	Total
1	Maersk	8	5	1	9	23
2	Mediterranean Shipping	3	1	8	2	14
3	DAF France	1	4	9	11	25
4	Hapag-Lloyd	5	7	5	6	23
5	Eva	8	4	6	7	25
6	Cosco	13	4	4	8	29
7	Cosco	7	6	7	7	27
8	Mitsui O.S.K. Lines	11	3	3	5	22
9	American President Lines	7	4	5	7	23
Total		63	38	48	62	211

Source of data:
Official websites of various liner companies

China's shipping route connectivity with countries along the Maritime Silk Road

China - Southeast Asia

China—Vietnam, Myanmar

The China-Vietnam, Myanmar route mainly caters to maritime trade and transportation between China-Vietnam and China-Myanmar.

From the perspective of commodities traded, China exports steel, equipment, cotton and textiles to Vietnam and imports coal, crude oil, fruits and vegetables from Vietnam; China exports timber, agricultural and mineral products to Myanmar and imports complete sets of equipment, mechanical and electrical products, textiles, motorcycle accessories and chemical products from Myanmar.

Details of ports covered by the route:

Qinzhou - Yangpu - Zhanjiang - Gaolan Port - Yantian - Nansha - Ho Chi Minh City (Vietnam) - Singapore - Yangon (Myanmar) - Palawan (Indonesia) - Singapore - Qinzhou.

The route provides direct services from South China (Northern Bay) to Vietnam, Singapore, Myanmar and Indonesia; with transit at Ho Chi Minh City and Singapore.



Figure 22 Main route between China and Vietnam, Myanmar

China—Philippines

Manila is the largest seaport in the Philippines and it is also its political, economic, cultural and transportation centre.

The route supports majority of the trade and transportation between China and the Philippines.

From the perspective of commodities traded, China exports textiles, coal and clothing products to the Philippines; and imports electronic devices, raw steel and bananas from the Philippines.

Details of ports covered by the route:

Qingdao - Shanghai - Ningbo - Manila (South) - Manila (North) - Qingdao, the route's biggest advantage is the provision of direct services from Qingdao to Manila and rapid service from Central China to Manila.



Figure 23 Main route between China and Philippines



Figure 24 Main route between China and Singapore, Malaysia

China—Singapore, Malaysia

In recent years, the number of ports along the China-Singapore, Malaysia route has increased significantly, which has, to a certain extent, promoted trade development between the parties.

From the perspective of commodities traded, China exports steel products, machinery, electronics, ships and furniture to Singapore and Malaysia; and imports mineral fuel, organic chemicals, natural rubber, plastics and their derivative products from Singapore and Malaysia.

Details of ports covered by the route:

Newport-Dalian-Qindao-Shanghai-Xiamen-Hong Kong-Singapore-Klang Port (Malaysia)-Penang (Malaysia)-Singapore-Hong Kong-Xingang, the biggest advantage of this route is the provision of direct services from major Chinese ports to Malaysia.



Figure 25 Main route between China and Indonesia

China—Indonesia

With the implementation of foreign policies such as the “Belt and Road” initiative, China has currently become the largest trading partner of Indonesia, resulting in the China-Indonesia route becoming more vibrant.

From the perspective of commodities traded, China exports mechanical and electrical products, machinery equipment, steel products and base metal products to Indonesia; and imports mineral fuel, animal and vegetable oils, miscellaneous chemical products and rubber from Indonesia.

Details of ports covered by the route:

Shanghai-Newport-Dalian-Qindao-Ningbo-Nansha-Jakarta (Indonesia)-Klang Port (Malaysia)-Singapore-Laem Chabang Port (Thailand)-Hong Kong-Shanghai; the biggest advantage of this route is the provision of rapid services from major Chinese ports to Jakarta.

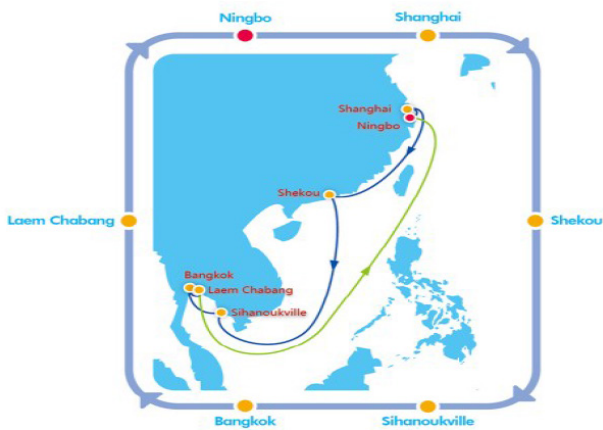


Figure 26 Main route between China and Thailand, Cambodia

China—Thailand, Cambodia

Diplomatically, Thailand and Cambodia have always been China’s friendly neighbours, where trades rely mainly on maritime transportation.

From the perspective of commodities traded, China exports mainly organic chemicals, steel, machinery, electronics and optical medical equipment to both countries; and imports agricultural products, plastics and their derivative products, rubber and its derivative products, machinery and electronic products from Thailand and Cambodia.

Details of ports covered by the route:

Ningbo-Shanghai-Shekou-Sihanoukville (Cambodia)-Bangkok-Leam Chabang (Thailand)-Ningbo; this route mainly provides direct services from the Eastern China region to Thailand and Cambodia.

China - South Asia route

China—Pakistan

In recent years, cooperation between China and Pakistan are getting closer.

From the perspective of commodities traded, Pakistan's export to China mostly includes cotton, mineral ore, mineral slag and mineral ash; its import from China includes mainly machinery equipment, mechanical and electrical products, knitted products and steel products.

Details of ports covered by the route:

Qingdao - Shanghai - Ningbo - Singapore - Klang Port (Malaysia) - Karachi (Pakistan) - Mundra (India) - Colombo (Sri Lanka) - Singapore - Qingdao line is the fastest route from North China and East China to Karachi and provide the fastest service from Singapore to Qingdao.



Figure 27 Main route between China and Pakistan

China—India, Sri Lanka

The China-India and Sri Lanka routes provide services to Shanghai, Ningbo, Shekou, Singapore, Port Klang, Naivasiwa, Pippawa, Colombo, etc.

In the bilateral trade, India exports mainly cotton, mineral products, copper and its derivative products, organic chemicals and construction materials to China; its import from China includes mainly mechanical and electrical products, machinery equipment, organic chemicals, cultural artefacts and fertilisers.

Details of ports covered by the route:

Shanghai - Ningbo - Shekou - Singapore - Port Klang (Malaysia) - Nawa Shiva (India) - Pipavawa (India) - Colombo (Sri Lanka) - Port Klang - Singapore - Ho Chi Minh City (Vietnam) - Hong Kong - Shanghai.



Figure 28 Main route between China and India, Sri Lanka



China-Middle East Route

China—Iraq, UAE

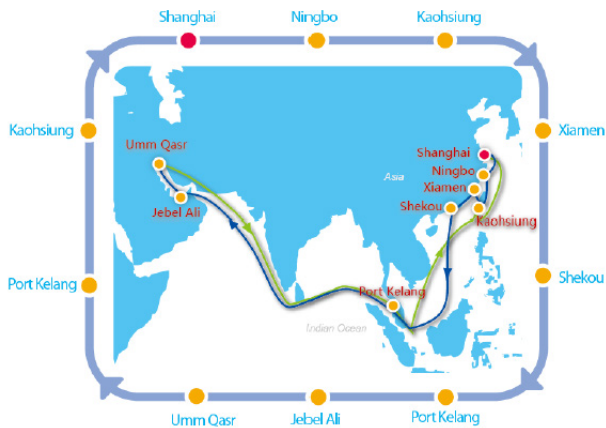


Figure 29 Main route between China and Iraq, UAE

The route supports about half of China's offshore oil shipments and is the lifeline of China's energy imports.

Additionally, the route is the key trade channel between China and countries like India and Pakistan.

Therefore, the route plays an extremely important role in the implementation of the 21st-Century Maritime Silk Road and safeguarding China's energy supply.

Details of ports covered by the route:

Shanghai - Ningbo - Kaohsiung - Xiamen - Shekou - Port Klang (Malaysia) - Alishan Port (UAE) - Umm Qasr (Iraq) - Port Klang - Kaohsiung - Shanghai.

China—Red Sea

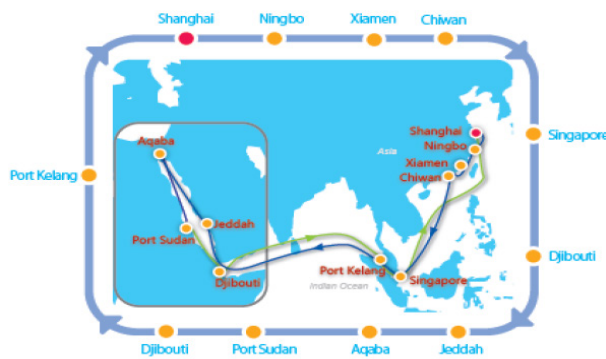


Figure 30 Main route between China and the Red Sea

At present, Saudi Arabia has become one of the most important and most stable overseas crude oil suppliers to China.

Meanwhile, Sudan is equally rich in fossil oil and mineral resources. Two-thirds of its oil is exported to China, accounting for 6% of China's total oil import. It is China's third largest trading partner in Africa. Conversely, China is Sudan's largest trade partner.

From the perspective of commodities traded, China imports mainly oil and petrochemical products from Saudi Arabia; and exports mainly clothing, IT products and household appliances to Saudi Arabia. China is the second largest source of imports for Saudi Arabia.

Adhering closely to the national "Belt and Road" strategy, the route provides direct services to Sudan's port and Djibouti; its services covers Saudi Arabia, Jordan, Sudan and Djibouti simultaneously, and is a contributing factor to trade development amongst regions bordering the Red Sea.

Details of ports covered by the route:

Shanghai - Ningbo - Xiamen - Chiwan - Singapore - Djibouti (East Africa) - Jeddah (Saudi Arabia) - Sudan (Sudan) - Djibouti - Port Klang - Shanghai.

Main routes between China and East Africa

The implementation of “Belt and Road” strategy has enabled rapid growth of trade between China and Tanzania, as well as between China and Kenya; thus, the volume of cargo transportation has also been increasing steadily along this route.

From the perspective of commodities traded, China's export to Kenya mainly includes machinery equipment, household appliances, textiles, daily necessities, hardware tool, building materials, pharmaceuticals and chemical raw materials. Kenya's export to China mainly includes animal hide and skin, timber, sawn timber, sisal, pyrethrum and fish maw.

From the perspective of commodities traded, China's export to Tanzania mainly includes grain, vehicles, textiles, light industrial products, petrochemical products, machinery products, electrical appliances and steel products. China imports dried seafood, raw leather, timber, blister copper and wood handicrafts from Tanzania.

The route provides rapid, direct and quality services from China's main ports to MBA/DAR.

Details of ports covered by the route:

Dalian-Tianjin-Ningbo-Nansha-Singapore-Colombo (Sri Lanka)-Mombasa (Kennedy)-Dar es Salaam (Tanzania)-Colombo (Sri Lanka)-Pasir Gudang (Malaysia)-Singapore-Shanghai-Dalian.

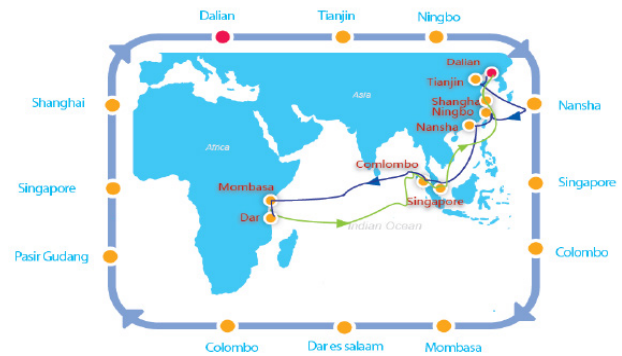


Figure 31 Main route between China and East Africa

China—Europe

The European Union is China's largest trading partner and largest export market. It is also the largest source of technology imports and the fourth largest true investor; China is the largest trading partner of the European Union.

With the increasingly close economic and trade relations between China and Europe, the China-Europe route has played an important role in maritime trade and transportation.

The advantage of this route is the provision of market-leading direct services to Piraeus, with full connectivity to ports in the Far East including Northern China, Eastern China, Southern China, Taiwan and Southeast Asia. The route also provides optimum services to Italy, France's Fos-sur-Mer, Spain return services, as well as direct services connecting the Mediterranean to the Red Sea and to Colombo of South Asia region.

Details of ports covered by the route:

Qingdao — Shanghai — Ningbo — Kaohsiung — Hong Kong —Yantian — Singapore — Piraeus (Greece)—La Spezia (Italy) —Genoa (Italy)—Fos-sur-Mer (France) —Valencia (Spain)— Piraeus (Greece)—Jeddah (Saudi Arabia)— Colombo (Sri Lanka)— Singapore — Hong Kong.



Figure 32 Main route between China and Europe



Environmental Analysis for Shipping Along the Maritime Silk Road

Relying on the Annual Global Competitiveness Report and Executive Opinion Survey by the World Bank and World Economic Forum, and based on the research logic of Xinhua-Baltic International Shipping Center Development Index, shipping environment of countries along the Maritime Silk Road can be gleaned from their quality of infrastructural development and efficiency of customs procedures.

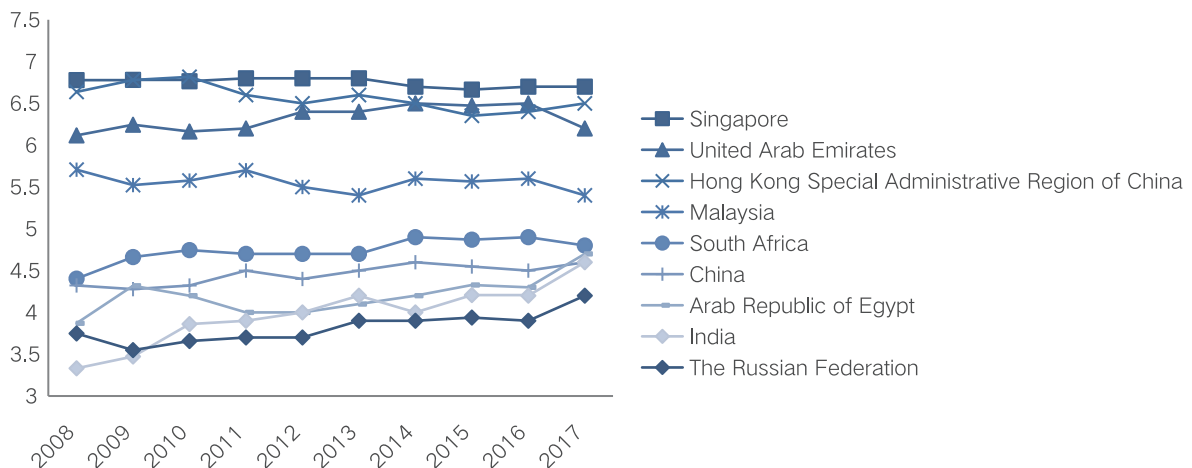


Figure 33 2008-2017 Quality of Port Infrastructure of Countries (or Regions) along the Maritime Silk Road

The quality of port infrastructure is used to measure the perceptions of corporate executives about their port facilities. The data was derived from Executive Opinion Surveys conducted over the past 30 years by the World Economic Forum and its 150 partner research institutes. The 2009 survey involved more than 13,000 respondents from 133 countries. The sample surveys adhered to a two-tier model that is based on the size of the company and the industry in which it operates. Data was collected via online surveys or face-to-face interviews. The survey responses were aggregated using industry-weighted averages. The most recent year data is combined with the previous year to create a two-year moving average. The score ranges from 1 (extremely undeveloped port infrastructure) to 7 (Highly developed and efficient port infrastructure that is of international standard). Respondents from landlocked countries were asked about the availability of port facilities (1 = very poor availability; 7 = highly available).

On the whole, quality of port infrastructure of sampled ports of countries (or regions) along the Maritime Silk Road has been relatively stable.

The quality of port cities in China, Arab Republic of Egypt, India and Russia has been improving continuously.

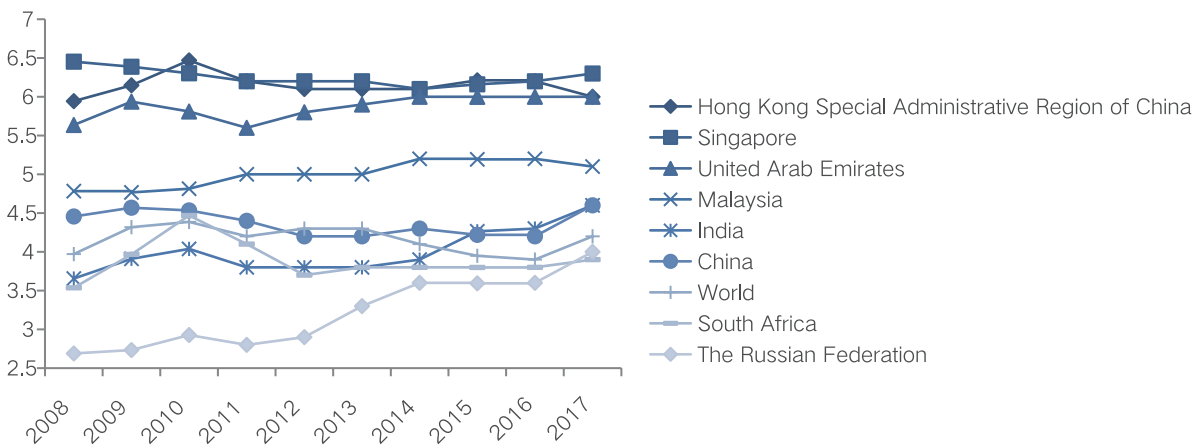


Figure 34 2008-2017 Burden of Customs Procedure of Countries (or Regions) along the Maritime Silk Road

On the whole, there was improvement in efficiency of customs clearance for ports along the Maritime Silk Road.

Customs procedures in Hong Kong, Singapore, and the United Arab Emirates have been relatively efficient, and they have maintained at a relatively high level of above 5.5.

The efficiency of customs clearance in port cities in Russia, China and India has been improving; the upward trend was evident.

In recent years, various port cities have continuously exploited deep integration of intelligent technologies with port businesses in order to simplify custom clearance procedures and complex logistic problems. Such effort has laid a solid foundation for significant improvement in customs clearance efficiency.





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Global Viewpoint:

Enhancing the Stability of Shipping Network of 21st Century Maritime Silk Road

Shi Xianliang

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Since time immemorial, human beings have accorded great importance to reliability. In an effort to resolve the problem of massive failure of electronic products after the Second World War, reliability research had ascended gradually to become a systematic discipline of science. In the face of complex and ever-changing environment along with fierce competition in the shipping industry, the development of the 21st Century Maritime Silk Road will require continuous improvement and optimisation in shipping service networks as well as enhancement in the reliability of shipping networks in order to provide safe, rapid and efficient shipping services.

1. Definition of reliability of shipping network

Reliability is a measure of the stability of a system in the provision of services. For shipping network systems, reliability benchmarks include connectivity reliability, time schedule reliability, capacity reliability, vulnerability and sustainability.

Connectivity reliability of a shipping network. Container transportation services between designated ports within a service network are generally provided through a combination of shipping routes. Thus the ability of a shipping network to provide container transportation services between designated ports within the service network is of utmost importance. As such, connectivity reliability of a shipping network mainly describes the ability to maintain the prescribed connectivity when a node within the network fails randomly, and evaluates the ability to maintain connectivity between various nodes from an overall service network perspective.

Time schedule reliability of a shipping network. Disruptive events occurring at port nodes can often result in additional waiting time caused to container ships at the said ports. Such events will reduce the reliability of shipping schedule and increase costs to customers. As such, time schedule reliability of a container shipping network mainly analyses the ability to achieve the prescribed transportation mission within the specified time schedule even under the pressure of additional waiting time caused by random node failure.

Capacity reliability of a shipping network. The ability to provide maximum container transportation capacity between designated ports within the prescribed time is an important factor. Disruptive events occurring at ports can often result in additional waiting time caused to container ships at the said ports. Such events will reduce transportation capacity of the service network. As such, capacity reliability of a shipping network mainly studies the ability to achieve the

prescribed transportation capacity even under the pressure of additional waiting time caused by random node failure.

Vulnerability of a shipping network. A service network comprises of many port nodes. These nodes are distributed in different regions and countries around the world. Different port nodes play different roles within the service network depending on the port's natural condition and infrastructure development. Disruptive events in an important port node are important issues as they have great impact on the stability of shipping routes. As such, vulnerability of a shipping network mainly studies the ability to achieve the prescribed transportation capacity even under the pressure of disruptive events at an important node.

Sustainability of a shipping network. The shipping industry is a relatively heavy consumer of resources and contributor to environmental pollution that heightens ecological carrying load. Due to its global characteristic carbon emission issue, the shipping industry – serving as the link connecting international trades – should vigorously deploy low-carbon technologies in its development. As such, sustainability of a shipping network does not merely mean paying attention to environmental protection while operating the port for economic benefits, but more importantly, it means emphasising mutual integration between shipping economic benefits and the environment to meet the requirements of sustainable development. The connotation lies in the embedding of ecological and environmental issues into various aspects of modern shipping operations, an in-depth analysis of operational mechanisms, development strategies and business models to develop a functionally sound logistic life-cycle that incorporates environmental protection into a sustainable development model – that is, the green shipping concept.



2. Issues that present challenges to the reliability of a shipping network

From the numerous issues inherent in shipping network, it can be seen that the shipping industry faces fierce competition, growing complexity of external environmental factors and increasing uncertainties. These uncertain factors would entail potential risk and cause adverse effects to the shipping network in four aspects: namely, economic, safety, convenience and green concept.

Firstly, the economic aspect. Unreliable shipping network may put the shipping company at a disadvantageous position, resulting in increased costs or even severe economic losses. Facing the current issues of complex and ever-changing shipping environment along with fierce competition within the shipping industry, it is necessary to continuously improve and optimise the shipping service network.

Secondly, the safety aspect. Ports with berthing for container liners are often affected by disruptive events such as congestion, strikes, natural disasters, wars and bad weather. In addition, there may also be incidences of missing cargo. Such events will affect the port's function in the shipping network.

Thirdly, the convenience aspect. With deteriorating port congestion, large vessels with poor manoeuvrability will have difficulty entering and exiting ports, further adding to port congestion. This is worsened by longer loading and unloading time due to poor collection and distribution system inherent in the port. The result is a continuous decrease in on-time rate and heightened inconvenience.

Fourthly, the sustainability of green concept. In the era of economic globalisation, there is increased risk of environmental pollution by the shipping industry due to rapid development of the shipping industry, increasingly frequent marine transportation, substantial increase in number of vessels and other vessel-related activities. Meanwhile, environmental protection awareness and demand have also increased globally; and hence shipping pollution is gaining widespread attention. In recent years, marine transportation has caused serious ocean and atmospheric pollution. It was estimated that by 2020, vessels operating on the globe will consume 400 million tons of fuel, causing a 75% increase in green-house emission based on current year's value. Therefore, there is an urgency to introduce low-carbon shipping and green development, without delay.

3. Suggestions to improve reliability of shipping network along the Maritime Silk Road

(i) Strengthen protection strategies and enhance emergency response procedures for major ports Shipping networks in the 21st Century Maritime Silk Road comprise of several major international transit ports. Such major ports should have extensive protective measures to reduce the risk of failure and strengthen security management. Among the shipping networks in the 21st Century Maritime Silk Road, major transit ports like Singapore Port and Port Dickson should be given due attention during the development of the Maritime Silk Road. Starting from connectivity reliability aspect of the shipping networks, we must strengthen the construction and development of small and medium-sized ports while promoting the development of large international ports. We should focus on ports that have strong connection and transfer capabilities as these will help in the provision of safe, rapid, efficient and green interconnections for the 21st Century Maritime Silk Road.

(ii) Improve emergency response system Ports with berthing for container liners are often affected by disruptive events such as congestion, strikes, natural disasters, wars and bad weather. Additionally, there may also be incidences of missing cargo. Such events will affect the port's function in the shipping network. As such, the port needs to strengthen its security management, and enhance its emergency response system for marine emergency events. In short, the port needs to improve its security monitoring and supervision as well as emergency response capabilities.

(iii) Promote the development of international maritime transportation corridor. We must plan and develop an international maritime transportation corridor with major port nodes along the coastal cities such as Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Shanghai, Ningbo-Zhoushan, Fuzhou, Quanzhou, Xiamen, Shantou, Shenzhen, Guangzhou, Maoming, Zhanjiang and Haikou. We must also actively promote the shipping route traversing the Straits of Malacca into the Indian Ocean towards Europe, as well as intensively develop the shipping route through Indonesia towards the South Pacific Ocean.

Global Viewpoint:

Investor Protection: Most Important Priority of Chinese Enterprises in Overseas Port Investments

Zhang Qiusheng

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1. Current status of Overseas Port Investments by Chinese Enterprises

In recent years, Chinese enterprises, encouraged by the "Belt and Road" initiative, have increasingly expanded their presence in overseas ports. The rapid development of domestic ports has laid a solid foundation in supporting Chinese enterprises in their port investments and construction projects globally. Since 2013, Chinese enterprises, mainly led by COSCO Shipping Port Ltd and China Commerce Port Holding Co., Ltd, have already set up strategic posts in major ports along the "Belt and Road" coasts. According to some partial statistics, China has invested in port construction in 23 countries or territories along the "Belt and Road", with an annual investment exceeding USD 10 billion. At present, Chinese enterprises are participating in the operation of more than 20 of the world's top 200 overseas ports by throughput. Also, port operations in more than a dozen countries like Greece, Myanmar, Israel, Djibouti, Morocco, Spain, Italy, Belgium, Cote d'Ivoire and Egypt are supported by Chinese enterprises.

2. Risks and challenges of overseas port investments by Chinese enterprises

Port investment and operation is a complex system project with a high degree of internationalisation. Global factors such as vessels and cargo from different countries, varied port customs practices and other sovereign institutions, as well as huge teams of local workforce represent trying challenges for the international stature of the port management team. Chinese enterprises' experience in overseas port investments is short. Such investments are basically represented by state-owned enterprises with strong capital; which are vulnerable to local hindrance and interference.

(i) The "China threat theory" is still an influencing factor in trade and investment environment.

The "China threat theory" has been around for a long time; and corollaries like "China's hunger for resources" and "harmful effect of China's investment" theories have emerged

from time to time. They are intended to set back or even hinder China's cooperation with other countries for mutual benefits. The "China threat theory" has taken a foothold in some countries where there have been incidences of hostility against the Chinese or expulsion of Chinese subjects, or deliberate measures such as increasing the fees for visa on arrival.

(ii) Inadequate or frequent changing laws and regulations

Many countries will regulate activities of foreign investors and foreign investments in their territories through presidential decrees or government regulations. Such decrees and regulations are certainly effective for their purposes. However, at times the frequent decree and regulatory changes might negate earlier policies, which seriously affects the stability of the investment environment and is not conducive for decision-making by investors. Additionally, increasing difficulty in obtaining labour licences and other mundane administrative procedures has stymied investment in labour-intensive industries like energy prospecting and mining, and project contracting.

(iii) Unsound financial market services

The post global financial crisis represents a new historical era for each country's economic recovery and market development. However, many developing countries still lack the capital market that provides comprehensive services to their local economies due to their generally low level of financial marketisation. "The Chinese are rich and they love to carry cash"; such is the common impression many foreigners have of Chinese people. In reality, the fact that Chinese people bring cash with them is due to the lack of Chinese-owned financial institutions and hence the inconvenience in currency exchange for international settlement. The side effect is that Chinese people have become frequent targets of robbers.

(iv) Shortage of talent and irrational structure

Many developing countries are way behind in their training of skilled workers, resulting in severe shortage of



labour in the engineering sectors such as petrochemical, mechanical, and construction engineering, and thereby in an unbalanced local talent structure. According to the local laws of some host countries, a foreign investment enterprise is required to employ local labour on a pro-rata basis. Therefore, finding local skilled workers has become a thorny issue for Chinese enterprises in their overseas port construction projects.

3. Measures and suggestions for protection of China's overseas port investors.

(i) Expand bilateral or multilateral investment trade agreements between countries

There should be extensive exchanges amongst various countries on economic development strategies and countermeasure policies. On the basis of seeking commonalities while preserving differences, such exchanges should negotiate and formulate plans and measures for promoting regional cooperation and encourage regional economic integration by introducing relevant policies and laws. Through a combination of long-term trade agreement, equity investment and investment holding, energy resource cooperation with Central Asia can be strengthened to establish multiple, stable and reliable energy resource supply channels.

(ii) Establish a support strategy for the "Go Global" strategy.

To better protect the interest of investors, the Chinese government and host countries should sign bilateral agreement to avoid double taxation, and to enable judicial assistance, social insurance, as well as inspection and quarantine procedures. Exemplify the role of policy-based financial institutions to encourage enterprises to "Go Global" by providing financing and other financial facilities. Exemplify the role of policy-based insurance institutions to improve risk protection mechanism for enterprises to "Go Global".

(iii) The government should participate in major project negotiation.

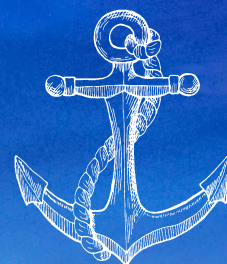
For major projects that have an impact on national strategic interests, the central government should authorise its relevant economic entities to negotiate with the host government to establish investment agreements and implement subsequent investment policies and investment environment that offer protection for Chinese investors and safeguard national economic interests. Depending on the nature of local projects, provincial or municipal governments may, under the pretext of "Friendship Province" or "Friendship City", enter into agreements that encourage mutual benefits and attract investments.

(iv) Large-sized enterprises should master their internal-strength to "Go Global" while small- and medium-sized enterprises should form alliances or huddle in a group under their relevant association organisations to "Go Global".

Firstly, the role of international shipping market on various countries along the "Belt and Road" should be clearly defined so that a more targeted strategy can be formulated. In the short to medium term, the regions with the greatest growth in port demand are Southeast Asian and South Asian economies. The capital, management and technical advantages of China's port industry perfectly match the needs of these two regions with potentially achievable mutual benefits. In the West Asia region, the six Gulf Cooperation Council countries have achieved rapid economic development and their demand for ports will continue to grow. However, the region is generally abundant in capital and hence more restrictive on foreign investment. As such, in the short to medium term, cooperation will mainly be based on engineering projects. In the Central and Eastern Europe regions, a small number of economies such as Poland have secured better economic growth and have potential demand for container terminals. However, their trading partners in Western Europe are served by relatively advanced terrestrial and inland river transport system and less dependent on marine transportation. Consequently, there is little room for development and further analysis is needed. The Balkan Peninsula is closer to the European hinterland, with the potential to develop into a gateway port to Europe. However, most of the Balkan Peninsula countries have yet to join the European Union. Moreover, their backline transportation networks are relatively weak and they lack the criteria for developing container terminals in the short term. Further observation is needed.

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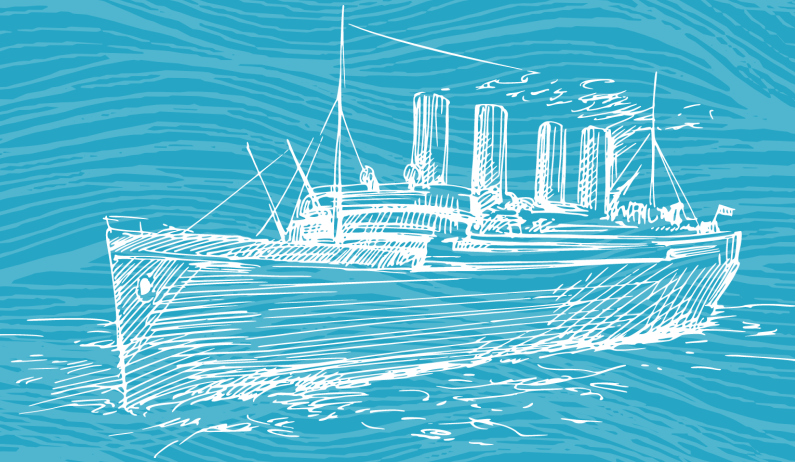




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Chapter 6

Featured Topic

Research: Global

Intelligent Port

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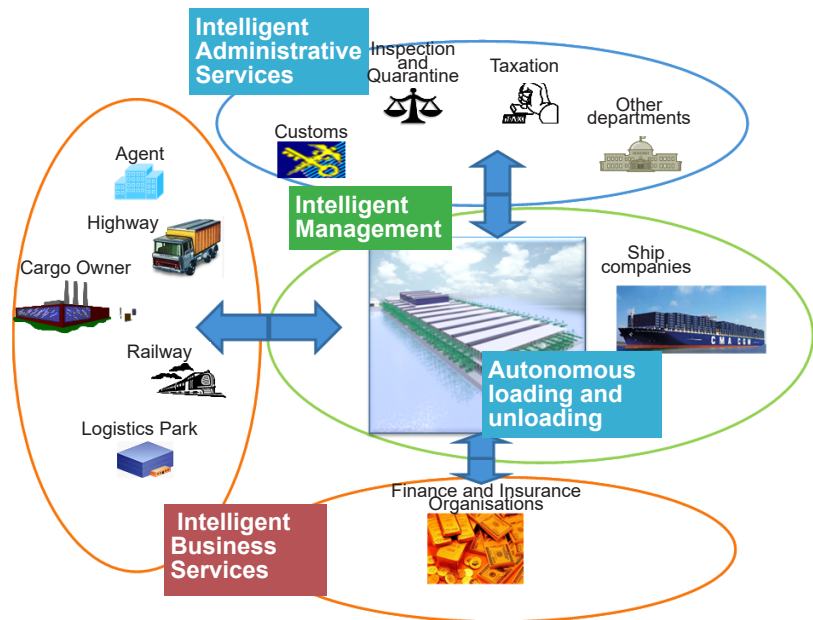


Figure 35 Functional composition of intelligent ports

The concept of intelligent port

Since the advent of the “Smart Planet” concept broached by IBM in November 2008, the concept of “intelligent port” soon emerged.

Many ports began to deploy a combination of information technologies including the Internet, the Internet of Things (IoT), cloud-computing technologies, geographic information systems and computer simulation technologies in production and management processes of the ports. The objective is to optimise various aspects of port operation, improve relationship with customers and enhance production efficiency of ports. Such technologies will not only provide the basis and reference for decision-making by port operators, but also become the new focus of economic growth.

“Intelligent port” has been described as a new type of port with fully integrated transportation system supported by innovative application of advanced technologies based on cyber-physical system as its structural framework. In addition to providing seamless supply chain integration between both the supply and demand sides, such systems should also greatly enhance the capability of processing all information relevant to the port and its associated logistics zones. The other key features of the system should include optimised allocation of relevant resources, intelligent supervision, intelligent services, as well as autonomous loading and unloading. In short, such systems should provide high-safety, high-efficiency and high-quality services demanded by modern logistics industry.

An intelligent port encompasses: 1) intelligent business transactions between trading parties (such as shippers, maritime transport service agencies, road transport, rail transport, logistics zones, financial institutions), both domestic and foreign, and their associated logistics participants; 2) intelligent supervisory functions such as customs, taxation, maritime affair bureaus and border securities; 3) intelligent management of logistics enterprises such as shipping companies and terminals; and 4) provision of autonomous loading and unloading services to logistics enterprises.

In terms of business functions, the main differences between intelligent ports and traditional ports are:

With the application of advanced technologies, the intelligent port is capable of offering intelligent services including intelligent governance, intelligent business transaction, intelligent management and autonomous loading and unloading.

06

Characteristics of an Intelligent Port

Comprehensive perception.

Comprehensive perception is the foundation of all in-depth intelligent applications. The test for such intelligence is full digitalisation of on-site data.

These include on-site IoT, remote transmission networks and data integration management (screening, quality control, normalisation and data collation).

Intelligent decision making.

Intelligent decision-making is the rapid determination of effective decision on complex planning and scheduling issues based on a collection of decision-making information, ranked by explicit decision-making goals and constraints.

Autonomous loading and unloading.

Based on intelligent decision-making process, the autonomous loading and unloading function autonomously identifies and determines the loading and unloading target and proceeds to complete the operation safely, efficiently and automatically.

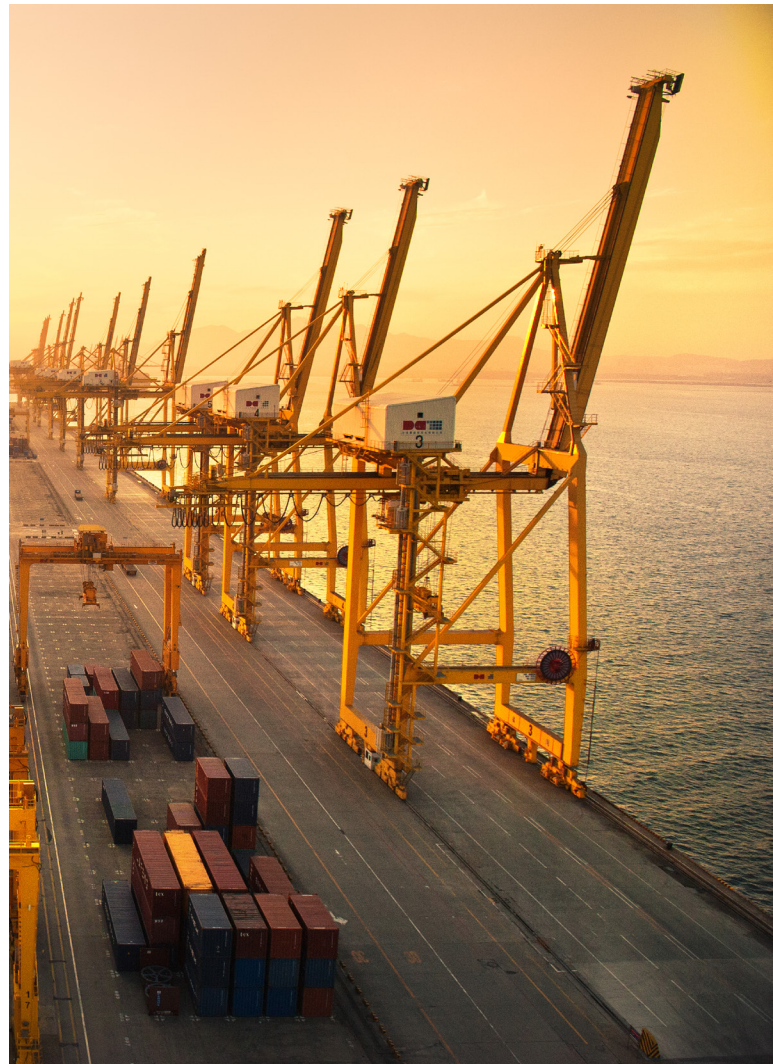
Full participation

With application of cloud-computing and mobile Internet, relevant parties of a port can access and be fully integrated with the unified cloud platform using multiple terminal devices from anywhere and at any time.

With extensive connectivity and in-depth interactivity, the port's integrated information platform is optimised to provide immediate response to requests by multiple supply-side and demand-side parties.

Continuous innovation.

The intelligent information system is capable of autonomous learning via human-machine interactions with the port administrator and through extensive participation and in-depth interaction with other port related parties. Such autonomous learning capability will enable the port to continuously innovate and self-improve, a feature which represents the most important characteristic of an intelligent port.



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The key technologies of an intelligent port

IoT Technology

The Internet-of-Things technology uses sensory devices such as RFID, IFR sensors, global GPS system and laser scanner to link any objects to the communication network as stipulated by the contractual agreement. Thus the IoT is a network technology used by intelligent systems to identify, locate, track, monitor and manage an object within the network.

Typical IoT application in the port operation and management include:

Electronic tags for containers, port equipment operation status monitoring, engineering equipment asset management and intelligent energy management system.

Big data technology

Big data (also called huge data and massive data) means a collection of data which is so huge that objective results can only be obtained through statistical comparison and analysis with the help of computers.

In the port industrial sector, the use of statistical analysis and forecast, and data-mining to scrutinise the huge amount of import/export data will help develop business opportunities for the port and business decision-making of related parties such as the shipping companies and shippers. It can also help fight smuggling and enhance inspection activities.

Artificial Intelligence Technology

Artificial intelligence has wide applications, including problem-solving, machine learning, expert systems, pattern recognition and robotics.

Artificial intelligence may find wide applications in port operation systems such as intelligent port equipment scheduling, intelligent site planning and intelligent berth planning.

Automated port handling equipment

Advanced sensors, automatic positioning, machine vision, remote control, equipment intelligent diagnosis and assessment can be installed in large-scale port-side loading and unloading installations (such as stacker-reclaimer for bulk terminals, yard hanging-rail of container wharves, driverless automatic guided transport vehicles) to implement unmanned or autonomous loading and unloading operations.

The development of automation equipment can significantly improve the efficiency of ports, reduce overall operating costs and improve safety.

Global Practice of Intelligent Ports

Intelligent port is not a new topic. In fact, the world's top ten ports by goods throughput have all begun to explore or develop intelligent ports.

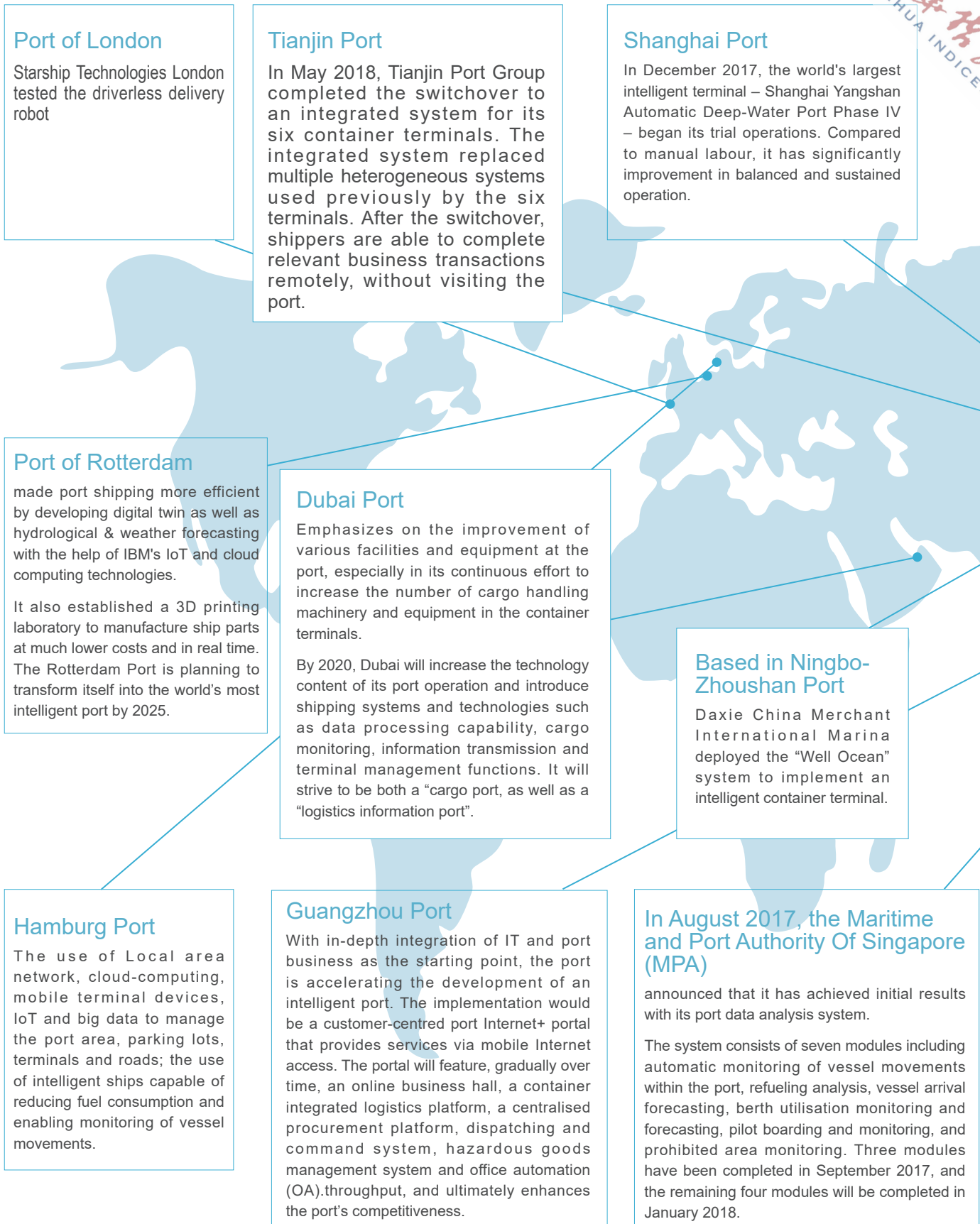


Figure 36 The Top Ten Ports with the Largest Throughput in 2017



Busan Port

Korea will set up an IoT framework at its Busan Port and upgrade its cargo management system. The newly-deployed system will link equipment, ships and terminal cargo vehicles through wireless networks, which will effectively manage freight forwarding at Busan Port and improve port security.

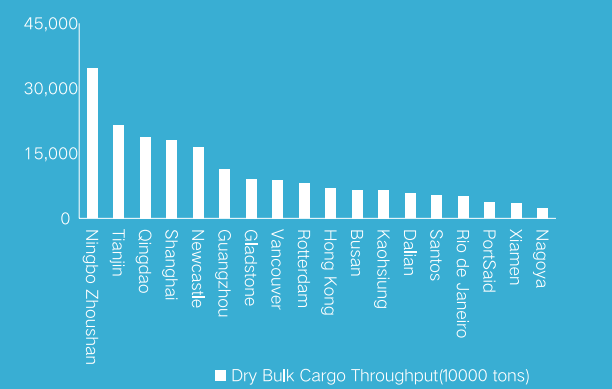
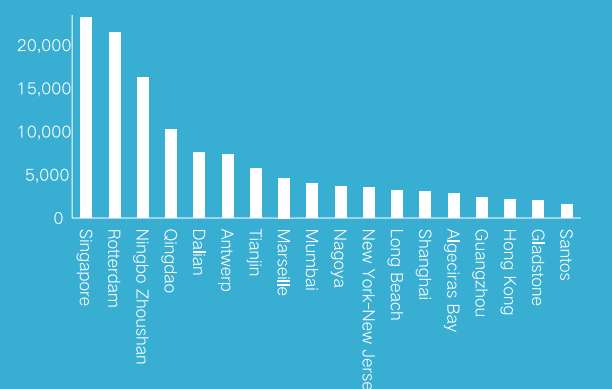
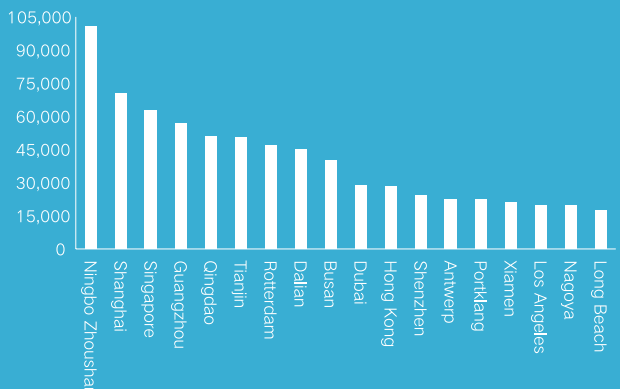
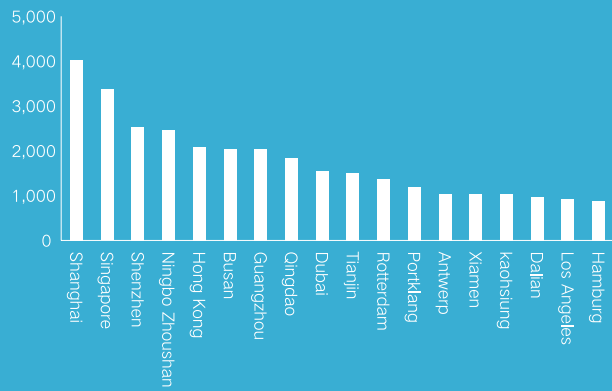
Dalian Port

Independently developed by Dalian Port Group, China's first intelligent quay-cranes with voice prompting system were successfully launched in May 2015.

The system implanted "intelligent chip" into the huge quay-cranes of the container terminal, thus enabling these terminal equipment to "speak".

Qingdao Port

Qingdao Port fully-automated container terminal was officially put into operation on 11 May 2017. A single hoisting machine achieved an average operating efficiency of 39.6 containers per hour – an achievement that broke the world record on operating efficiency of a single hoisting machine of a fully automated terminal.



Global Viewpoint:

Building Intelligent Ports to Optimise the Port Business Environment

Shanghai Port Group

"Intelligent port" is a multi-boundary, systematic port ecosystem that exploits the Internet, Internet of things (IoT) and artificial intelligence for the automation of terminals.

At present, advancement in science and technology has made "intelligent port" the main focus of new development in the industry, with high potential and possibility for another industrial revolution.

In the transformation led by intelligent port, a port's strategic focus will shift from controlling resources to that of micro-managing resources; from optimisation of internal processes to that of increased interaction with external parties; and from increasing customer value to that of maximising the value of the whole ecosystem.

The construction of an intelligent port not only includes compliance with new requirements and new challenges, but also creation of new opportunities and new developments. It is particularly important to be able to seize such opportunities and accelerate innovative transformation to capture a leading position in port innovation.

One of the most important tasks and key objectives of developing an intelligent port is to continuously optimise the business environment of the port. Supported by even more efficient digitalisation of information, transparency and efficiency of trades and logistics flows through the port can be significantly improved; and the port will better serve the needs for trade expansion as well as national economic development.

The new economic norm promotes port transformation and development

Under the new economic norm, trade situation has stabilised.

The traditional model of port development, which relies on trade growth with sustained injection of investment to increase throughput and profits, is facing increasing resistance.

In order to differentiate oneself and enhance competitive advantage, the port hopes to adopt a more advanced development model that caters for new trends of port logistics such as growing vessel sizes and shipping alliances or promotes further transformation towards an intelligent port that offers further reduction in both transactional and logistical costs of the port.

The transformation and upgrading from traditional ports to intelligent ports include:

1) Standardised, automated and intelligent operations: Introduce standardised workflows and interfaces, and support it with automated processes and intelligent operations to enhance the port's efficiency and exploit the core advantages of an intelligent port; 2) Hinterland logistics

transportation: Strengthen route network of hinterland transportation and build Internet-based information platform to provide integrated port services for all parties of the logistics chain with the aim to reduce port operation costs; 3) Co-development of intelligent port and intelligent city: A port can have significant influence on the economic development and environmental protection aspect of its host city – accelerated implementation of energy-saving and emission reduction policies to encourage innovation in new infrastructure and other measures that help optimize port environment.

Digital technology becomes the new driving force for port logistics transformation

Digital technology will become an important factor in promoting industrial reformation. On the one hand, "digitalisation of port" will enhance services throughout the supply chain. On the other hand, an open and shared digital platform will provide opportunities for new growth avenues, and provide the impetus for the transformation of both business and operation models.

Future ports will see abundant application of technologies such as sensor technologies, mobile devices, video analysis, wireless radio frequency, pattern recognition and intelligent scheduling and remote control. The construction of high-speed network infrastructure, introduction of new energy technology and breakthrough in application of artificial intelligence to the port industry will stimulate a series of business innovations in the industry.

The use of modern information technologies such as cloud-computing, big data, IoT and block chain will enable full monitoring of the entire trade and logistics chain with real-time trade transaction and logistics operation data. Starting from the signing of foreign trade contract between enterprises, to the subsequent booking of carrier, loading, shipping, arrival at destination port, tallying cargo, and customs clearance, all data are captured into a single platform. These are then intelligently correlated with relevant information – such as advanced declaration of manifest, customs declaration data, declaration of means of transport, confirmation of data, the state of cargo in port, cargo tally data and actual trade data of the enterprises – received by the port supervision agencies using highly-effective AI analysis to capture risk factors with minimal manual intervention. Under the premise of advanced declaration by the enterprises, such intelligent systems will enable immediate release of cargo upon arrival at the port, within the confines of controllable risk.

With digital transformation and information integration, information from various sources such as customs, ports, shipping and trade can be consolidated to eliminate hindrance to trade growth caused by information asymmetry or inefficient data exchanges, promote business process reengineering, reduce costs of compliance with port logistics, and improve transaction efficiency of port trades.



Open Innovation Promotes the Formation of Intelligent Ports

As a traditional industry with a history of a few millennia, the most direct and effective way of port innovation is the use of external driving forces to jointly create a new development paradigm.

New digital technologies will spell the future trend for an open, collaborative, highly-interconnected, digitised and intelligent ecosystem. However, the achievement of such economic goals depends on the government, enterprises and innovative agencies to cooperate in an orderly manner to create a win-win situation that supports trade growth and economic development.

The construction and development of intelligent ports require the leadership by port authorities and large and medium-sized shipping enterprises; it will also require even more support from small and medium-sized enterprises and entrepreneurial teams.

Experience from other industries has shown that an open innovation will bring about a "catfish effect" which in turn, will actively and effectively promote healthy development of the industry ecosystem.

3E class intelligent ports will greatly enhance business environment at the port

The establishment of an intelligent port should be based on the strategic objective of a "3E"-level port: that is, there should be excellent port operation (Excel), extended openness in eco-environment construction (Extend), and sustainable exploratory development in innovative business (Explore).

A "3E"-level port will greatly enhance a port's business environment through five means: intellectualised operation of terminals, collaboration of marine logistics, facilitation of international trades, popularisation of financial scenarios and innovation of data services.

(1) Intellectualisation of port operations

At present, there are significant differences in the scope of improvement needed for the level of automation and utilisation of assets and human resources of the ports. Issues such as information silos and structural shortage of talents are exerting increasing impact on the efficiency and quality of port operations.

The automation of port facilities, intellectualisation of scheduling and dispatching, as well as visualisation and exchange port data will further enhance the efficiency and quality of the port's core business and provide more convenient, safe and stable port services.

(2) Collaboration of Marine Logistics

The goal of collaboration of marine logistics is to remedy the current long-standing situation of lack of in-depth collaboration between different agencies and operating units within the same port. Additionally, collaboration of marine logistics will attract end shippers through the establishment of strategic collaboration within the port by optimising its multimodal transportation network. The collaboration will

establish a community to pool the business needs of various logistics participants, and to retain end shippers with the help of information platform. The collaboration will also encourage innovative logistics services, provide value-added services, enhance the overall efficiency and service quality of the value chain, and enhance customer experience.

(3) Facilitation of International Trade

The core objective of an intelligent port is to establish – with comprehensive cost advantage – a safe, convenient, efficient, transparent and clean port business environment to promote and facilitate international trade.

Firstly, facilitation of trade requires convenient information availability. This can be achieved by information sharing and improvement in efficiency of customs clearance and tax return processes. Secondly, facilitation of trade requires convenient service provision. This can be achieved by using information technology to provide services to end shippers, and reducing the time cost of the shippers. Finally, strengthening cooperation between port operators and related logistics parties to seek opportunities for better trade facilitation and provide more customised value-added services.

(4) Popularisation of financial scenarios

In this Internet era, the real economy will be better served with interconnectivity between finance and the industries.

Under the premises of integration of information, business and logistics flow, intelligent port can deploy its transaction scenarios to establish online payment modes and consolidate its capital flows.

A port credit system established with big data can perform in-depth mining of financial demands supported by real trade scenarios. This can prompt relevant port services agency to provide more personalised and risk-controllable financial services.

(5) Innovation of data services

Humongous amount of data is accumulated in port operation. Such collection of data is of great potential value.

Data mining techniques can explore trade and logistics characteristics or portraits to effectively coordinate between supply and demand and hence optimise the allocation of various types of port resources, promote development of port trade and create social value.

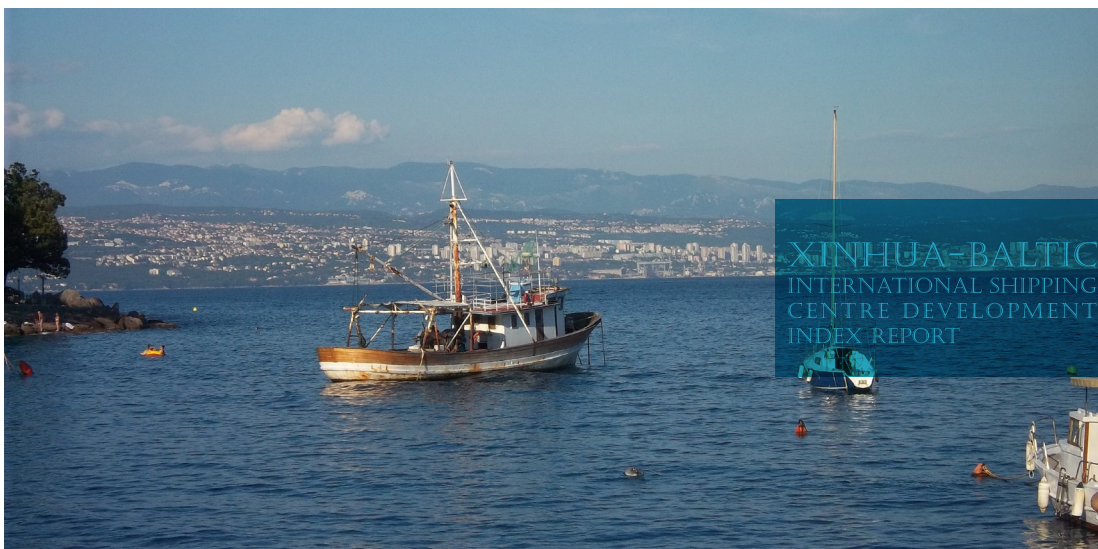
The elimination of the long-standing silo effect of port data will provide better support for traders and logistics companies in decision-making and promote better value-added business opportunities, and support continuous optimisation of port business environment through a steady stream of innovative ideas.

Global Viewpoint:

Understanding the development of Intelligent Ports

Jia Dashan

China Waterborne Transport Research Institute, Ministry of Transport.



Since IBM put forward the idea of “Smart Planet” in November 2008 (dubbed “Intelligent Earth” in Chinese), the concept caught on very quickly, and corollary concepts like “intelligent cities”, “intelligent medicine”, “intelligent ocean” and “intelligent port” soon followed.

With deepening research and practices, the focus of development of intellectualisation began to converge in three areas: comprehensive perception, extensive interconnection, as well as intelligent management and control; superimposed with autonomous learning, automatic improvement and spontaneous adjustment. The fact that Alpha Go beat the world champion in the game of Go – with moves considered irrational by professional players – was a classical application of such superimposition; and it is refreshing.

More than 90% of China's foreign trade is transported through its ports. As a large trading country, seven of the world's top ten ports by throughput and container throughput are located in China. As an integrated transportation hub, an important logistics node and transportation centre for international trade, China exerts great influence on regional economic and industrial development. It possesses strategic resources and data for the region to integrate into the global economy; and acts as the cluster for technology development. As the home of a number of world-class ports, China can exploit the advantages of its advanced information technology, large-scale port operations and be a massive data aggregator to accelerate its development of intelligent ports.

Judging from the specific promotion measures taken by the government, the Ministry of Transport has selected a batch of ports based on logistical characteristics and safety management of hazardous cargo, to be officially launched as a pilot intelligent port construction project. From the perspective of business promotion measures, with the integration of modern information technologies like the Internet, IoT, big data, and cloud-computing into traditional transshipment services, terminal operators are encouraged to integrate into the supply chain management and tap into the potential of value-added services.

Meanwhile, automated terminals continue to advance with improved level of intelligent management to enhance terminal transshipment services.



Basic understanding of intelligent port

By providing safe passages or berthing for ships, the port acts as a transshipment hub between land and water transport. It is also the distribution centre for industrial and agricultural trades as well as foreign import and export cargo. A port is also the venue for ship berthing, cargo loading and unloading for transshipment, embarkation and disembarkation of passengers, as well as replenishment of supplies.

About 70% of the world's geographical features are covered by water; hence the role of ports as important logistics nodes. About 85% of the world's foreign trade cargo is transported through the ports; and as much as 90% in China's case.

Institution and technology innovation has always been the two basic driving forces to make the operation of a port safer, more convenient, more efficient and greener. The same driving forces are also responsible for nudging the transformation of port from traditional transshipment, industrial and logistics functions towards a resource-efficiency-oriented, network-based function. On the relationship between the port and its city, there is transformation from mere port-city symbiosis and co-development to that of mutual prosperity.

Modern technological advancement, especially the complete integration of information technology into transportation management and services, has enabled the intellectualisation of transportation facilities and organisations, and thereby enhanced operation efficiency and service quality. The subject of intelligent ports, mainly through digitalisation, automation and intellectualisation, is also gaining public attention.

With thriving application of new generation of information technologies such as cloud-computing, big data, IoT and mobile network in recent years, we see that machines can not only greatly extend human's physical ability and perception, but also extend human's cognitive intelligence – represented by capability of autonomous learning, automatic improvement and spontaneous adjustment (decision-making). They are no longer merely operating strictly to pre-coded instructions by a human.

A machine that can harness powerful computing, memory and learning capabilities will create a profound impact on the daily lives of people from all industries.

Therefore, construction of intelligent port should have focus on the dual-driving factor of institution and technology. Driven by capital and the market, operators may invest in new technologies with potential high-return on the ports to generate new value-added services or new business models. Such new business models will need to be supported by institutional reform for sustainable development to realise a win-win situation for stakeholders. From the

features perspective, an intelligent port should possess four main features: namely, comprehensive perception, extensive interconnection, intelligent management and control as well as autonomous adaptations (autonomous learning, automatic improvement and spontaneous adjustment).

Comprehensive perception of a Port

Comprehensive perception is the basis of an intelligent port.

There are two aspects to this perception. One aspect is the port's stakeholders (terminal operators, government agencies and customers) and their comprehensive perceptions of the port's internal operational elements. Such perceptions are then shared with other stakeholders through some relevant mechanisms.

From the point of view of the terminal operators, it means comprehensive measurement and monitoring of all internal operational elements that are measurable, visible and controllable including delivery vehicles, loading and unloading equipment, operating personnel, and cargo throughout the port operations. Such measurements – which encompass all necessary static and dynamic data, including information flow, logistics and capital flow data – are in turn used for real-time and dynamic analysis to accurately grasp the operating status of the whole port system.

Some of these data need to be reported to the government agencies for statistical analysis; some need to be shared with supervisory agencies; while some are needed by investors of the port. From the viewpoint of the government: on the one hand, it is the comprehensive perception of the port's operation, including the adaptability of the port's capability, the impact of the port on regional economy, efficiency on the use of resources, safe operation and environmental protection.

On the other hand, the government will facilitate comprehensive perception of its relevant policies by the society and stakeholders. These include understanding the responsibilities of its various agencies, the port master plans, relevant technical standards, approval agencies and supervisory agencies. This will enable more convenient and accurate communication between terminal investors or operators and government agencies on subjects like project approval, operations, safety supervision, and environmental monitoring.

At present, China's ports are still in the development stage on the achievement of comprehensive perception. For the terminal operators, the main challenge is whether their investment on perception system can bring about new value-added services than can sustain further development. For the government, comprehensive perception will entail many institutional and technical issues. For example, many aspects of port such as adaptability of the port's capability, safety supervision over hazardous cargo in the port, and

pollution emission zone will require real-time information.

At the same time, the integration of technologies into the market will create new business models, thus challenging the government in maintaining its technical standards, responsibilities, investment on facilities, and regulatory responsibilities. Such challenges are far greater than the return capital challenges that operators face.

Wide interconnection of ports

The extensive interconnection of a port is multifaceted. Firstly, the interconnection between the port's channels and other network nodes.

As a collection and distribution system, the port connects with its hinterland via the many inland service network nodes.

Over a long period of development, collection and distribution system of China's ports are increasingly more sophisticated to date; with handling capacity that is relatively adaptable to the needs of social economic development. Take the case of a dry port as the benchmark, the port is even more closely interconnected with its hinterland. With improvement in hardware and extensive application of information technologies, the port's traditional transportation function is being transformed into one with full logistics service function with integrated supply chain management that offers new potential value-added services.

The construction of inland network nodes to enhance a port's radiation coverage is exemplified by Tianjin Port (Group) Co., Ltd who exploited the advantages of its port size and huge inland hinterland. It built numerous dry ports to expand its hinterland network nodes and enhanced its capability to provide full logistics services throughout the hinterland. These inland cities include Beijing, Hohhot, Eriianhaote, Zhangjiakou, Shijiazhuang, Handan, Anyang, Houma, Hebi, Xi'an, Taiyuan, Baotou, Datong, Yinchuan, Shizuishan, Ordos, Dezhou, Huinong, Dulata and Lanzhou.

For improvement of the collection and distribution system in response to faster economic growth in the Western China region, the ports will accelerate the development of sea-rail transshipment mode, which in turn, enhance the ports' radiation coverage and service capability. Example ports include Dalian Port, Yingkou Port, Tianjin Port, Qingdao Port, Lianyungang Port, Ningbo-Zhoushan Port and Shenzhen Port. Development of sea-rail transshipment of containers is growing steadily. In 2017, the domestic total sea-rail container transshipment was 3.48 million TEU, up 30% year-on-year.

The remaining issues are mainly related to optimisation of the structure of collection and distribution systems: that is, the lack of effective last mile connectivity. Secondly, the lack of information connectivity.

Port information connectivity involves connectivity between ports and customers, ports and ports, as well as ports and government agencies.

To drive the development of the port's various

businesses, terminal operators and government agencies introduced numerous IT systems. These IT systems have effectively supported the development of the port's business and improved its operation efficiency. However, they also resulted in information silos that posed challenges for further digitalisation and data standardisation and integration between the old and new systems. Thirdly, the interconnection between the port's resources.

A port can fully exploit its informational and hub advantages by actively participating in organising and planning cargo circulation so as to achieve good connections with its global suppliers, transporters, and consumers. Such collaborative management corresponds with the concept of fourth-generation port.

Different terminals in different location that are operated by the same operator and management agency can be managed collaboratively to form a network of terminals to enhance the port's resource utilisation. This not only means provision of better services but also contribution to the development of trade and cities.

Resources of a port include administrative resources, natural resources and management resources. Interconnection between these resources is conducive to improving the efficiency of their utilisation. At present, efforts to interconnect China's port resources are reflected in the efforts in consolidation of port resources and the development of port networks.

For example, Guangxi Province has formed the Guangxi Northern Gulf Bay Area International Port Group; Hebei Province has formed the Hebei Port Group; Fujian Province has established three port authority agencies to serve Fuzhou, Xiamen and Meizhou respectively; and Zhejiang has constructed the Ningbo-Zhoushan Port.

A port, with its characteristic resources, has a role in the regional economy and social development. On that basis, the government should play its "visible hand" in the allocation of administrative resources and natural resources in response to efforts by ports in exploring how the ports' resources can be consolidated. In this way, the market will have a definitive role in the allocation of business resources.

For example, Shanghai International Port (Group) Co., Ltd, relying on its of size and location advantages – being on a T-shape hinterland served by the Yangtze River water channel – has successfully invested in the terminal facilities of Suzhou Port, Jiangyin Port, Nanjing Port, Wuhu Port, Anqing Port, Jiujiang Port, Changsha Port, Wuhan Port, Yibin Port and Chongqing Port. These investments were made through holdings, equity acquisition, operating and other appropriate technical means. At the same time, the company also acquires the role of provision of coastal terminal and logistics services through the holding of companies such as Shanghai Jihai, Jiangsu Jihai, Chongqing Jihai and equity participation in Minsheng Shipping Co., Ltd.

Another important sign of the extensive interconnection of Chinese ports is the development of global terminal



operators and the improvement of the global network of terminals.

Particularly, and in recent years, with the strategic opportunities provided by globalisation and the “Belt and Road” initiative, China’s port enterprises have seized the opportunity to globalise their operations; hence the emergence of two top terminal operators in the world by throughput.

Backed by The Merchants Group with its long-term investment strategy and the advantage of terminal operations, The China Merchants Port has quickly grown into global terminal operator through investment and acquisition. It ranked first in the world in 2017 with a container throughput entitlement of 102.9 million TEU. In the process, the operator took the role of a commerce chamber agency to collaborate a tripartite “port-park-city” development model.

Having the advantage of a fleet of liners in the possession of its parent company China COSCO Shipping Corporation Limited, COSCO Shipping Port embarked on global investments in terminal operation. It ranked second in the world in 2017 with a container throughput entitlement of 100.2 million TEU.

Intelligent control of the port

Intelligent port control involves both the government and the enterprise. In the face of global industry 4.0 and the development trend of “Internet+”, automated container terminal has become the highlight of the management and control of the current intelligent port.

Since the first-generation automated container terminal was put into operation in 1994, technologies have advanced unceasingly and we are at the fourth generation of technology innovation. In total, 51 ports have completed or are in the process of implementing automated container terminals; of which, 36 are semi-automated terminals based on automatic loading/unloading yards, and 15 are fully automated terminals based on fully automated loading/unloading capabilities.

Although China started relatively late in the automation of its terminals, it has the late-comer’s advantage to seize applicable information technologies and successively transform Xiamen Port, Qingdao Port and Shanghai Port through the introduction of new containers. Its level of automation is now leading in the world.

Container terminal automation is a comprehensive application of many disciplines including artificial intelligence, operation research and system engineering theories. It uses automated operating equipment with supporting management and control software to form a complete container handling process system. The system can replace, in whole or in part, complex container handling or loading/unloading that usually requires manual controls. This has resulted in significant reduction in the number of on-site personnel at the terminals.

However, from the perspective of utilisation of coastline

resources, China’s main ports can only achieve a hectometre coastline throughput capacity of 250,000 TEU, while the actual maximum throughput achieved is 350,000 TEU. Therefore, the increase in operating efficiency and reduction in labour costs brought about by terminal automation still lacks direct economic attractiveness when measured against the increase in investment.

However, advancement in technologies will enhance operational efficiency of automated terminals, and reduce the cost of investment per unit throughput. Meanwhile, labour costs will continue to rise. Therefore, an economic inflection point will be reached where automation of terminals will find wider adoption.

Self-adaptation of the port

With continuous advancement in technologies and improvement in management and regulatory systems, the ports will, in partnership with the development of smart cities, attain the goal of comprehensive perception, extensive connectivity and intelligent management and control. That is when the full economic competitiveness of intelligent port is manifested; and when the operating systems of intelligent port attain self-adaptability, which represents the ultimate stage of evolution of an intelligent port.

Much like the Alpha Go, whose “intelligence” is capable of beating professional Go players, it is conceivable that with emerging new technologies applicable to port operations, the port may one day come “alive”, only with much stronger memory and supercomputing capability. Then, given its extensive interconnectivity and humongous amount of operation data, the port may form its own knowledge logic through self-learning by digital trial and error testing of its huge database. The new knowledge logic can then be automatically tested in practice and refined; and effective knowledge thus tested may then replace the old knowledge fed to the system by humans previously. Such effective knowledge will also be communicated to the port’s stakeholders. With new knowledge: terminal operators can enhance their operations and organisation; government agencies can improve their technical standards, safety supervision and environmental protection policies; and cities can achieve better port resource utilisation. At the same time, in response to external environmental changes, the port system may effect spontaneous adjustment according to a self-selective development path. Under such circumstance, “decision-making” by the system is no longer the so-called “decision-making system” of the current information system, but autonomous decision-making when big-data analysis attains a certain level of sophistication. This is an all-new, beyond-imagination capability of an intelligent system.

Even though we have yet to see such futuristic intelligent port, it is still foreseeable that the ability to extend human’s physical labour limit, perception capability as well as analysis and judgement capability will entice the port’s stakeholder to have more liberal play with such technologies.

Global Viewpoint:

Asia-Pacific Green Port Construction

Yu Xiujuan

Asia-Pacific Port Service Organisation

Asia-Pacific is the world's largest economic sector, and is also an important engine of world economic growth.

In 2017, nine out of the world's top ten ports were located within the Asia-Pacific region.

With the rapid development of ports in the Asia-Pacific region, the impact of ports on the environment is receiving growing attention. The construction of green ports is an attempt to seek balance between environmental protection and port development. It is the rational development and utilisation of the port while being mindful of protecting the ecological environment.

In 2016, the APEC Port Services Network (APSN) launched the Asia-Pacific Green Ports Award Systems (GPAS) that meets the level of port development in the Asia-Pacific region. It provides comprehensive, scientific, rational and systematic guidance for the development of green ports in the Asia-Pacific region to lead and encourage these ports along the path of sustainable development.

In 2016 and 2017, a total of 14 ports from six economies have won the title of Asia-Pacific Green Port.

The Asia-Pacific green ports with relatively more matured economies have been able to adopt, at an early stage, the ecological concept of "Ports-Human-Nature" co-development into all aspects of port planning including development, operation, maintenance and management. This helps to prevent environmental pollution and ecological damage at source, protect water resources and port ecological environment, minimise the port's impact on neighbouring environment and communities, and achieve a win-win situation for both port development and urban environment.

Port planning and development:

Rational use of coastal resources, avoidance of sensitive areas, vegetation planning for port area, and planning for wildlife habitats.

Port production and operation:

Prevention and control of pollution emission, development and use of clean energy, research in environmental protection technologies, waste recovery and recycling, protection of marine life, resource conservation and utilisation, and soil protection.

Port maintenance:

Establish environmental testing standards, formulate port environmental restoration plans, formulate environmental

risk emergency plans, and strengthen education and dissemination of environmental protection concepts.

While vigorously carrying out infrastructure construction, the ports in the Asia-Pacific region also place emphasis on sustainable green development. Each major port endeavours to construct a green port that commensurate with its local characteristics. Their experiences on green ports are shared below:

The Los Angeles-Long Beach Port is an outstanding representative of green ports of North America. In 2017, the port upgraded its clean air action plan (CAAP) with the aim of reducing greenhouse gas by 40% based on the 1990 level by the year 2030, and 80% by the year 2050.

The port of Vancouver in Canada places great emphasis on the development of green port ecology. It has launched various initiatives such as the Eco Action programme and the Enhancing Cetacean Habitat and Observation (ECHO) programme.

This new ship award programme aims at reducing the impact of underwater noise on marine life during ship navigation. Canada is the first country in the world to have set up a plan for reducing marine noise.

The Port of Singapore the world's leading hub port. It has implemented a green shipping programme to encourage Singapore ship owners to adopt energy-efficient ship designs. The design benchmark exceeds the IMO's ship energy efficiency design index.

At the Port of Singapore, such energy-saving ship will enjoy a 50% discount in registration fee and 20% discount in tonnage tax. Ships adopting desulphurisation technology that is superior to IMO's emission requirement will enjoy a 25% discount in registration fee and 20% in tonnage tax.

Ship adopting both energy-saving design and superior desulphurisation technology will enjoy a 75% discount in registration fee and 50% discount in tonnage tax.

Singapore, as the world's largest refuelling port, is gradually developing its LNG clean fuel refuelling business as the date of implementation of the "Sulphur Restriction Order" approaches in 2020.

In 2017, the Maritime Port Authority of Singapore (MPA) announced an additional investment of 12 million Singapore dollars to support the building and use of LNG ships.

Jurong Port, a private terminal company headquartered in Singapore, is one of the largest cement terminals in the world.



The cement terminal is a fully-enclosed cement-processing installation which can prevent pollution caused by cement dust.

With more than 95,000 square metres of solar panels installed atop the roof of the warehouse in Jurong Port, it is the world's largest solar panel project to be based in a port.

Capable of generating 1,200 kilowatts of electricity annually, the solar panel is able to reduce an equivalent of 5,200 tons of carbon emission. Excess solar electricity is channelled back into the national electricity grid.

As the world's largest sea port, Ningbo-Zhoushan Port places great emphasis on energy conservation and emission reduction.

It invested 400 billion Yuan in "Petrol to Electricity Conversion" programme for its gantry cranes, with the target to reduce greenhouse gas emission by 98,000 tons annually. It also actively promotes the LNG container truck programme. To date, it has already introduced 535 new LNG container trucks.

The world's largest and most automated container port – Shanghai Yangshan Deep-Water Port Phase IV – began operation at the end of 2017. Port operation is fully automated from container unloading at the port terminal to transportation to the warehouse. The whole operation achieves zero emission.

Qinhuangdao Port is one of the largest coal terminals in the world. Electricity is its main source of energy and accounts for 98% of its energy consumption. Major energy-consuming equipment includes dumpers, stackers, reclaimers, ship loaders and conveyor belts.

The key measures of Qinhuangdao Port in terms of green ports include:

In the process flow, change the reverse direction activation of the conveyor belt to forward direction of material flow; implement speed regulation of the conveyor belt by frequency control; deploy deceleration motor technology to the conveyor belt; reengineer for potential energy feedback of the dumpers; and use of energy-saving lighting system.

The coal yard in Qinhuangdao Port has the longest windbreak net in Asia and is surrounded on three sides by

dust-control vegetation. The use of snow-making machines in China's bulk terminals to create snow during the winter is effective in reducing dust. This method is superior to using water spray during winter as it may cause icing on the road and introduce potential hazardous condition. Water spray may also cause clumping of frozen coal which leads to blocking of the funnel.

Apart from the green construction by the ports themselves, international organisations have also formulated corresponding regulations to protect the ecological environment of a port. Some examples are as follows:

In 2016, the decision to implement a sulphur limit of 0.5% in 2020 stipulated in "The International Convention for the Prevention of Pollution from Ships" was taken by the International Maritime Organisation (IMO).

The IMO issued another warning in December 2017:

Ships failing to comply with the emission rule could be considered as "unseaworthy", thus affecting their charter contracts and insurance claims.

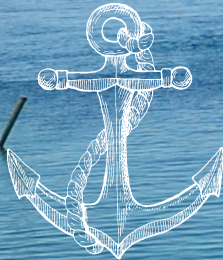
All signatory states to the Convention have taken measures to comply with the convention to reduce emission by ships in their emission control zones.

Since the announcement of the "Sulphur Restriction Order", all signatory states have formulated their own emission control zone policies. Every shipping company has also started relevant research to comply with the policies of such emission control zones. For example:

How changing shipping routes and cruising speeds can reduce consumption of low-sulphur fuel and reduce fuel consumption cost?

Building resource-saving and environmentally-friendly Asia-Pacific green ports is the common goal of Asia-Pacific economies.

Construction of a green port not only requires the effort of the port itself, but also requires cooperation of terminal operators, shipping companies, energy suppliers, the government and the public. Let us work together to build the Asia-Pacific green port region and enjoy our blue skies and seas.



XINHUA-BALTIC
INTERNATIONAL SHIPPING
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INDEX REPORT

2018







Chapter 7 Featured Topic Research: International Shipping Centres and Bay Area Economies Around the World

07
XINHUA-BALTIC
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Bay Area Economy

The bay area is an area consisting of a bay or several bays, ports and neighbouring islands. It also includes several ports and cities or clusters of ports and cities dotted along the coast.

The synergistic economy derived from such bay area is defined as bay area economy. The bay area economy is an important form of economy for the coastal area. It defines the synergistic existence and mutual development between the shipping centre cities and their associated hinterland. Such high level of synergy among port economy, agglomeration economy and network economy allows for greater integration between the shipping centre and urban development to achieve an agglomeration economy.

1. Superior geographical condition is a fundamental condition for formation of a bay area economy. Proximity to the sea, bay or river is the natural key to a bay area that enables lower cost of water transportation which, in return, is conducive for the development of the ports for foreign trades, especially when supported by a huge hinterland.

2. A developed shipping centre city is the driving force for the formation bay area economy. International shipping centre acts as “growth magnets” and plays a key role in the formation of bay area economy through agglomeration and distribution of various industries. For example, the New York Bay Area and Tokyo Bay Area are so named due to their associated international shipping centre cities.

3. Reasonable division of labour and collaboration is a key factor in the formation of bay area economy. Collaboration between clusters of cities and ports within the bay area can not only avoid vicious competition but also enhance competitive advantage of the entire bay area.

Additionally, sound innovation system, efficient transportation, pleasant living environment, and perfectly coordinated mechanism are all important factors in promoting the formation of bay area economy.

Well-known bay areas in the world

At present, major bay areas are concentrated in developed countries in Europe and America.

Of these, the four famous bay areas are New York Bay Area, Tokyo Bay Area, San Francisco Bay Area and London Bay Area.

New York Bay Area

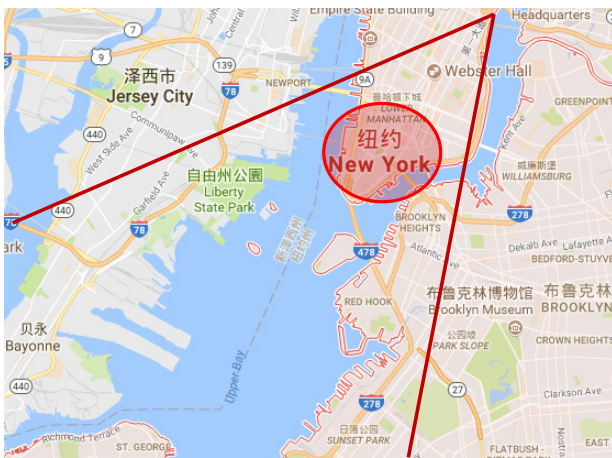


Figure 37 New York Bay Area

Source:

Subject Research Team

New York Bay Area is not only an international shipping centre but also the financial centre and commercial centre of the world. It is also one of the world's most densely populated and a city enjoying a hugely busy public transportation system.

New York Bay Area accounts for 20% of the United States' population. It houses 40% of the world's top 500 companies and contributed twenty trillion dollars to the US GDP in 2017.

The development of shipping centres in New York Bay Area mainly focuses on New York-New Jersey ports.

With an International Shipping Centre Development Index Score of 73.24, New Jersey was ranked 9th in the world. Ranked 21st in the world, container throughput of New Jersey Port was 6.71 million TEU.

Tokyo Bay Area



Figure 38 Tokyo Bay Area

Source:

Subject Research Team

Tokyo Bay Area is located on the Pacific coast of central Honshu. It includes five cities, namely Tokyo, Kawasaki, Yokohama, Funabashi and Chiba; and a cluster of six closely-connected ports, namely Yokohama Port, Tokyo Port, Chiba Port, Kawasaki Port, Kisarazu Port and Yokosuka Port. Its annual throughput is more than 500 million tonnes.

The Tokyo Bay Areas supports a gamut of Japanese industries, including electronics, steel, oil refining, petrochemical and automobile. With a well-defined labour specialisation system, the Tokyo Bay Area is evidently industry-driven.

Having one of the world's highest level of urbanisation and the most economically developed city clusters, the Tokyo Bay Area contributed 1/3 of Japan's economy.

The development of international shipping centre constitutes a strong impetus that drives the development of Tokyo Bay Area.

Tokyo International Shipping Centre Development Index scored 68.17 points, and ranked No. 10. Port of Tokyo handled 4.5 million TEUs in 2017.



XINHUA-BALTIC INTERNATIONAL SHIPPING CENTRE DEVELOPMENT INDEX

San Francisco Bay Area

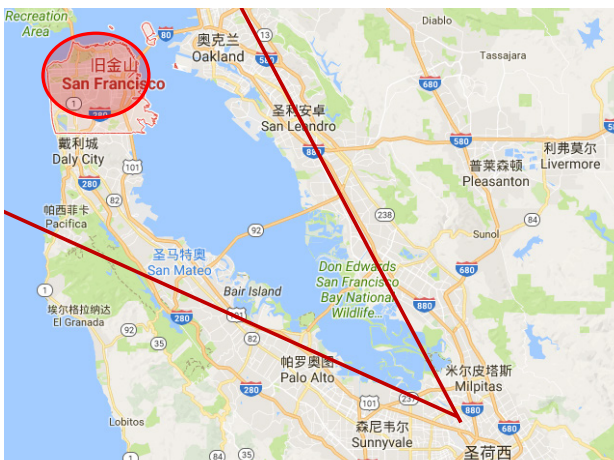


Figure 39 San Francisco Bay Area
Source:
Subject Research Team

The San Francisco Bay area encompasses the San Francisco Bay on the west coast of the United States.

Through years of development, San Francisco has significant achievements in areas of hi-tech industries, international trade and tourism. Aided by its unique natural landscape, livability and transportation convenience, San Francisco has become a renowned technological Bay Area in the world.

London Bay Area

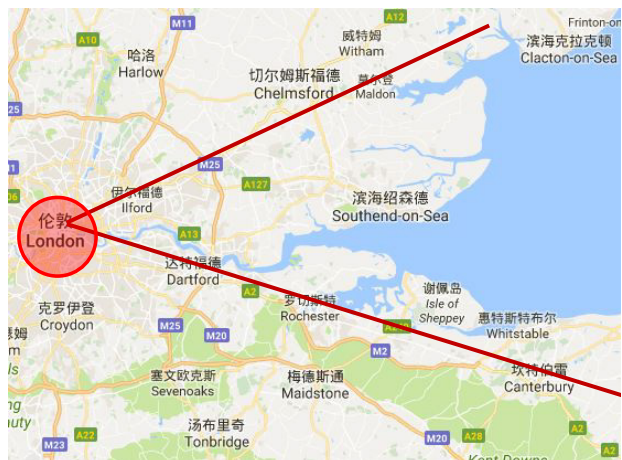


Figure 40 London Bay Area
Source:
Subject Research Team

As the largest bay area in Europe, London Bay Area is also the trade and financial centre of Europe.

With London Port as its base, and providing mainly professional shipping services, London Bay Area manages to attract renowned shipping companies and shipbrokers from around the world to set up offices in the area.

With an International Shipping Centre Development Index Score of 83.82, London was ranked 3rd in the world. London Port has a container throughput of 2.49 million TEU in 2017





Economic Development of China's Domestic Bay Area

In 2014, the Shenzhen Government Report first broached the topic of "bay area economy" for the first time;
 In 2015, a top-level design proposal for the "Belt and Road" initiative proposed the subject: "Deepen cooperation between Hong Kong, Macau and Taiwan to create a Guangdong-Hong Kong-Macau Greater Bay Area";
 In March 2016, the National Development and Reform Commission included the item "Promote the development of Guangdong-Hong Kong-Macau Great Bay Area and cross-provincial cooperation platform" into China's 13th Five-Year Plan;
 In March 2017, Development of Guangdong-Hong Kong-Macau Great Bay Area was covered in the Government Work Report for the first time, thereby escalating it to a national strategic project;
 The first Guangdong-Hong Kong-Macau Greater Bay Area Forum was held in Hong Kong was held in June 2017;
 In July 2017, the "Framework for Cooperation Between Guangdong, Hong Kong and Macau on the Promotion of the Greater Bay Area" was signed.
 In the first half of 2018, the "Outline of Development Plan for Guangdong-Hong Kong-Macau Greater Bay Area" will be announced.

(A) Guangdong, Hong Kong, and Macao Greater Bay Area

Guangdong-Hong Kong-Macao Greater Bay Area include Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen, 9 cities of Zhaoqing as well as Hong Kong and Macao, with a total area of approximately 56,000 square kilometres.

The urban infrastructure of Guangdong-Hong Kong-Macao Greater Bay Area is relatively complete with clear characteristics of an export-oriented economy. The industry is dominated by advanced manufacturing and modern service industries.

Guangdong-Hong Kong-Macau has a total GDP of more than ten trillion Renminbi in 2017, making it the most powerful economic entity in China to vie for the world's third largest bay area economy.

(B) Shanghai-Hangzhou-Ningbo Greater Bay Area

The Shanghai-Hangzhou-Ningbo Greater Bay Area is located south of Shanghai, in the north-eastern region of Zhejiang. Adjacent to the Zhoushan and Beilun ports, it is connected to the west with Shaoxing, to the east with Ningbo, and to the north with Jiaxing and Shanghai. It covers an area of 55,000 square kilometres and has a population of about 62.12 million. Main cities in the Hangzhou Greater Bay Area include Shanghai, Ningbo, Hangzhou and Suzhou.

From the perspective of port cluster, the Shanghai-Hangzhou-Ningbo Greater Bay Area Port has a densely populated cluster of ports that serves both its river estuaries and the open ocean. It has a total of 23 ports, 21 airports, 40 large-scale bridges, and is served by a high concentration of high-speed rail connection and highway networks.

In 2017, Shanghai's container throughput was ranked first in the world. In the same year, Ningbo-Zhoushan's bulk cargo throughput was ranked first and its container throughput was ranked third in the world.

From the perspective of industrial cluster, the area has a strong manufacturing base supporting a complete range of products including steel, petrochemical, automotive, ship building, equipment and textile products. The level of technologies and brand advantages are much higher than other areas surrounding the Pearl River Delta region. Its cluster of traditional industries is very well developed and is accelerating towards the mid- to high-end of the global value chain.

From the perspective of city cluster, the area has 26 cities covering an area of 211,700 square kilometres. Its total GDP in 2016 was 14.7194 trillion Yuan, or 2.2 trillion USD. With a total population of 150 million, it is already amongst the world's top city clusters.

From the perspective of high-end factors, the area has well-developed education with a good talent pool. It has more than 300 institutions of higher learning including China's top universities such as Zhejiang University, Fudan University, Shanghai Jiaotong University and Nanjing University. It is also home to more than 300 innovative enterprises including the National Engineering Research Centre and engineering laboratories. It also includes the Shanghai Stock Exchange, which is the second largest exchange in China and the third largest in Asia. It attracted investments from more than 400 of the Fortune 500 companies.



(C) Bohai Rim Bay Area

The Bohai Rim Bay Area consists mainly of cities like Dalian, Shenyang, Huludao, Qinghuangdao, Tangshan, Beijing, Tianjin, Dongying, Yantai, Weihai and Qingdao. Encompassing the Liaodong peninsula, Beijing-Tianjin-Jizhou belt and the Shandong Peninsula, it covers an area of 518,000 square kilometres supporting a population of 230 million. The main cities, including Shenyang, Dalian, Beijing, Tianjin and Qingdao, have already become the “driving engine” for development of North China’s economy.

The Bohai Bay Area is one of the regions with the most concentrated transport network; it is a hub for shipping, railway, highways, aviation, and communication networks.

With more than 40 ports, six major international airports and more than ten high-speed rail stations, it forms a three-dimensional transportation network covering land, sea and air.

In addition, the Bohai Bay Area is centrally located within China’s Northeast economy circle. Connecting Korea and Japan to the east, as well as Mongolia and Russia to the north, it acts as an important communication link of the Northern and North-eastern China.

However, the area covered by Bohai Bay Area is simply too large, and traverses several administrative regions. Thus the market is severely segmented with kinks in industrial chain; thus less economic cooperation between cities, and less economic links between the cities.

(D) Northern Gulf Bay Area

The Northern Gulf Bay Area is situated in the southeast of China’s South Sea; it borders Leizhou Peninsula and Hainan Island to the east, Guangxi Zhuang Autonomous Region to the north, and Vietnam to the west. With an area of 56,000 square kilometres, its main cities along the coast include Nanning, Beihai, Qinzhou, Fangchenggang, Haikou and Zhanjiang.

Located strategically at the forefront facing the China-ASEAN economic and trade zone, the Northern Gulf Bay Area is China’s maritime bridgehead to ASEAN and is of great significance to China’s development of international economic exchanges and cooperation.

In April 2017, while visiting Guangxi, Chairman Xi Jinping stressed, “the Northern Gulf Bay area must be constructed, managed and operated well.”

The development of coastal cities along the Northern Gulf Bay Area is relatively sluggish, with weak industrial foundation and incomplete transportation infrastructure, and feeble innovation capacity. The lack of comprehensive universities and scientific research institutions makes it difficult to attract Fortune 500 companies to settle in Northern Gulf Bay Area. Hence, it is still relatively behind compared to other bay areas in the world.

Appendix I : Methodology for International Shipping Centre Development Index

The General Rationale

The research process for Xinhua-Baltic International Shipping Centre Development Index consists of 7 steps:

Step 1: Theoretical research on index: Collate and study relevant literature to achieve a comprehensive understanding of the theoretical foundation of international shipping centres and the current state of development.

Conduct In-depth interviews with government organisations, university academia and professional experts to collate their expertise and suggestions on the rationale for selecting indicators and the methodology for index computation.

Step 2: Index system design: The Xinhua-Baltic International Shipping Centre Development Index system will be jointly developed by China Economic Information Service and the Baltic Exchange, which will be authenticated by an expert committee.

Step 3: Data collection and processing: Initial data for indicators will be collected through two channels: China Economic Information Service and the Baltic Exchange. This data will then go through a normalisation process to form the relevant indicator data.

Step 4: Index model construction and computation: Based on earlier theoretical research and in accordance with correlations between indicators, an index model will be constructed. Subsequently an index will be computed using the model.

Step 5: Index report writing: A report about the creation of the index will be produced under the guidance of the index expert committee.

Step 6: Organise an expert team to ascertain the scientific foundation of the research and confirm the final result.

Step 7: Announcement of index results.





Index System

Primary Tier		Secondary Tier	
Name	Weight	Name	
Port Factors (A ₁)	0.20	Container throughput (B ₁)	
		Dry bulk cargo throughput(B ₂)	
		Liquid bulk cargo throughput(B ₃)	
		Number of cranes(B ₄)	
		Total length of container berths(B ₅)	
		Port draught(B ₆)	
Shipping Services(A ₂)	0.50	Shipping Brokerage Service(B ₇)	
		Ship engineering service(B ₈)	
		Shipping business service(B ₉)	
		Maritime legal service(B ₁₀)	
		Shipping finance service(B ₁₁)	
		Ship repair service(B ₁₂)	
General Environment(A ₃)	0.30	Government transparency(B ₁₃)	
		Extent of e-government and administration(B ₁₄)	
		Economic freedom(B ₁₅)	
		Customs tariff(B ₁₆)	
		Ease of doing business index(B ₁₇)	
		Logistics performance index(B ₁₈)	

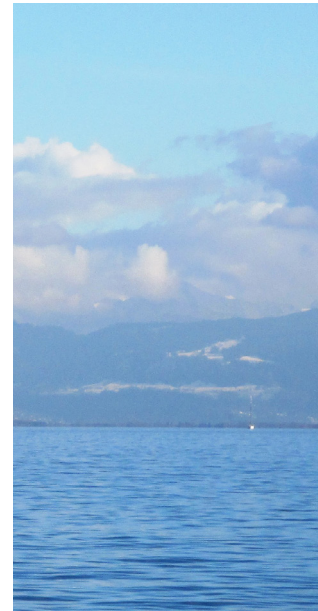


Table 6 Indicator system and associated weightage for Xinhua-Baltic International Shipping Centre Development Index

A1 Port Factors

This refers to infrastructures of the port city and the actual throughputs of various types of cargo.

A2 Shipping Services

This refers to the level of shipping services provided by the port city. This can be gauged by how the shipping centre capitalise on its services to portray its ability in the allocation of shipping resources globally.

A3 General Environment

This refers to the business and economic environment together with government policy measures to support the development of the port city.

B1 Container throughput

Container throughput is an important indicator of the size of the port. It refers to the number of containers passing through the boundary of the port via its waterway for loading or unloading within the reported period.

Container throughput data used in this report is container count. The computation unit is “10,000 TEU”.

Source of data: China Economic Information Service Database

B2 Dry bulk cargo throughput

This refers to the quantity of dry bulk cargo passing through

the boundary of the port via its waterway for loading or unloading within the reported period. The unit is “ton”.

Source of data:

China Economic Information Service Database

B3 Liquid bulk cargo throughput

This refers to the quantity of liquid bulk cargo passing through the boundary of the port via its waterway for loading or unloading within the reported period. The unit is “ton”.

Source of data: China Economic Information Service Database

B4 Number of cranes

Cranes are machinery for loading and unloading containers in the wharf area. Operating capacity of cranes can determine the cargo handling capacity of a wharf.

Source of data: Drewry

B5 Total length of container berths

Berths refer to locations within the port where ships can dock. A single location equipped with berthing facilities to accommodate a single ship is called a berth. The length of a berth is determined by the length of ships it plans to accommodate and the safety distance required for two adjacent ships. These include quayside berth, pontoon berth and anchorage berth.

Berthing facilities is an important indicator reflecting the ability of a port to accommodate berthing ships. It is one of the basis for measuring the size and capacity of the port.

Total length of container berth refers to the actual length of berth available – including various types of fixed or floating wharf – for berthing of ships for loading and unloading of containers within the reported period.

The unit of computation is in “metres”.

Source of data: Drewry

B6 Port draught

Draught of a ship refers to the maximum depth of the ship that is under the water line.

Different ships have different draught. Moreover, the draught of a ship may even differ depending on its load and the salinity of water in the region.

Port draught is an important indicator that reflects the deadweight of a ship that can be accommodated by the port.

Port draughts in this report refers to water depth statistics of the deepest container berth in the port.

Source of data: Drewry

B7 Shipping Brokerage Service

Characterised by its intermediary services, brokerage is the key services provided by shipping agencies.

An important component of shipping services, shipbrokers provide professional agency, brokerage and consultancy services on a gamut of industries including transportation, insurance, financial and commerce, which facilitate shipping development.

In this report, shipping brokerage services will be assessed based on the distribution of the Baltic Exchange – Global Shipping Brokers Membership together with other factors.

Main source of data: The Baltic Exchange

B8 Ship engineering service

Ship engineering service enterprises are companies with marine engineering professionals having the ability to provide ship engineering technology and related services. The sector also provides training on basic theory and technical skills in seamanship and transportation that comply with relevant occupational certification by the authorities;

as well as training of professional on advanced applied technologies to enable them to navigate vessels.

In this report, ship engineering service is assessed based on the number of shipping companies available in the port city together with other factors.

Professional fields of ship engineering company include ship engineering, repairs, quantity surveying and ship classification.

Main source of data: International Association of Classification Societies (IACS)

B9 Shipping Business service

A shipping company may manage its own vessels or vessels commissioned by other owners.

In this report, shipping business service consists mainly of the following three indicators:

the number of ship management companies operating in the port city as published by the website of Lloyd's List, the number of branches of top 100 container shipping companies and top 100 bulk carrier companies, and in conjunction with other factors.

Main source of data: Lloyd's List

B10 Maritime legal service

In this report, the overall service level of maritime legal service will be assessed from the two perspectives of maritime arbitration service and total number of partners practicing in legal offices.

Maritime arbitration refers to the agreed system whereby any dispute shall be arbitrated in an agreed arbitration institution in accordance with the arbitration agreement (terms) established before or after the dispute event.

In this report, maritime arbitration service is assessed based on the number of arbitrators located in international arbitration centres in London, Singapore and New York, and in conjunction with other factors.

The number of partners in law firms is assessed based on the Legal 500 Law Firm Index or enquiry on the number of partners using the Chamber or websites of respective law firms, and in conjunction with other factors.

Main source of data: London Maritime Arbitrators Association, Singapore Institute of Arbitrators, Society of Maritime Arbitrators, Legal 500, Chambers

B11 Shipping finance service

The scope of shipping finance service covers four areas:

namely ship financing, capital settlement, maritime insurance and maritime financial derivatives.

Wherein, ship financing includes syndicate loans, debt capital market and equity capital market.

Maritime insurance refers to a kind of insurance taken on cargo or ship against the potential risks of loss or unforeseen expenses during the sea journey.

The types of maritime insurance include cargo insurance, ship insurance, freight and P&I insurance.

Statistical collation by IUMI includes maritime insurance premiums for ship insurance, cargo insurance, maritime liability insurance and offshore energy insurance.

In this report, shipping insurance service is assessed based on maritime insurance expenses of the port city. To compute maritime insurance expenses of a city, first compute the sum



of ship and cargo insurance premiums of each country, then distribute the total premium to each port city based on the port's cargo throughput.

Source of data: Marine Money, Dealogic, International Union of Marine Insurance(IUMI)

B12 Ship repair service

Ship repair service refers to regular repair and maintenance to keep a ship in good technical condition during its life time.

Classified ships (see CCS, China Classification Society) must also be inspected regularly by the classification surveyor in order to maintain its classification.

Ship repairs are categorised into the following five types: annual maintenance, overhaul, voyage repair, accident repair and retrofitting repair.

In this report, ship repair service is assessed based on the number and types of repair services (including full overhaul, ordinary repairs and emergency repairs) that can be handled by the port city in conjunction with other factors.

Ship repair can be categorised as follows:

A – Overhaul: Complete retrofitting or reconstruction in a well-equipped dock

B – Moderate overhaul: Complete retrofitting or reconstruction without the need for docking system

C – Ordinary repair: Small repair jobs that can be carried out by independent machine shops or factory

D – Emergency repair

N – None of the above.

Main source of data: United Nations Conference on Trade and Development

B13 Government transparency

Government transparency is a concept about publicised rules, plans, processes and operations so that the general public understand the why, how, what and how much of policies.

Transparency can ensure that the conduct of public officials, civil servants, administrators, company board members and businessmen are open and understandable. Reports can also be made against them so that they would be held accountable for their conduct.

This is the most reliable way to prevent corruption and help increase our confidence towards this group of people who are closely linked to our future.

Source of data: Transparency International

B14 Extent of e-government and administration

e-Government and administration refers to the government's willingness and ability to implement information technology in the provision of public services.

Ability, as used here, refers to the extent of support provided

by the government towards national finance, infrastructure, human resources, management, administration and system function.

The willingness to provide information and knowledge to empower its citizens is a measure of the government's commitment.

Source of data: United Nations e-Government Development Database

B15 Economic freedom

Economic freedom means each individual has the fundamental right to control his/her own labour and property.

In a free economy and society, an individual is free to work to engage in production, consumption and investment in any way. The government will allow free movement of labour, capital and goods. The government will avoid applying excessive constraints on freedom while in the process of protecting and maintaining freedom itself.

Source of data:

"Wall Street Journal" and The Heritage Foundation, Index of Economic Freedom Report

B16 Custom tariff

Custom tariffs refer to the rate applicable to computation of tax on targeted taxable goods stipulated in custom regulations.

Source of data: "Wall Street Journal" and The Heritage Foundation, Index of Economic Freedom Report

B17 Ease of Doing Business Index

Economies are ranked on their ease of doing business, from 1 to 189; 1 being the best.

A higher rank means the regulatory environment is more conducive for doing business.

The index is derived from simple averages of national ranking by percentage scores on 10 themes under doing business ranking by the World Bank.

Source of data: World Bank Database

B18 Logistics performance index

Logistics performance index is a score that reflects the following logistics attributes of a country: The efficiency of customs clearance process; quality of trade and transport related infrastructures; the ease of arranging competitively priced shipments; quality of logistics services; ability to track and trace cargo; and the frequency with which shipment reaches the recipient within expected delivery schedule.

The index ranges from 1 to 5; a higher score means better logistics performance.

The data are derived from the Logistics Performance Index Survey, which is conducted by the World Bank in cooperation with academic institutions, international organisations, private enterprises and international logistic professionals.

Source of data: World Bank Database

Data Processing

Data for secondary indicators required for the Xinhua-Baltic International Shipping Centre Development Index are mainly sourced from authoritative organisations such as the Baltic Exchange, Drewry, World Bank and World Economic Forum.

Due to the differing nature of various indicators (size, ranking, ratio, etc.), if the raw values of these indicators are used directly in analysis, then indicators with large quantitative values may weaken the effects of indicators with smaller quantitative values; thus resulting in unequal contribution of each indicator to the computation.

To avoid such phenomenon, each indicator should be normalised – through relative processing to make its statistical variables dimensionless – before using it in index computation.

Divide the raw data into two categories:

The first comprises indicators with score values ranging from 1 to 100. This category of indicators can be used directly for computation. The second category comprises indicators with absolute score values. These indicators will be normalised by applying the standard deviation approach on data distribution.

Determining sample mean and standard deviation

Supposing that the data distributions of secondary indicators are all normal distributions, bootstrap resampling is applied to these samples. After 500 resampling, the mean value and standard deviation are computed from the normal distribution of each indicator.

$$mean_{l,m} = \frac{1}{a} \sum_{i=1}^a \bar{x}_{l,mi}, sd_{l,m} = \frac{1}{a-1} \sum_{i=1}^a (\bar{x}_{l,mi} - mean_{l,m})^2$$

Where, $l=1,2,3$, $m=1,2,\dots,6$, $\bar{x}_{l,mi}$ is sample mean of each sampling of the m-th indicator, $a=500$ indicates a total of 500 resampling, $mean_{l,m}$ is the mean value obtained after bootstrapping the m-th secondary indicator, and $sd_{l,m}$ is the standard deviation obtained after bootstrapping the m-th secondary indicator.

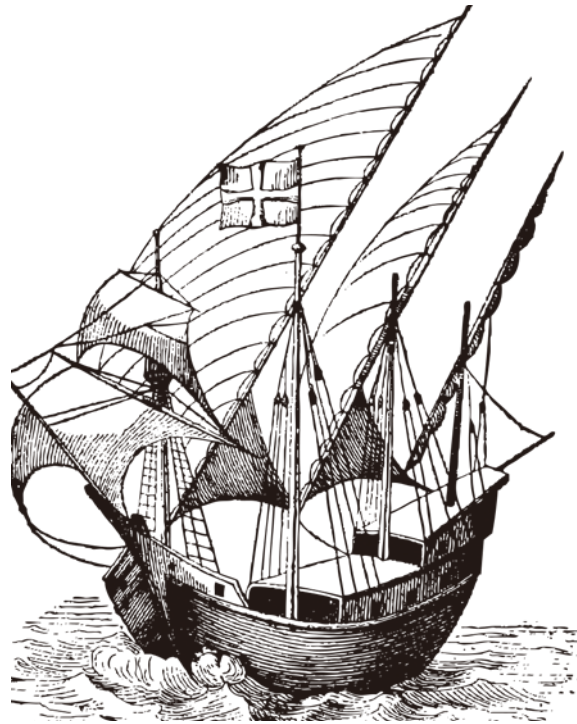
Computing the score for secondary indicators of sample cities

Based on the mean value and variance of each indicator, compute the indicator's quantile score for each city.

The quantile score of the m-th indicator for the p-th city is computed with the following formula:

$$y_{l,mp} = \phi\left(\frac{x_{l,mp} - mean_{l,m}}{sd_{l,m}}\right)$$

Where, $y_{l,mp}$ is the quantile score of the m-th secondary indicator for the p-th city, $x_{l,mp}$ is the indicator value of the m-th secondary indicator for the p-th city, and $\phi(\cdot)$ is the distribution function of standard normal distribution.





Model Computation

Design of weighting system

The design of the weighting system for the Xinhua-Baltic International Shipping Centre Development Index employs analytic hierarchy process (AHP algorithm).

The basic principle of AHP is to break down the problem into a hierarchical structure consisting of goals, sub-goals (guidelines), constraining criteria and departments to analyse the various factors. From the hierarchical structure, apply pairwise comparison to determine the judgement matrix. Derive the components of the eigenvector corresponding to the largest eigenvalue of the matrix. These components represent the corresponding coefficients that will be used to compute the weight of each factor (degree of priority).

AHP algorithm can be broken down into the following 6 basic steps:

(1) Defining the problem:

Clarify the problem in terms of scope, contributing factors and the relationship between different factors in order to have sufficient understanding of the problem.

(2) Construct a hierarchical structure:

In this step, the factors are assigned to different hierarchical levels. It comprises the goal at the top level (goal level), several intermediate levels (guidelines levels) and the bottom level (solutions level).

If an element is linked by all elements from the next level immediately below it, this element is said to have complete hierarchical relationship with the next level. If an element is linked by only some elements from the next level immediately below it, this element is said to have incomplete hierarchical relationship with the next level. A sub-level can be inserted between two hierarchical levels.

This sub-level is subordinate to one element on the main level. The elements of the sub-level may be linked with the next level but the sub-level may not constitute an independent level.

(3) Construct judgement matrix:

This is the critical step in AHP.

The judgement matrix defines the relative importance of relevant elements within a hierarchical level that is linked to an element in a higher level. For n indicators, $\{A_1, A_2, \dots, A_n\}$, a_{ij} is the judgement value that signifies the importance of A_i relative to A_j . a_{ij} is generally assigned a 5-grade rating scale of 1, 3, 5, 7, 9. A rating value of 1 means A_i and A_j are of equal importance; 3 means A_i is slightly more important than A_j , 5 means A_i is relatively more important than A_j , 7 means A_i is significantly more important than A_j , and 9 means A_i is extremely more important than A_j . The mid values of 2, 4, 6, 8 may also be used for intermediate judgement, especially when five grades become insufficient to represent the level of importance.

(4) Single-level order:

The purpose of single-level order is to sort elements in the current level in order of their importance with respect to a linked element in a higher level.

It is the basis for ordering all the elements in the current level in terms of importance with respect to an immediate higher level.

If we take the weight vector, $W = [w_1, w_2, \dots, w_n]^T$, then we have:

$$AW = \lambda W$$

If λ is the largest eigenvalue of A , then W is the eigenvector of A with respect to λ .

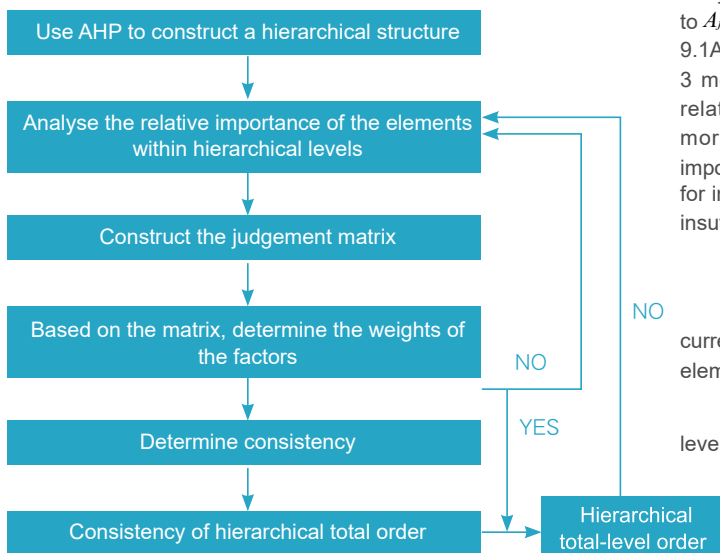


Figure 41 Basic processes of AHP algorithm

Hence, single-level order process can be achieved by solving the judgement matrix for the values of λ_{max} and its corresponding eigenvectors to obtain the relative weighting of this group of indicators.

In order to test the consistency of judgement matrix, we need to calculate its consistency index:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

When $CI = 0$, judgement matrix is complete consistency; conversely, a larger CI value indicates lesser consistency in judgement matrix.

(5) Total-level order:

Using the results of single-level order of all the levels with respect to the same level, we can compute the weight values representing the importance of all elements in this level with respect to the immediate higher level. This is known as total-level order.

Total-level order must be carried out layer by layer from top to bottom.

For the highest level, its single-level order is the same as total-level order.

If total-level order for all elements A_1, A_2, \dots, A_m of a higher level is completed, and the corresponding weight values $a_1, a_2, \dots, a_m, A_j$ are obtained, then the results of single-level order for B_1, B_2, \dots, B_n corresponding to elements in the current level are . Now, if $[b_1^j, b_2^j, \dots, b_n^j]^T$ is not linked to B_i , then $A_j, b_i^j = 0$, and total-level order is achieved.

(6) Analyse consistency:

Similar to single-level order, we need to assess the consistency of the results of total-level order. Therefore, we perform consistency check as follows:

$$CI = \sum_{j=1}^m a_j CI_j$$

$$RI = \sum_{j=1}^m a_j RI_j$$

$$CR = \frac{CI}{RI}$$

CI is the consistency index for total-level order; CI_j is the consistency index of judgement matrix a_j corresponding to level B; RI is the random consistency index of judgement matrix RI_j and a_j corresponding to level B; and CR is the ratio of total-level order consistency index to random consistency index.

Similarly, when $CR < 0.10$, the consistency of computation results of total-level order is deemed to be satisfactory; otherwise, the judgement matrices for the current level need to be adjusted until satisfactory consistency is obtained for total-level order.

Model for Index Computation

Specific computation formulae for the Xinhua-Baltic International Shipping Centre Development Index are as follows:

Use weighted sum method to compute the primary index:

$$y_{lp} = \sum_{m=1}^{l_m} y_{l,mp} * w_m = \sum_{m=1}^{l_m} \phi\left(\frac{x_{l,mp} - mean_{l,m}}{sd_{l,m}}\right) * w_m$$

Where, w_m are the weights of m secondary indicators; and y_p is the score of the l -th primary indicator of the P -th city.

The computation formula for comprehensive score of the sample cities is:

$$y_p = \sum_{l=1}^3 y_{lp} * w_l = \sum_{l=1}^3 \left(\sum_{m=1}^{l_m} y_{l,mp} * w_m \right) * w_l = \sum_{l=1}^3 \left(\sum_{m=1}^{l_m} \phi\left(\frac{x_{l,mp} - mean_{l,m}}{sd_{l,m}}\right) * w_m \right) * w_l$$

Where, w_l is the weight of l -th primary indicator; and y_p is the score of the P -th city.





Survey Questionnaire

Dear experts,

Greetings!

China Economic Information Service and the Baltic Exchange have embarked on a joint research to develop the Xinhua-Baltic International Shipping Centre Development Index.

The aim is to produce an objective, impartial and scientific review and assessment of the competitiveness of cities with international shipping centres. The main purpose of this questionnaire is to obtain some fundamental information regarding weight assessment for analytic hierarchy process (AHP). Your response is of utmost importance to this research. Therefore, we sincerely seek your support to fill out the questionnaire carefully. Thank you for your support!

Explanation for scoring

This questionnaire uses scoring rules based on the 1-9 scoring scale method of AHP:

1 means elements i, j are equally important;

3 means element i is slightly more important than element j ;

5 means element i is relatively more important than element j ;

7 means element i is significantly more important than element j ;

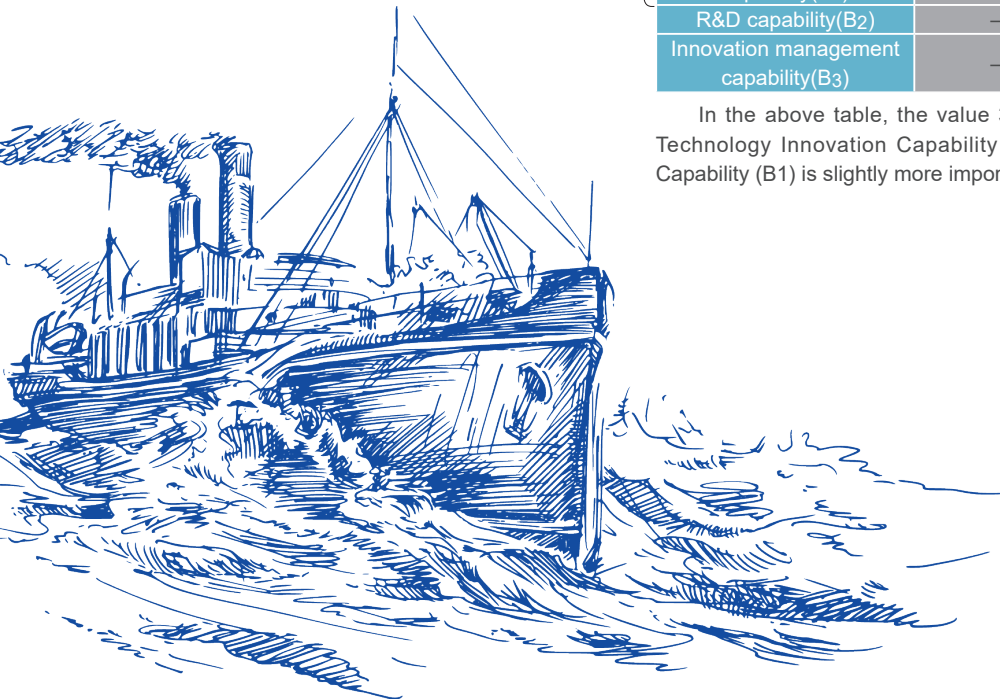
9 means element i is extremely more important than element j ;

The values 2,4,6,8 may also be used as mid value judgement for 1-3,3-5,5-7,7-9 respectively.

An example is shown below (vertical column represents element i , while horizontal row represents element j):

		Element j		
		B1	B2	B3
Element i	Technological innovation capability(A)	B1	B2	B3
	Innovative output capability(B1)	—	3	5
	R&D capability(B2)	—	—	2
	Innovation management capability(B3)	—	—	—

In the above table, the value 3 (2nd row and 3rd column) means that for Technology Innovation Capability (A) on the target level, Innovative Output Capability (B1) is slightly more important than R&D Capability B2).



Scoring by experts

Scoring for primary indicators

(a) Please fill in the value of importance between the primary indicators(A₁-A₃)with respect to the ultimate indicator (D). The shaded areas need not be filled (same for all tables below).

Xinhua-Baltic International Shipping Centre Development Index(D)	A1	A2	A3
Port Factors(A1)	—		
Shipping Services(A2)	—	—	
General Environment(A3)	—	—	—

Scoring for secondary indicators

(a) Please fill in the value of importance between the secondary indicators□B₁-B₆□with respect to the primary indicator (A₁).

Port Factors(A1)	B1	B2	B3	B4	B5	B6
Container throughput(B1)	—					
Dry bulk cargo throughput(B2)	—	—				
Liquid bulk cargo throughput(B3)	—	—	—			
Number of cranes(B4)	—	—	—	—		
Total length of container berths(B5)	—	—	—	—	—	
Port draught(B6)	—	—	—	—	—	□—

(b) Please fill in the value of importance between the secondary indicators(B7-B12)with respect to the primary indicator(A2). Shaded areas need not be filled.

Shipping Services(A2)	B7	B8	B9	B10	B11	B12
Shipping brokerage service(B7)	—					
Ship engineering service(B8)	—	—				
Shipping business service(B9)	—	—	—			
Maritime legal service(B10)	—	—	—	—		
Shipping finance service □B11□	—	—	—	—	—	
Ship repair service□B12□	—	—	—	—	—	—

(c) Please fill in the value of importance between the secondary indicators(B13-B18) with respect to the primary indicator (A3). Shaded areas need not be filled.

General Environment(A3)	B13	B14	B15	B16	B17	B18
Government transparency(B13)	—					
Extent of e-government and administration(B14)	—	—				
Economic freedom(B15)	—	—	—			
Customs tariff(B16)	—	—	—	—		
Ease of doing business index(B17)	—	—	—	—	—	
Logistics Performance Index □B18□	—	—	—	—	—	—





Appendix II: Message from the CEO of the Baltic Exchange

Now in its fifth year of publication, the Xinhua-Baltic International Shipping Centre Development Index once again makes interesting reading as global cities react to the challenges of a fast-changing global shipping industry. Responding to a wave of environmental regulations and financial pressures, as well as recognising the huge opportunities offered by the big data revolution, the shipping industry is changing fast. New technologies are transforming the ways shipping companies do business. New regulations mean that a ship's environmental footprint needs to be smaller than ever before. To achieve this, companies are looking hard at both the structure and processes of their businesses. Location is an important ingredient for success and plays an important part in meeting the latest challenges. The right location gives companies access to clients and the best employees. The right location should be a platform for long-term business success.

A successful shipping centre provides everything that the international shipowner needs. It needs to be an efficient port with good onward connections and offer a competitive port services environment. It needs to be a one-stop shop for the shipowning and chartering community providing access to world-class finance, legal advice, shipbroking, IT and classification services. It should be a place which is able to attract the best international talent. It should have a robust and transparent legal system, backed up by efficient courts and arbitration services. A successful shipping centre has good quality office space and should offer a good quality of life. It should offer an attractive fiscal regime for international owners who, in theory, can base their operations anywhere.

All of the cities featured in the International Shipping Centre Development Index have their areas of excellence. Some are great port cities whose constant innovations mean that they are able to facilitate and open up trade to the wider region. Others' excellence lies in their provision of business services. Here experience counts for much. A city which can offer a choice of the best lawyers, brokers, bankers and underwriters is always

going to be a crucial part of the global trading system.

The report is based on numerous datasets and offers an impartial, independent view of the merits of the world's leading maritime cities.

We hope that this report helps shape shipping company executives' thinking and spurs cities and their governments to provide the best support possible. A successful shipping centre is after all a successful global city.

Mark Jackson
Chief Executive, the Baltic Exchange



Mark Jackson,

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China Economic Information Service
The Baltic Exchange

Xinhua-Baltic International Shipping Centre Development Index Report – Request for Comments

Description:

In order to continuously improve on the quality of this report and provide even more objective evaluation, we sincerely wish to have your opinions and ideas. Please make your request and offer your invaluable suggestions. Thank you.

Name of Company: _____ Address: _____

Designation: _____ City: _____

Contact Tel No.: _____ Email: _____

Feedback: _____

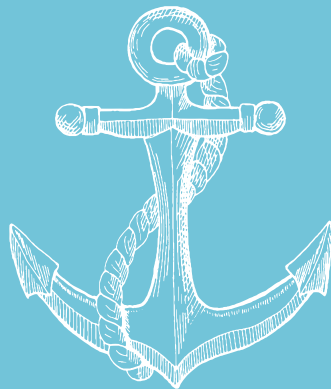
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