



BRS Shipbrokers Project & Corporate Finance Advisory

Shipping finance market update



Project & Corporate Finance Advisory
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Confidential



CORPORATE PRESENTATION – THE OFFICES



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CEO : François CADIOU

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A few BRS figures:

- 225 shipbrokers, all multilingual and educated to a high level
- 1,000 newbuilding transactions in 20 years including 450 in China

BRS, each year, this is:

- 100 assets transactions
- 3,500 bulk chartering transactions
- 2,000 tanker chartering transactions
- Dry bulk CoAs of 220 million tons
- Dry bulk CoA Period business equal to 410 years



530
Employees

225
Shipbrokers

20
Locations



Regular recognition from the industry's leading news outlets and specialized publications as a growing and innovative shipping player

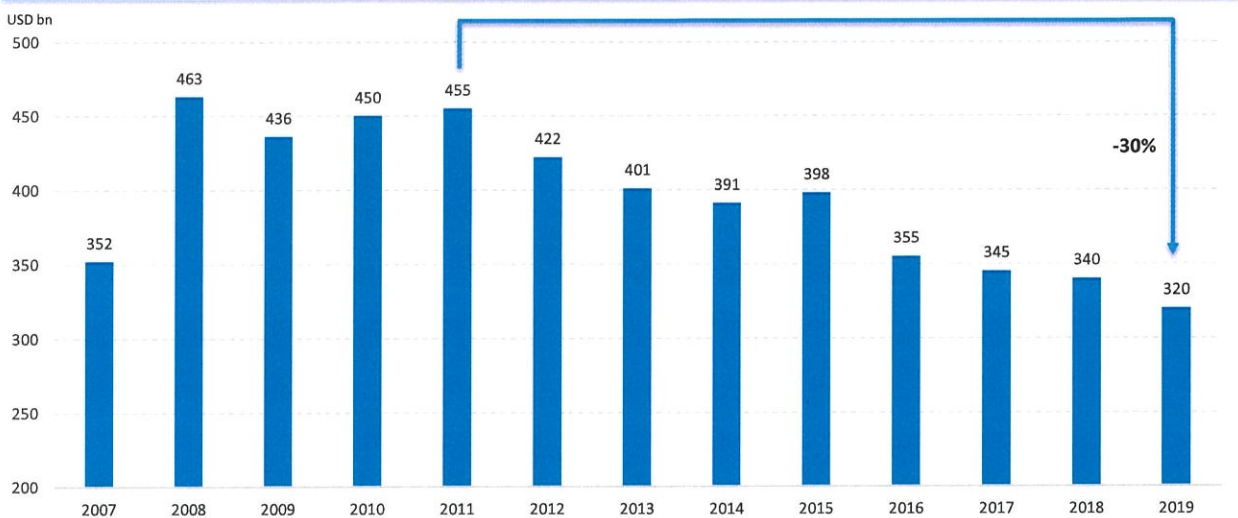
FACT 1

« Many shipping banks left the market, the ones remaining are lending less »

Commercial lenders

Evolution of total Ship Finance debt outstanding

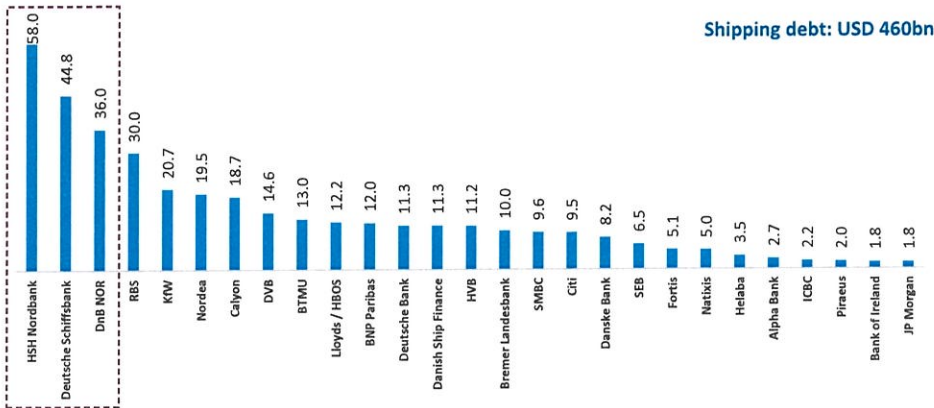
Total shipping bank debt (excluding lessors)



Source: BRS brokers, Marine Money

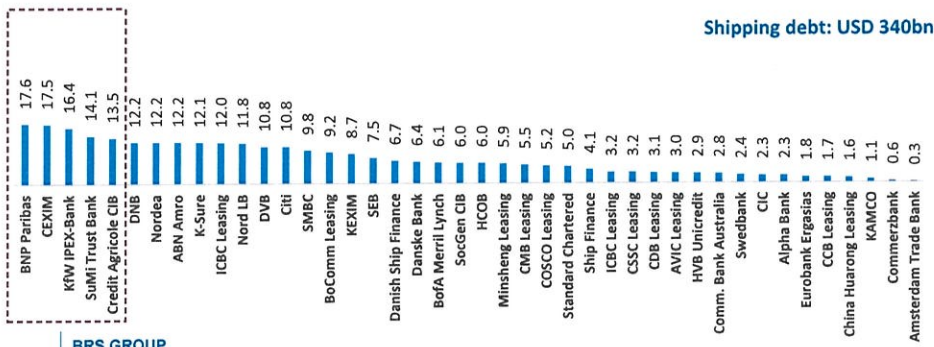
- 30% decrease in shipping loans, on same period: bulk carriers fleet capacity increased +100%, containers +60% and tankers +30%
- This compares to a world fleet valued in the range of USD 1000bn

Shipping banks in 12/2008



Top 5 in 2008	Exposure in 2008	Exposure in 2018
HSH Nordbank	58.0	6.0
DSB / Commerz	44.8	0.6
DnB NOR	36.0	12.2
RBS	30.0	-
KfW	20.7	16.4

Shipping banks in 12/2018



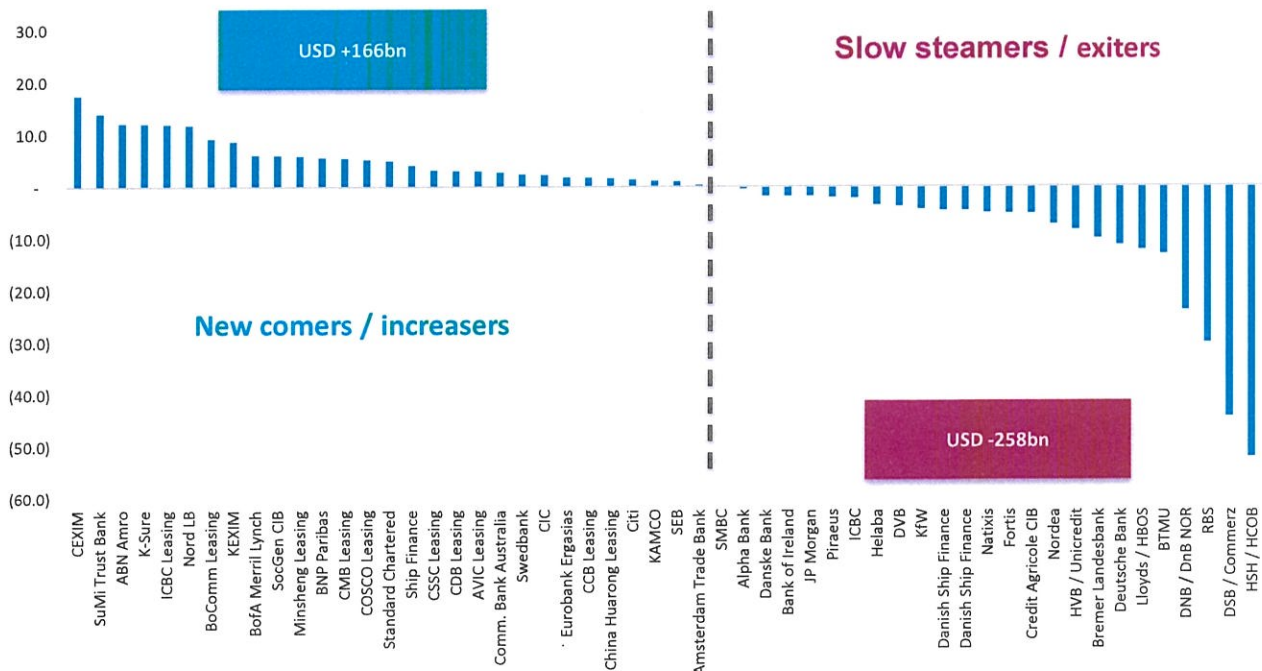
Top 5 in 2018	Exposure in 2008	Exposure in 2018
BNP Paribas	12.0	17.6
CEXIM	-	17.5
KfW IPEX-Bank	20.7	16.4
SuMi Trust Bank	-	14.1
Credit Agricole	18.7	13.5

BRS GROUP

Source: BRS brokers, Marine Money 5

Commercial lenders

Change in landscape: 10 years – movers in and movers out



BRS GROUP

Source: BRS brokers, Marine Money 6

Commercial lenders

Key drivers behind this shake up: what happened ?

What happened ?

- **2008/2010 crisis** killed shipping business for the leading banks (USD crisis, shipping crisis, offshore crisis)
- New regulations have made shipping less attractive to banks
- Banks that remained in the market now have to deal with:
 - More stringent regulations (Basel 3) affecting :
 - The cost of capital and therefore the need for **side business** and
 - The **proposed structures** : leverage, profile, duration
 - Compliance, environmental considerations
- Market has developed by itself alternative ways of getting finance

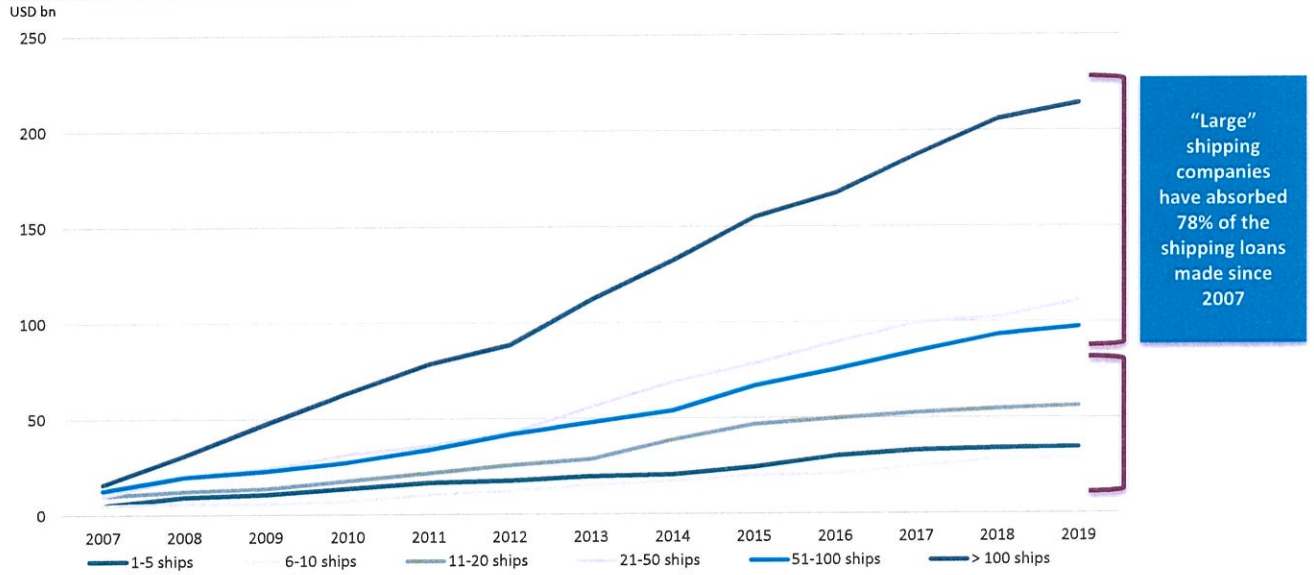
FACT 2

« Lenders are focusing on large companies »

Commercial lenders

Impacts of the change in financing landscape

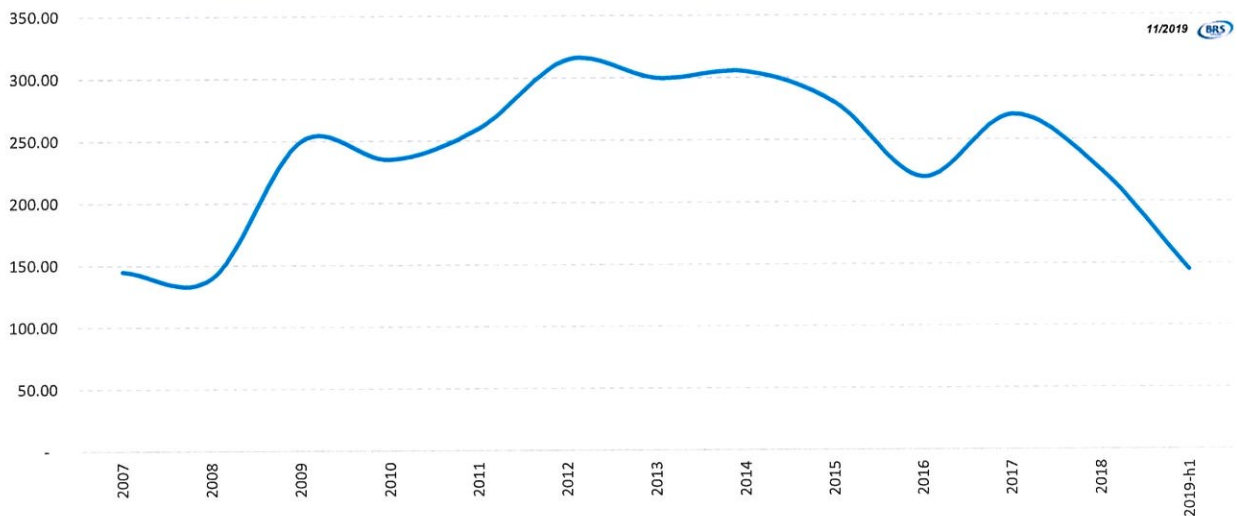
Allocation of NEW shipping loans by company size



Shipping Finance market update

Evolution of debt average margin

LENDING – Margin evolution (bps pa)



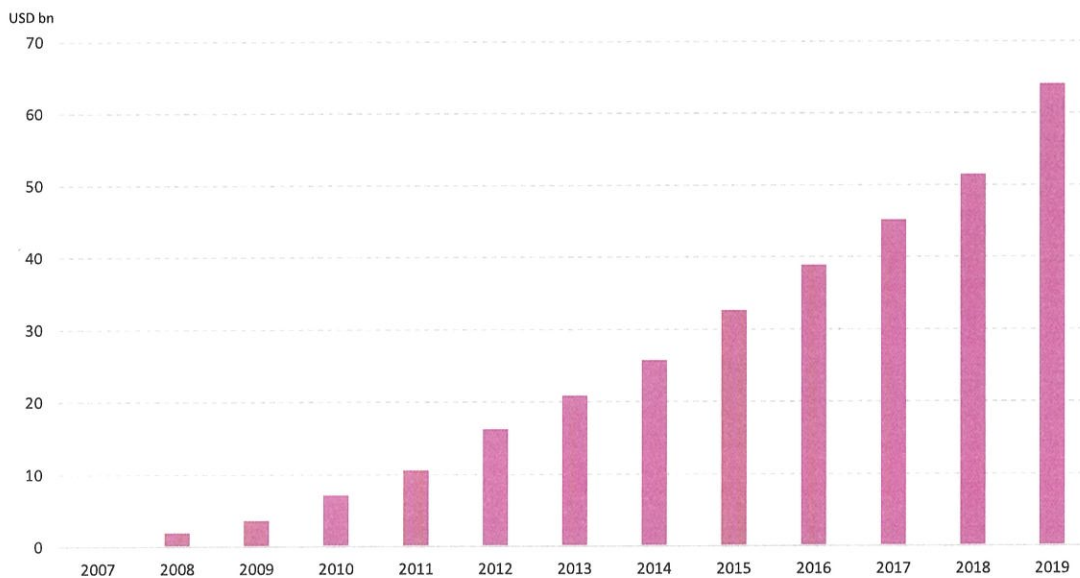
Sharp decrease in margins, reaching the historical low point of 2007 pre-crisis.

FACT 3

« Chinese Leasing has been a massive source of capital into shipping finance »

Shipping Finance market update

Chinese Leasing



Chinese Leasing developed very quickly into shipping

Shipping Finance market update

Chinese Leasing



But Chinese Leasing does not completely offset the lenders pulling out of shipping (and, most of the time, lenders and lessors serve the same high profile companies)

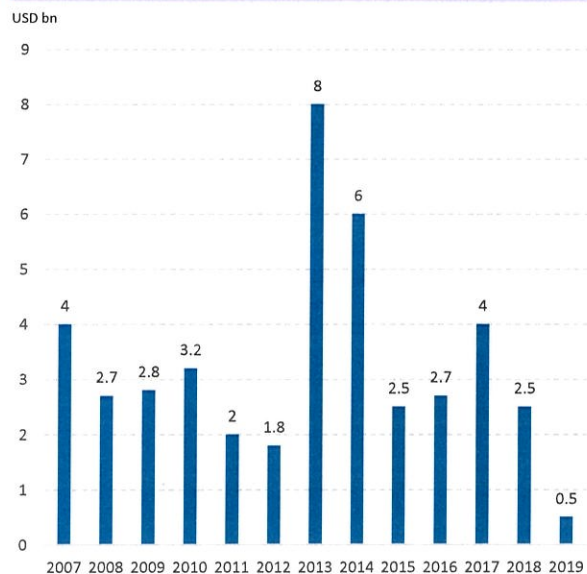
FACT 4

« Access to Capital Markets are narrowed a lot for shipping companies»

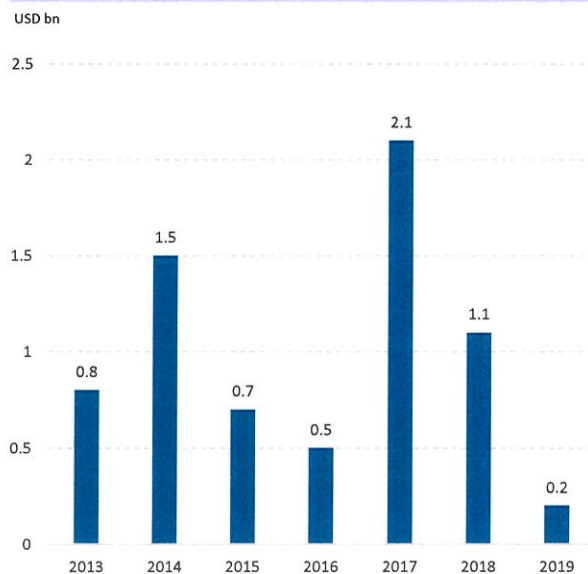
Shipping Finance market update

Capital Markets

Equity Capital Market



Oslo bonds



FACT 5

« Alternative lenders are opportunistically entering the market to fill the gap»

Shipping Finance market update

Alternative lending

Alternative lenders entering the market

Meerbaum finance vehicle spells cash for small owners
Maritime & Merchant Bank off and running
 Over 100 vessels after it was first tested, prospective investors have reported that Northern launches \$500m maritime fund
 Venture comes in partnership with private equity player Eikon Partners

Oaktree and Pappas in new shipping play: alternative lending
 If the deal is right, then the cash is still there
 Borealis links with KKR and Oak Hill to help fill bank funding gap
 New shipping fund has already reached up to \$100m in assets with a target of \$500m

Blue Ocean Maritime refinances Pyxis products tanker
 Hedge Fund Backed Finance Trustor completes maiden deal with Valerian Valerian MR1 tanker
 Financing a vessel

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Blue Ocean Maritime refinances Pyxis products tanker
 Hedge Fund Backed Finance Trustor completes maiden deal with Valerian Valerian MR1 tanker
 Financing a vessel

BUT

- Limited amount of liquidity available.
- Cost of finance is expensive, some claim that debt is more expensive than what can be expected on equity in an industry that tends to deliver 6-9% return in average.
- Some of those banks are involving shipowners as “advisors” or “shareholders”. This could bring some resistance to (i) share information with a competitor and (ii) get financed by an institution that is geared to repossess to operate.
- Very asset driven, does not give a lot of credit to the corporate set-up.

Many announcements

FACT 6

« Shipping finance for tomorrow is a question mark »

Shipping Finance: projected needs

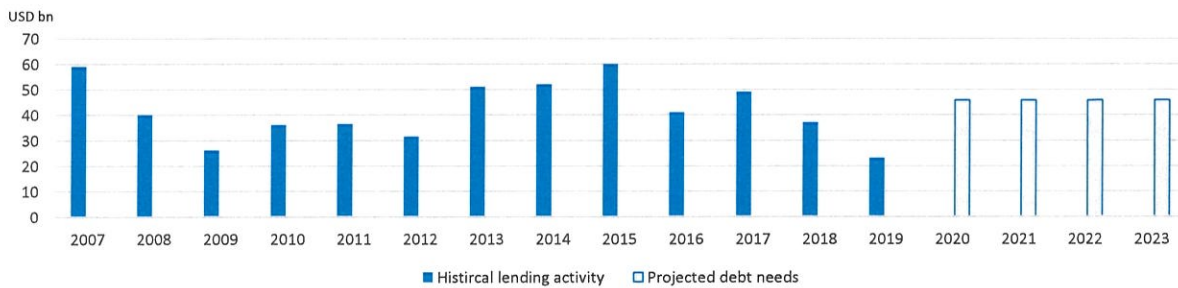
USD 45bn average yearly financing requirement over the next 4 years

Run off of portfolio : refinancing needs

- Total shipping debt in place is USD 320bn, we could assume a natural amortization of this portfolio of 15% per year.
- Giving effect of the ship ageing / depreciation we could infer a 5% refinancing requirement to maintain same leverage over portfolio

Orderbook

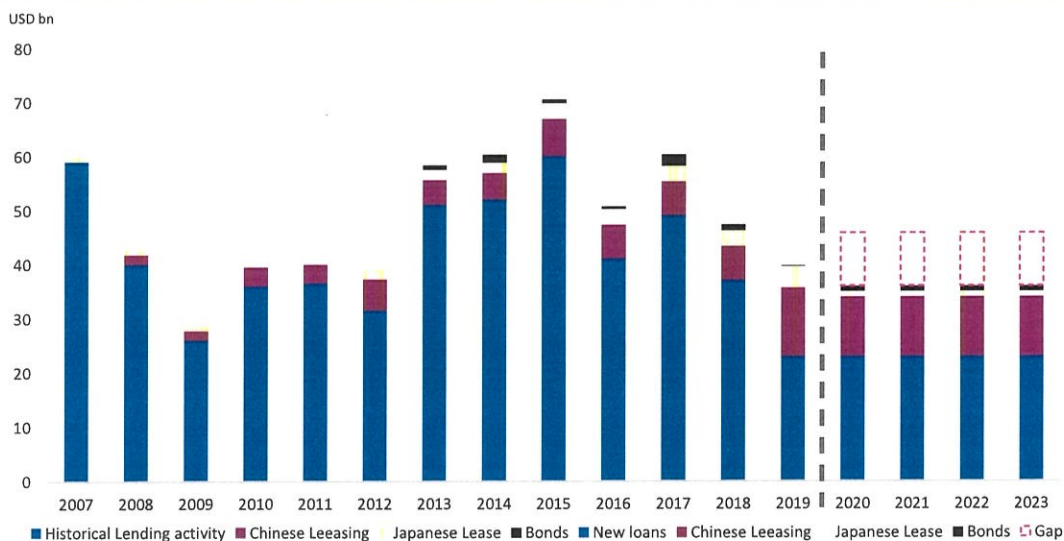
- Total orderbook for pure shipping is USD 183bn
- Assuming a 60% average leverage and a equal ship deliveries distribution over 4 years this would require c. USD 30bn new debt per year into shipping.



Shipping Finance: projected funding gap

USD 10bn average yearly funding gap over the next 4 years

USD 10bn funding gap per year on the debt side for the next 4 years



- Highly dependent upon Chinese Leasing for orderbook financing
- Export finance is a strong sponsor to finance newbuildings

FACT 7

«Access / Scarcity of Shipping finance is reshaping the industry on owners' side»

Shipping Finance: looking ahead

What's next

Shipping finance is driving the change over the industry

- Consolidation on the owners' side in order to grow in size and access to liquidity
- Increasing role of listed intermediate owners / financial owners that provide bareboat to the ship owners and receive loan from banks
- Chinese Lessors tend to adopt strategy of acting as ship owners with first class charterers
- The above pushes some owners to have less exposure to the asset play and act as service providers
- Newbuilding activity has been (and will have to remain) supported by innovative solutions from "in-house leasing platforms" and ECAs

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WP 6 – Session 2 Ship finance

Trends and challenges for the shipbuilding industry and the maritime equipment industry

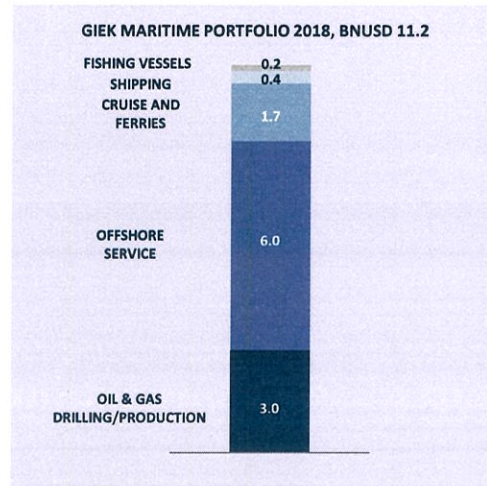
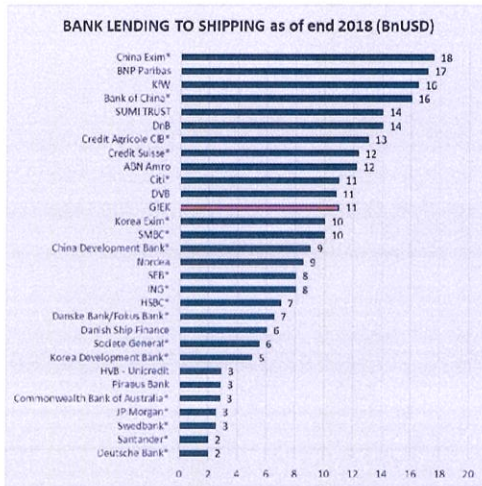
By Solveig Frøland, Director

Export credit agencies in Norway

GIEK



GIEK maritime finance directed to high value segments



Source: Marine Money 2019 - GIEK own

23

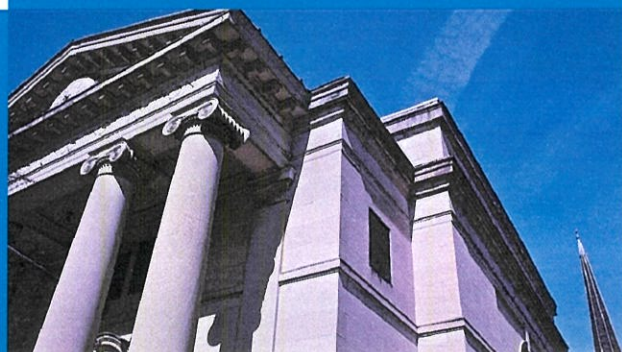


Benefits for the customer

- Overall satisfactory pricing
- Significant capacity
 - ↳ Diversification of capital sources
 - ↳ Considerable risk capacity
- Tailor-made and creative solutions
- Less volatile than commercial banks

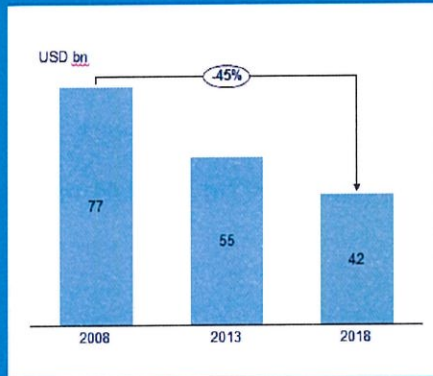
Benefits for banks

- Capital light product
- Improved return on equity
- ECAs are supplementary, not competitors



New traditional bank debt to shipping is declining

New facilities to shipping/offshore



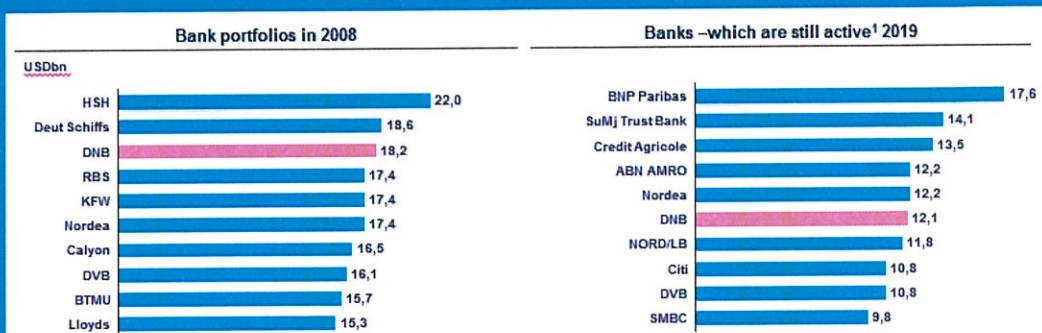
Banks are exiting the space



Source: DNB November 2019

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Mix of arranging banks is changed and exposures have reduced....

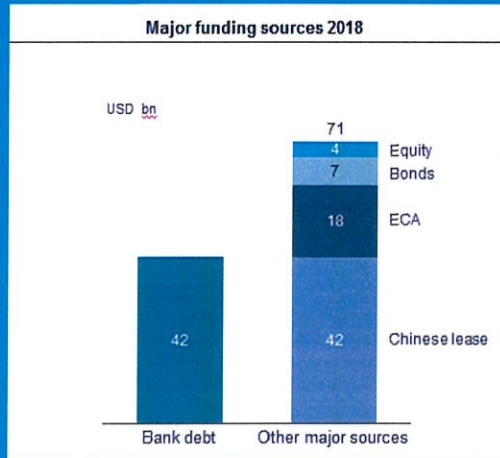


- Total portfolio of Top 10 Banks declined 30% from USD 175bn to USD 125bn
- Average portfolio size of top 10 lenders declined 30% from USD 17.5bn to USD 12.5bn
- Only two banks left in top 10 compared to 10 years ago

Source: DNB, Marine Money (excluding leasing and ECA)

6

BUT new capital flow to shipping is changing

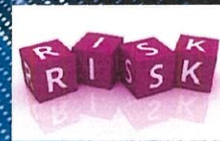


- Funding sources are more diverse and sophisticated. High level of competence is required. Banks remain natural partners to ECA's.
- Chinese leasing represent significant volumes. Facilitated by regulatory changes from 2013-2014 but also increased demand for alternative sources.
- Cruise finance is exceptional, still high degree of ECA finance (not included here).




Source: Dealogic, Marine Money, DNB. Syndicated loans, club deals, excluding ECA structures.

GIEK's credit assessment

- Very much like a bank's underwriting
- Credit quality of the borrower/debtor and guarantors
- Financial robustness of the project
- Collaterals
- Financial covenants and reporting schedules
- Risk sharing with commercial banks or other risk takers, co-ordination agreement with other lenders.
- Other mitigating factors, parent guarantees, subordination of other claims



Three types of ship financing available from Export Credit Norway and GIEK.

 NEW VESSELS	 PARTS OF SHIP	 RETROFIT & CONVERSION
<p>Ships built <u>in</u> Norway for:</p> <ul style="list-style-type: none"> • Foreign owner • Norwegian owner within the offshore sector <p>Ships built at Norwegian owned yard <u>outside</u> Norway</p> <ul style="list-style-type: none"> • Shipyard in Country A =>owner/buyer in Country #A. 	<p>For Norwegian content in ships built by yards outside Norway</p> <ul style="list-style-type: none"> • Repayment period – up to 12 years • Arranged as ECA tranche under secured vessel financing, pari passu with banks 	<p>Retrofit equipment to existing vessels is defined as capital goods</p> <ul style="list-style-type: none"> • Repayment up to 8½ years • Minimum 30% Norwegian content • Risk sharing with commercial banks
<p>Maximum 80% loan and 90% cover rate. Credit risk sharing with commercial banks (usually 70% GIEK cover).</p>	<p>Maximum loan is 80% of the Norwegian ship equipment value incl. services. GIEK cover rate of total financing depends on eligible export value.</p>	<p>Export Credit Norway can finance up to 85% of the retrofit contract. Maximum 90% cover. TCMB-BAP pricing</p>

Source: Export Credit Norway

Example of ECA finance. Modern and technologically advanced FSRU – “Høegh Esperanza”



Exporters

- **Company:** A number of Norwegian maritime exporters, such as Wärtsilä Norway, ABB Norway, Framo (Alfa Laval), Jotun, Kongsberg Maritime, MacGregor, DNV GL, FMC, Glamox, Scana, Norsafe.

Buyer

- **Company:** Høegh LNG Holdings Ltd
- **Location:** Bermuda
- **Industry:** Shipping
- **Operating income:** USD 353 million*

Product

- **Type:** Floating Storage and Regasification Unit (FSRU)
 - The FSRU receive liquid natural gas from a LNG carrier, store the gas and has a regasification process before the gas is fed into a country's gas network.
- **Location:** Tianjin LNG terminal and on 3+1 year time charter with CNOOC Gas & Power TM Ltd.
- **Built:** 2018 / Hyundai Heavy Industries, South-Korea
- **Flag:** Norway

Financing

- **Solution:** Ship equipment financing SSU terms
- **ECA Loan amount:** USD 150 million
- **Repayment period:** 12 years
- **Commercial loan amount** USD 80 million
- **Guarantor:** GIEK (100% of ECA), 65% of total
- **Arranger:** ABN Amro Bank NV (Amsterdam)
- **Loan structure:** Term loan facility, two tranches sharing collateral, pricing and documentation

* Høegh LNG 2018


Garantistuttet for
eksportkredit

Les mer på www.giek.no

Workshop on Trends and Challenges in Shipbuilding

Challenges for 'Green Financing' of Maritime Equipment

Jaesang LEW

Head of Container Team, K-SURE



ksure
KOREA TRADE INSURANCE CORPORATION

OECD WP6 Workshop, 12th December 2019

KOREA TRADE
INSURANCE CORPORATION

Table of Contents

- | **Green Policy Initiatives (1)**
- | **Choices of Market for Compliance (2 ~ 3)**
- | **Challenges and Issues (4 ~ 8)**
- | **Policy Suggestion (9)**

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1 Green Policy Initiatives

International Maritime Organisation (IMO)

- **2020 Sulphur cap** in fuel : < 3.5% → < 0.5% (ECA incl. CHN : 0.1%)
- **Ballast Water Treatment Convention** : until Sep. 2024
- **Green House Gas emissions** : at least 50% ↓ by 2050 compared to 2008
 - Average Carbon Intensity : at least 40% ↓ by 2030, and 70% ↓ by 2050

Poseidon Principles

- Framework for responsible and sustainable ship finance (18.June.2019)
 - Founding 11 banks include ABN Amro, Citi, Credit Agricole CIB, DNB, DVB, ING..
 - For Target of 'IMO GHG ' and 'Paris Agreement' (Increase limit 2°C of pre-industrial level)
 - Assess Climate Alignment Ship Finance Portfolios, Publish the results

2 Current Choices of Market for Compliance

Current Common Cases

- Compliant Fuels

- Minor Capital Expenditure
- Immediate Solution

- Ballast Water Treatment Systems

- > 28,000 ships to be equipped within 5 year time (Sep. 2024)

- Exhaust Gas Cleaning Systems (Scrubber Retrofit)

- No Change in Fuel (HSFO 3.5%)
- Lower Capital Investment than LNG

- Liquefied Natural Gas (LNG Powered Conversion)

- Regulatory Certainty³
SOx 90%↓, Nox 80%↓, CO2 20% ↓

3 Further Choices of Market for Compliance

Alternative Energy

- Biofuel

- Replaceable & Mixable with existing fossil fuels
- No major technical changes to the existing engine

- Ammonia

- Safer than gasoline
- Easy to liquefy, store and transport

- Methanol

- Minor Modifications to the existing equipment
- Refueling infrastructure cost lower than LNG

- Hydrogen

- Core eco-friendly technology in the future
- Requires further R&D investment

4 General Challenges for Green Financing

Structural & Economical Uncertainty

Q Lack of technological & commercial experience in the industry

e.g.) Scrubber: not yet fully operated through dry-dock intervals → repair & replacing cost?

LNG: Significant loss of cargo-space, Large difference of regional price → unstable profitability?

Q Insufficient infrastructure

e.g.) Scrubber: Limitation of production capacity, lack of shipyard slot for installation

LNG: Lack of bunkering infrastructure

Q Additional investments during cyclical downturn and under overcapacity

e.g.) Scrubber: U\$7~10mil per ship / LNG U\$25~30mil per ship

Spread between HSFO~LSFO : additional U\$200~250 per ton

5 Specific Issues of Uncertainty

How to Structure Financial Terms and Conditions

Tenor

Q) Shorter than useful life; but useful life of equipment ?

- ▶ Scrubber : **No hands-on data** collected yet reflecting harsh environment of ocean

Q) Longer than payback period; but payback of equipment?

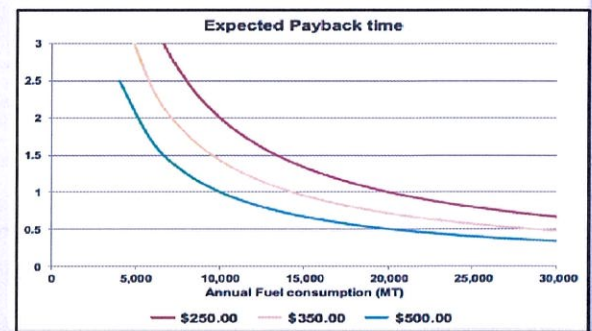
- ▶ Depending on **unknown price differential** in future

14K TEU with cargo loss

Case Div. (Base: Full MGO Operation)	Months			
	\$150	\$200	\$250	\$300
MGO-HFO Spread	\$150	\$200	\$250	\$300
Open Type	24.7	17.0	12.9	10.4
Hybrid Type	26.9	18.4	14.0	11.3

VLCC

Case Div. (Base: Full MGO Operation)	Months			
	\$150	\$200	\$250	\$300
MGO-HFO Spread	\$150	\$200	\$250	\$300
Open Type	27	19	15	13
Hybrid Type	35	24	19	15



Source: 2018 Marine Money Busan, by HGS

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5

6 Specific Issues of Uncertainty

Security

Q) 'Non Asset Backed Finance' unlike normal ship finance

- ▶ Equipment : Not detachable from vessel → very difficult for setting up a separate 'equipment-mortgage'
- ▶ New 'vessel-mortgage' would be also very difficult because 1st priority vessel-mortgage would have been already there

Q) Clash between new mortgage and existing 1st mortgage?

- ▶ Eligible 'vessel life' for retrofit : As remaining economic life of vessel should be longer than useful life of equipment, the vessels which are eligible for retrofit would be **up to around 10 years old**
e.g.) Economic life of Vessel : 15 yrs / Scrubber: 5 yrs
Oldest vessel for retrofit : 10 yrs old (+ 5 yrs of scrubber = 15 yrs)

▶ Those vessels (0~10 yrs) are likely to be **still under 'new ship building loan'** (Max repayment period in SSU of OECD : 12yrs)



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7 Specific Issues of Uncertainty

Lenders



Q) With existing banks?

- ▶ Increase existing loan : if all syndicated loan banks agree with the increase ✦ 1st priority mortgage possible
- ▶ Add separate additional loan-tranche : if only some of existing banks participate ✦ 2nd ranking mortgage under approval by all existing banks?

Q) With new banks?

- ▶ Separate unsecured Facility ✦ No mortgage, Corporate – Credit Based Financing
- ▶ All New Facility : Refinancing of existing vessel loan + financing of retrofit (conversion) ✦ 1st priority mortgage possible
- ✦ But, time consuming, complex discussion with multiple parties

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7

8 Specific Issues of Uncertainty

Limited number of yard slots available before Policy Deadline

Yards

1) Normally, new building projects preferred by yards

- ▶ Size of project, Profitability, Operating Period... matter

2) Original builder preferred by ship owners

- ▶ Original builders are more likely chosen to avoid incompleteness risk, and sudden procedural & technological delay in field

Summary

Challenges



Risk ↑



Cost ↑
(Interest Rate)

👉 Greener Industry, but Green Financing will come with a PRICE

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9

Policy Suggestion

(For 'export credits' to overcome challenges)

Introduction of reasonable market measures as 'common-approach' on a policy level in OECD (*i.e.* through SSU)

1) 'Green' Premium Benchmark

- ▶ Considering favourable environment attributes (not only by credit rating)

2) Flexible profile for repayment of principal and payment of interest

- ▶ Equal instalments of repayment of principal and payment of interest combined
- ▶ Transparent Irregular instalments ▶ Fixed Interest scheme (e.g. CIRR)

3) Tailor made further new rules based on also 'level-playing-field'

- ▶ New maximum support rules for 'tenor', 'percentage of cover (LTV)'...

Thank you



Future Tendencies in the Global Shipbuilding Market

Workshop on Trends and Challenges in Shipbuilding
OECD Council Working Party on Shipbuilding (WP6)

Dr Adam Kent - Maritime Strategies International (MSI)



Agenda

Future tendencies in the global shipbuilding market

Vessel Demand – Structural Changes

Supply Side Changes

Emissions – The New Challenge

Shipbuilding Evolution

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A globally renowned, independent maritime consultancy firm specialising in model-based forecasting and structured quantitative analysis, supporting business decisions to shipping, offshore and allied industries



1986

MSI founded from the spin-off of shipping analysis from Chase Econometrics.



1999

MSI launches container report and model service.



2004

MSI launches chemical tanker market service



2005

MSI coverage extended to include additional sectors.



2015

MSI launches credit risk modelling (CRM) service



2019

All MSI sector models moved to online platform



1996

First multi-year consultancy contract signed with a government agency



1999

MSI launches its shipbuilding industry report and model service



2002-03

MSI sector coverage extended to LNG and LPG



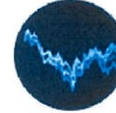
2004

MSI begins issuing certificated valuations to banks.



2009

Sector coverage extended to include offshore market



2016

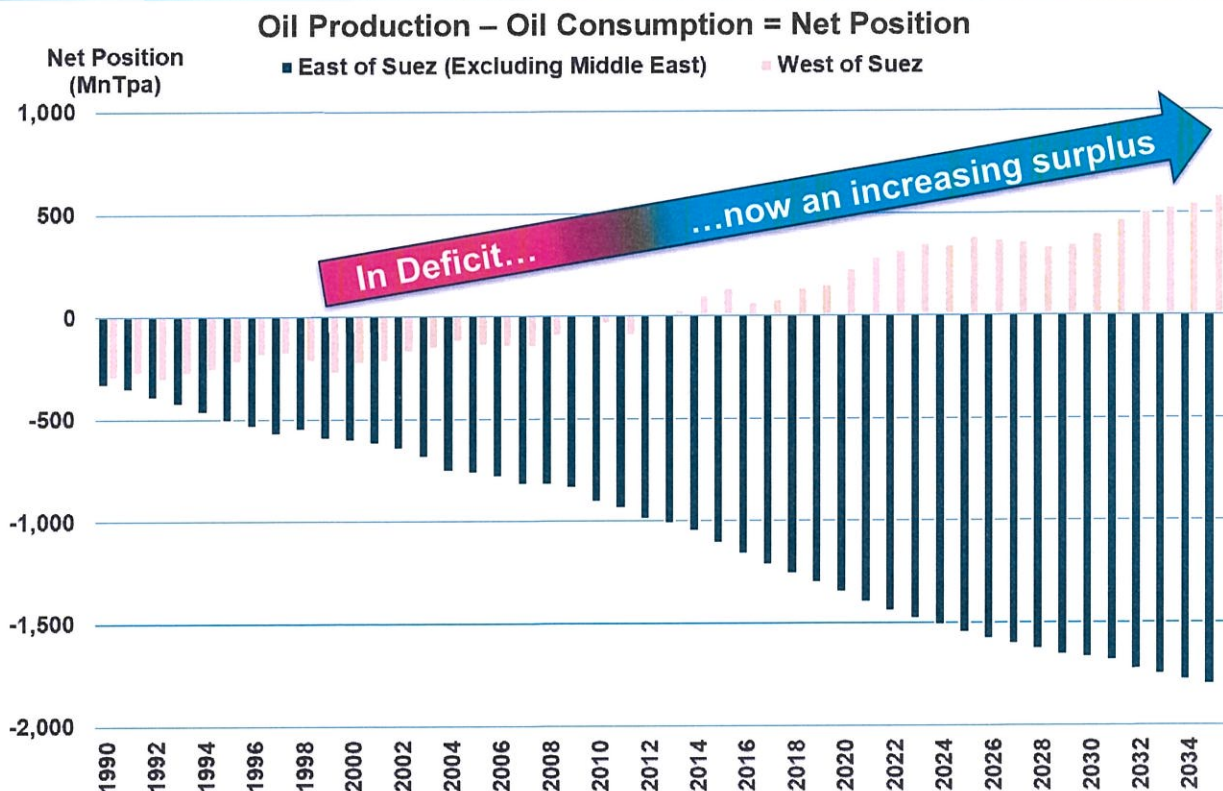
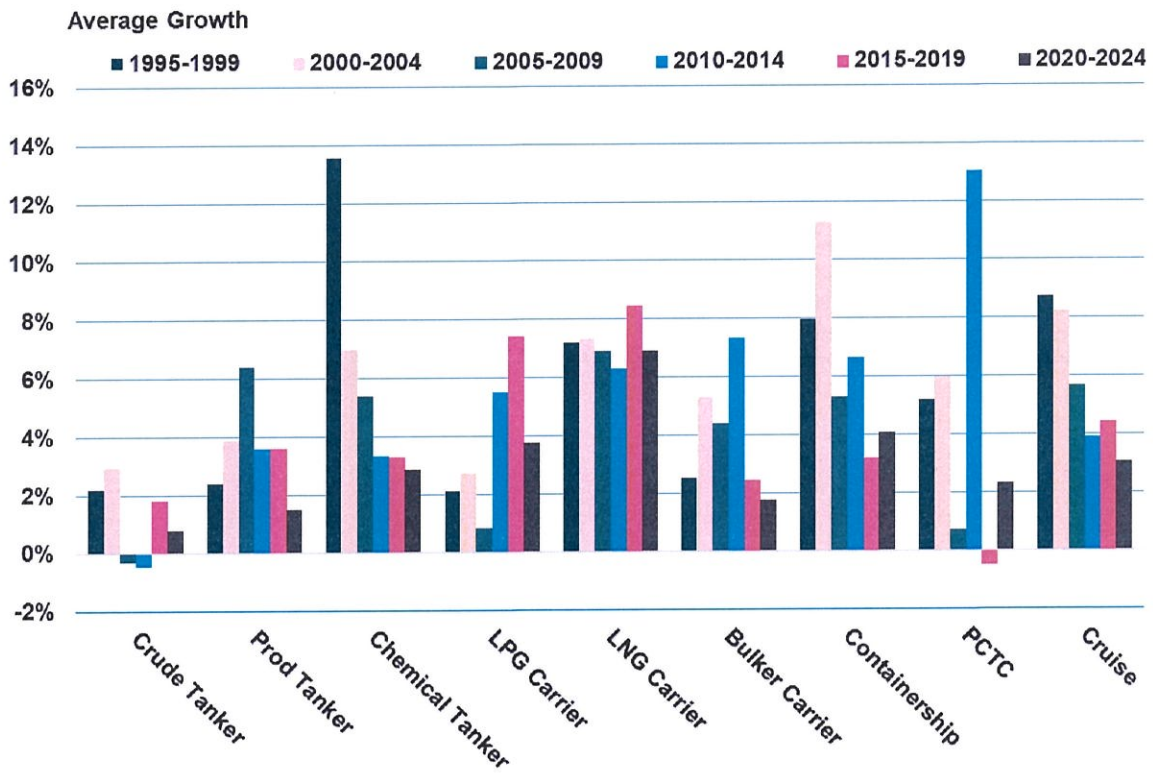
MSI launches FMV, the first online valuation platform offering future value assessments.

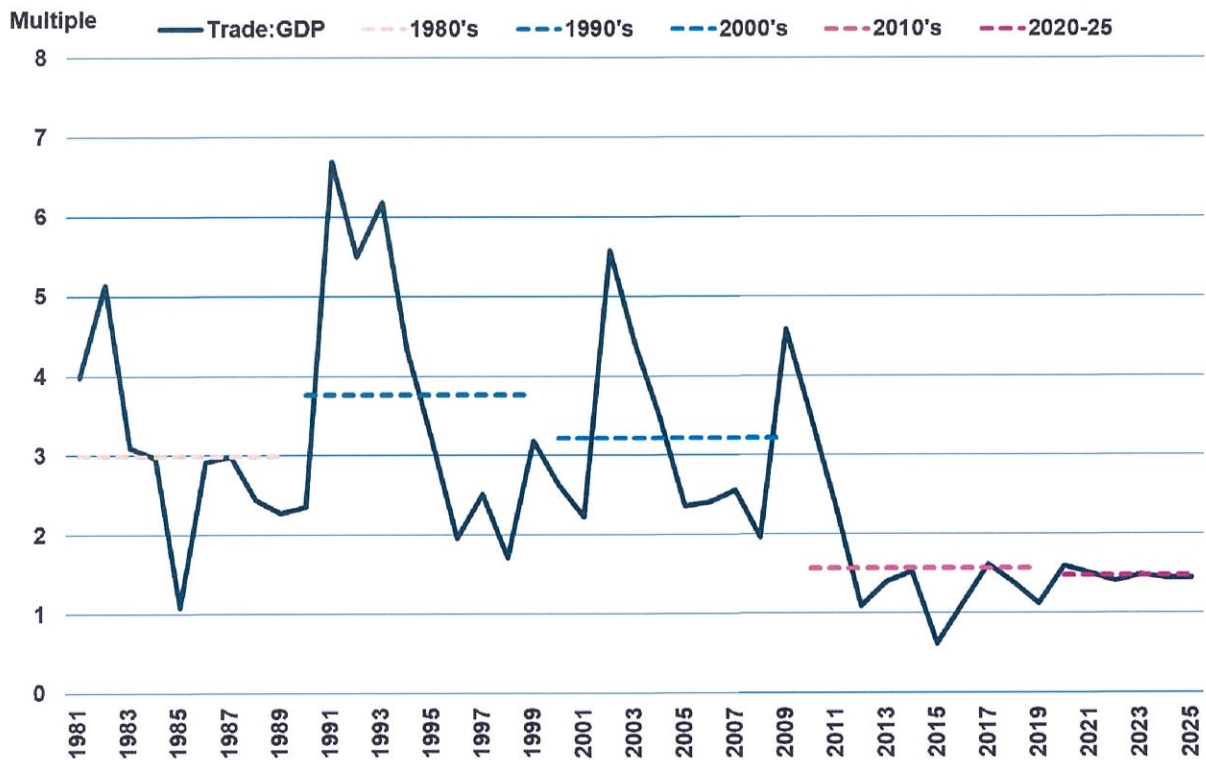
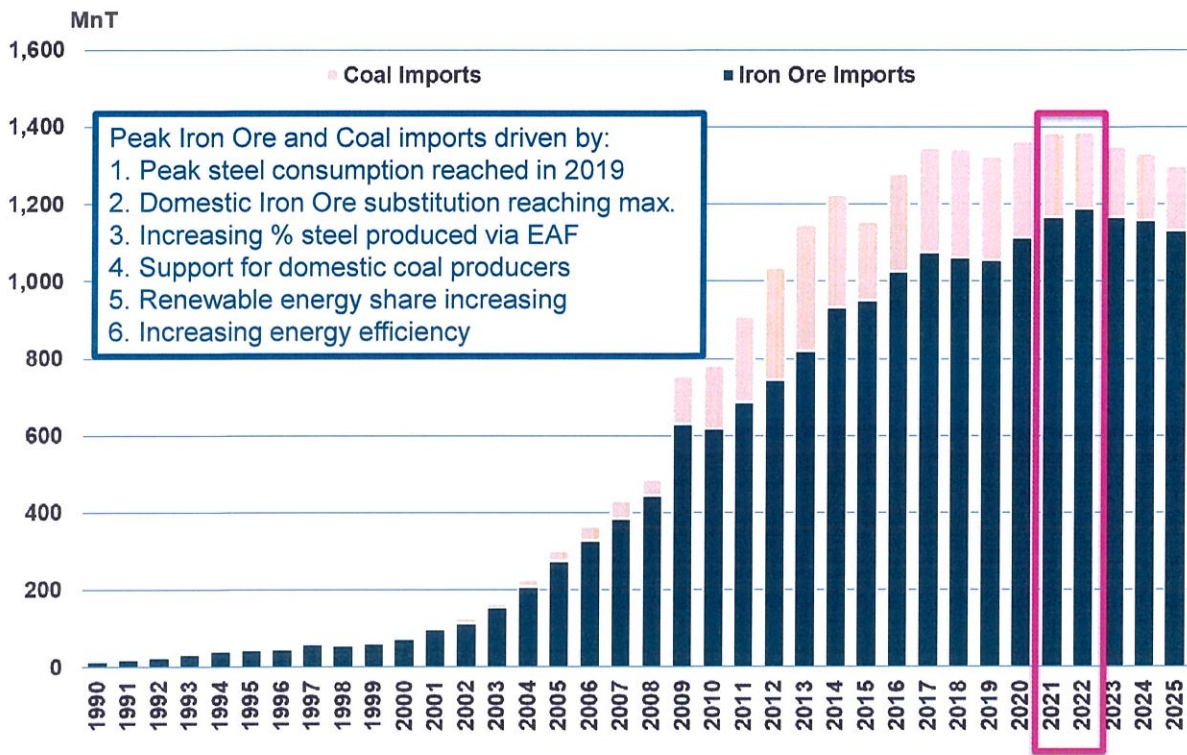


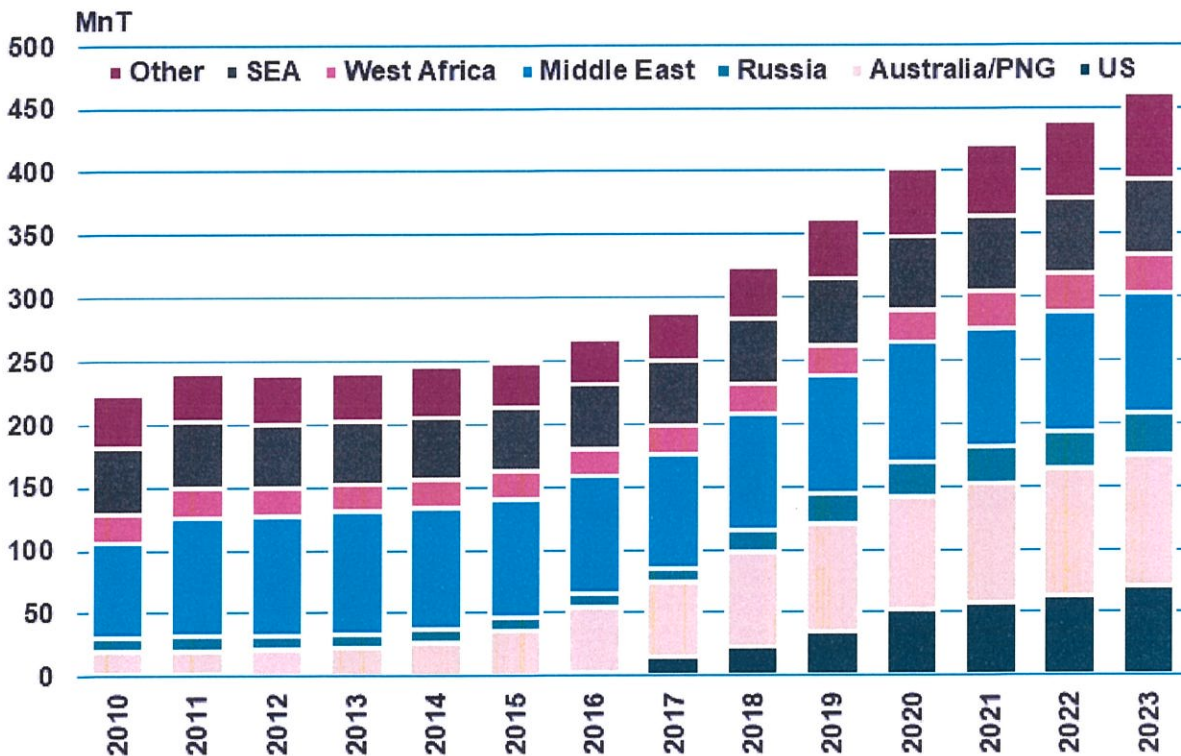
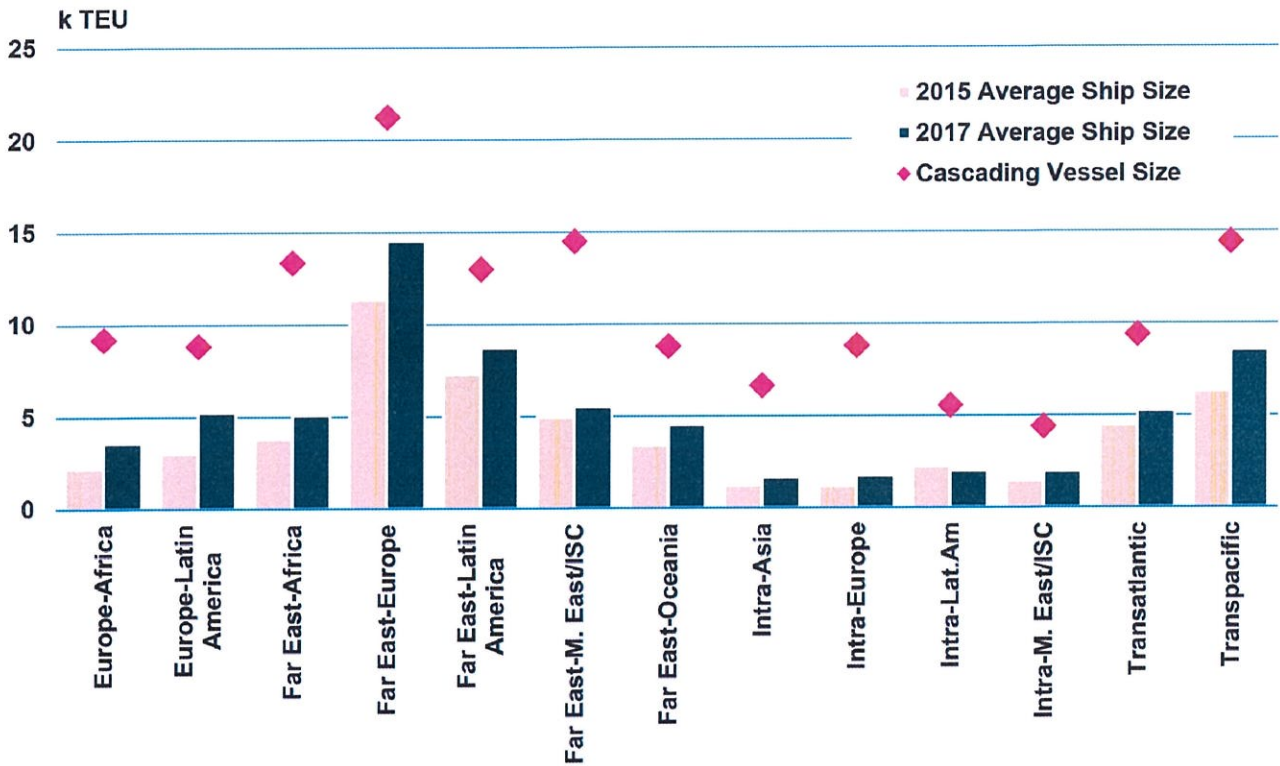
Vessel Demand – Structural Changes

Future tendencies in the global shipbuilding market











Supply Side Changes

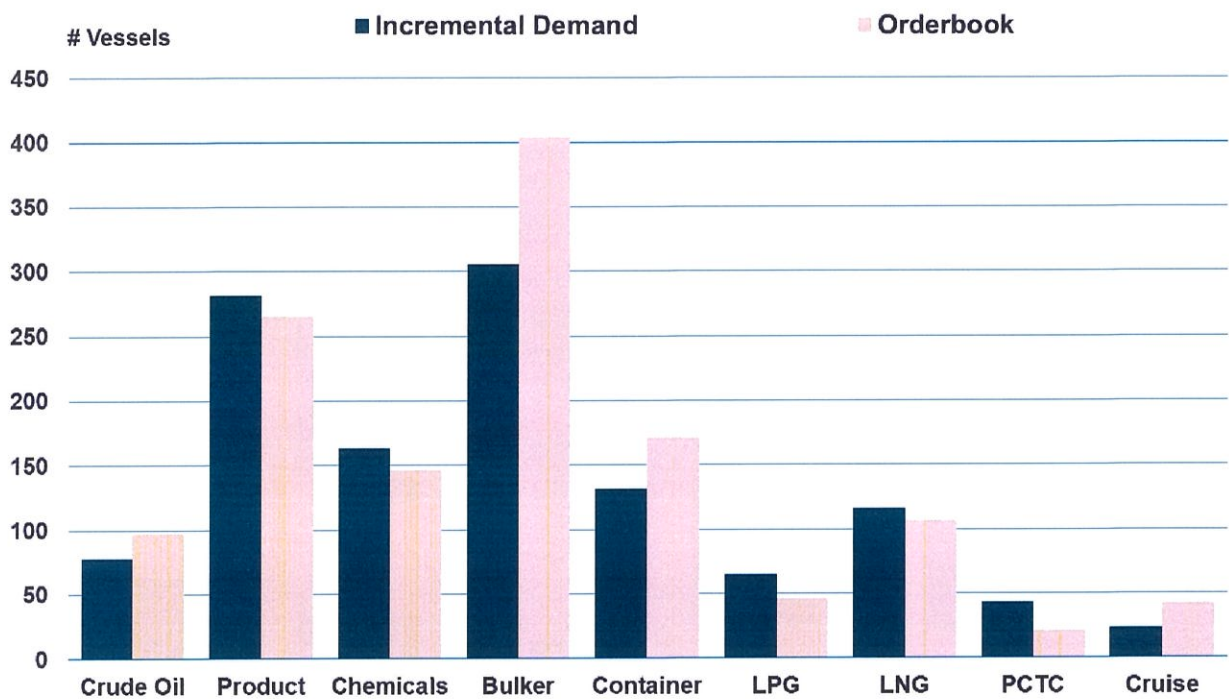
Future tendencies in the global shipbuilding market



11

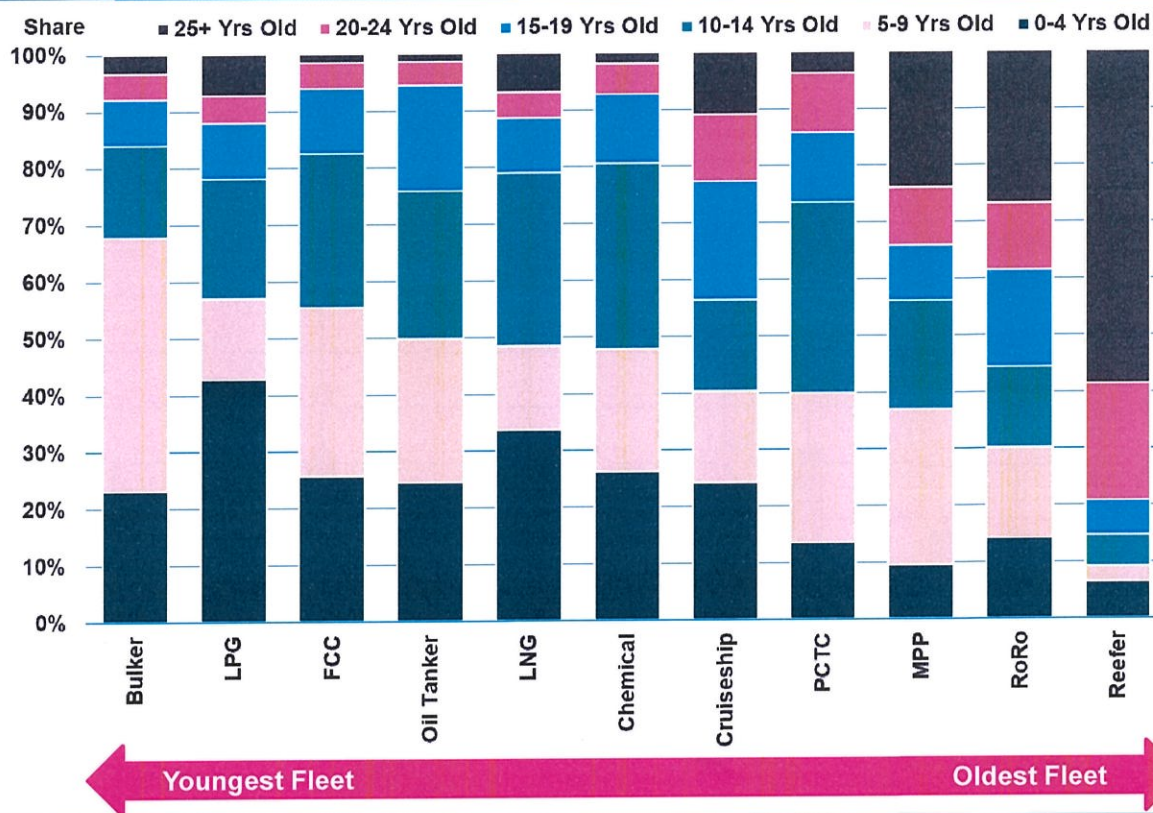


Demand Versus Orderbook

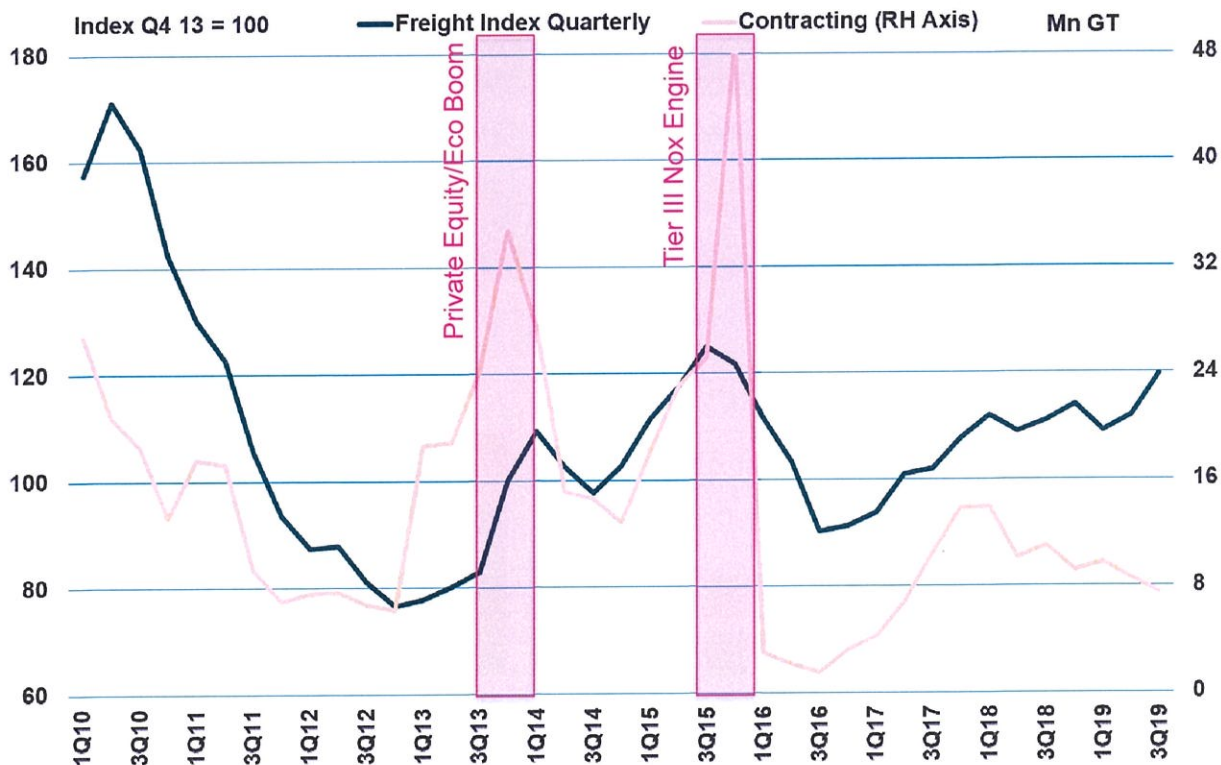


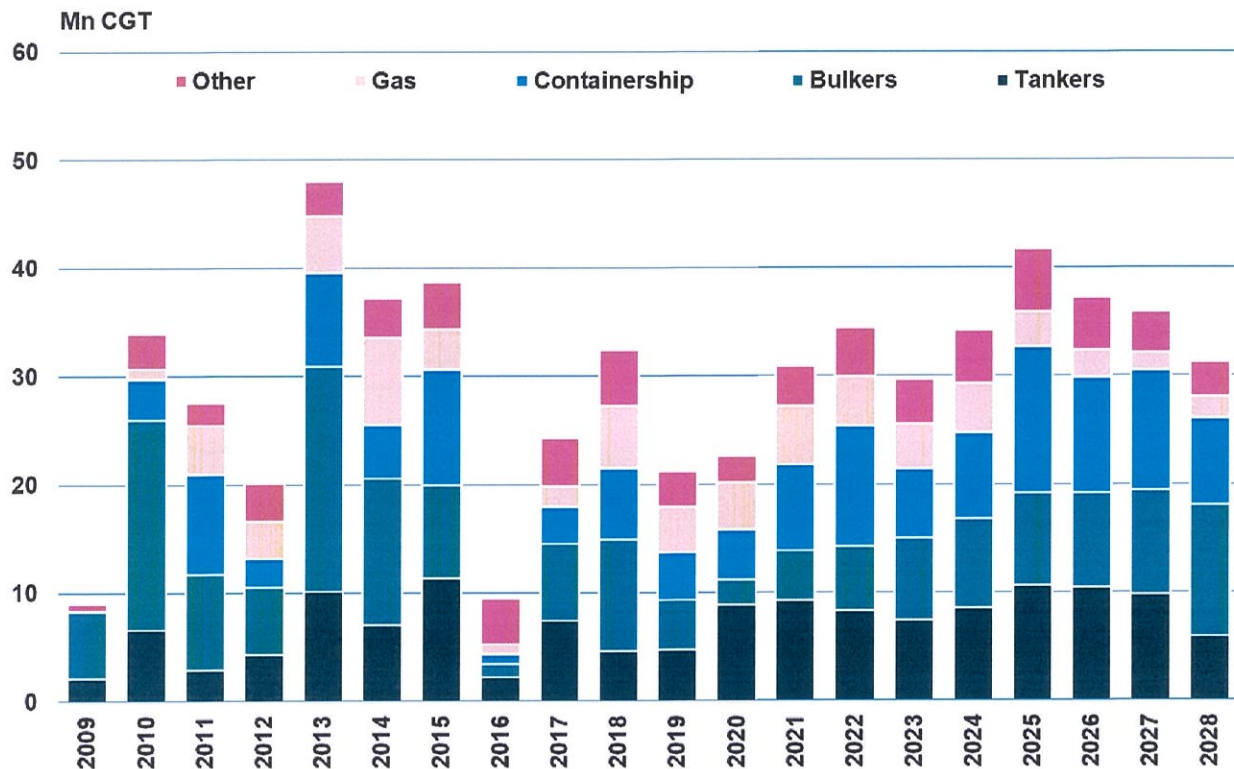
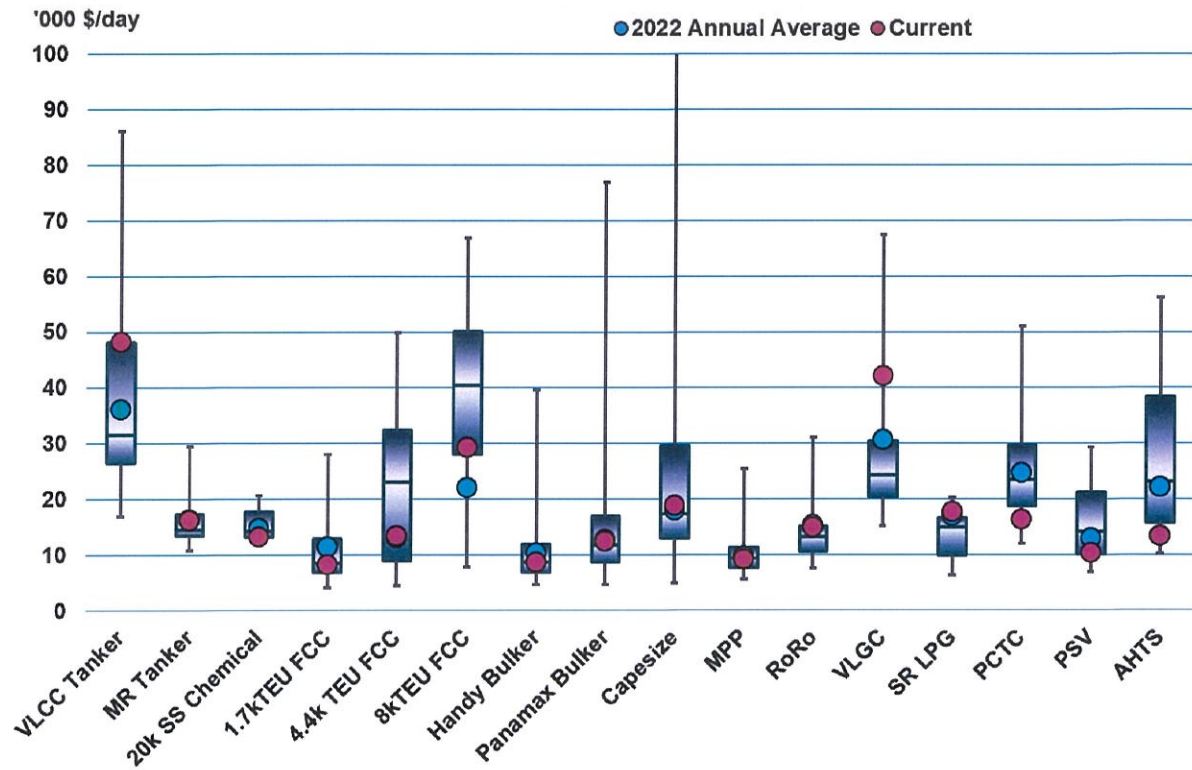


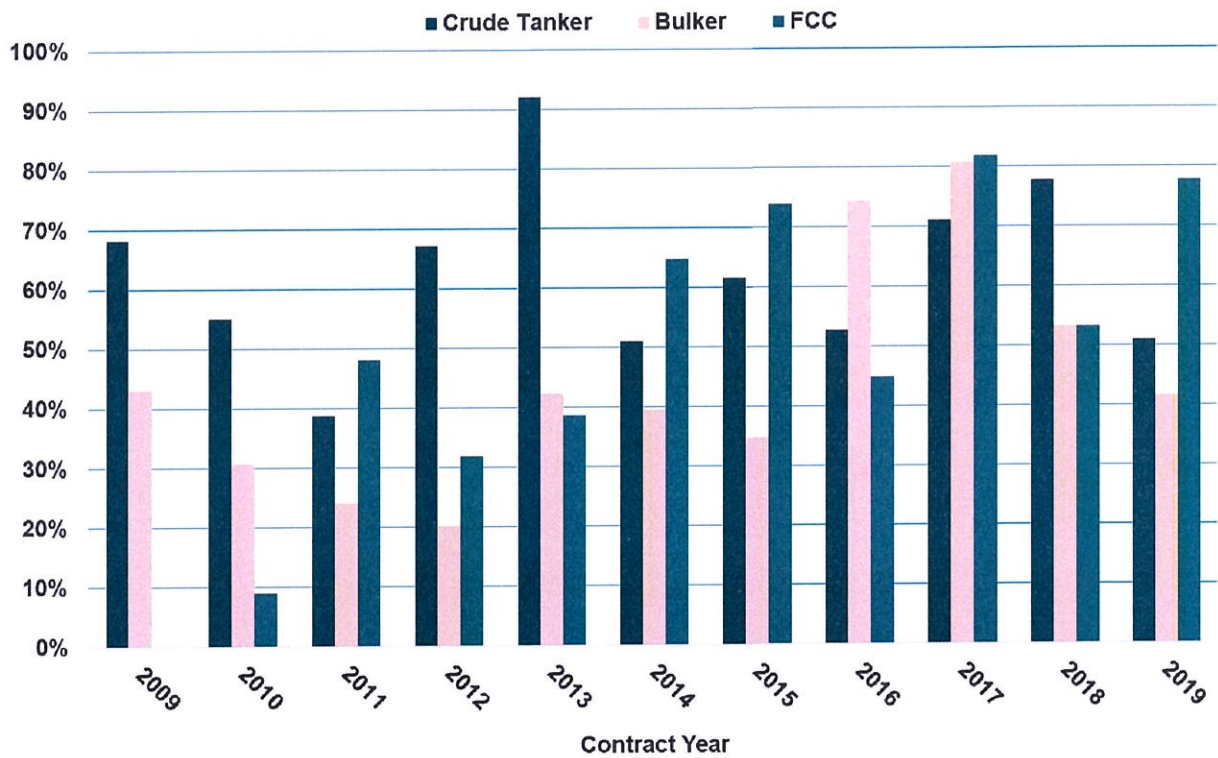
Fleet Age Profile and Required Renewals



Contracting Tied to Earnings





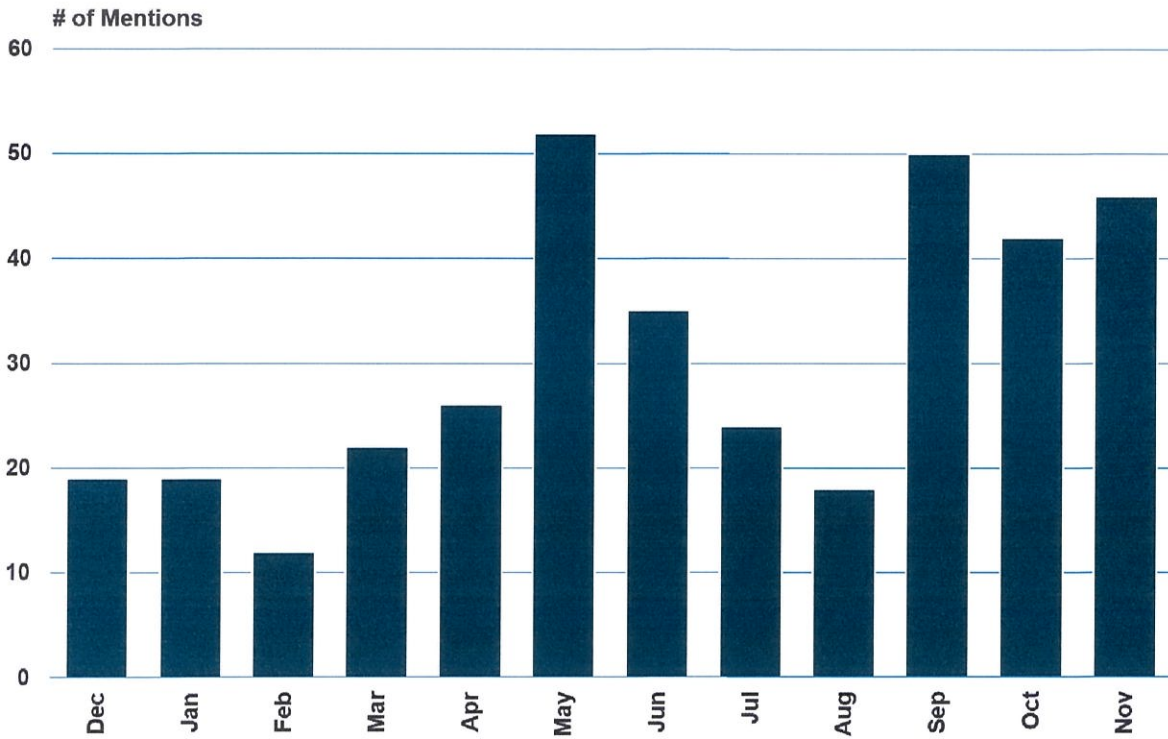


Large = Crude Tanker 200+ k DWT, Bulker 150+ k DWT, Container 12,000+ TEU



Emissions – The New Challenge

Future tendencies in the global shipbuilding market



*Combined news article mentions in Tradewinds and Lloyds List

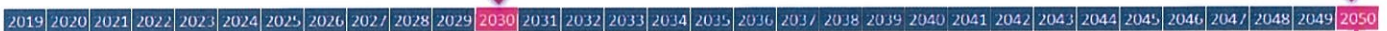
Where is the Current Asset Risk- Vessel Age or Elapsed Time?

IMO GHG Strategy

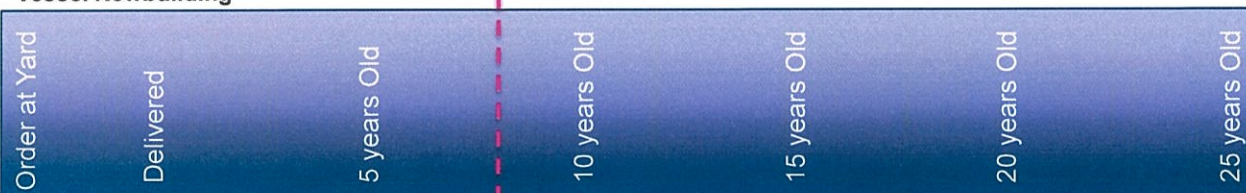
Reduce the average CO2 emissions per 'transport work' by at least 40%

Reduce total GHG emissions by at least 50%

Timeline



Vessel Newbuilding



Modern Vessel



Increased Risk of Obsolescence/Two Tier Market



POSEIDON PRINCIPLES

- The Poseidon Principles are a framework for assessing and disclosing the climate alignment of ship finance portfolios.
- Signatories will, on an annual basis, measure the carbon intensity and assess climate alignment relative to established decarbonization pathways.

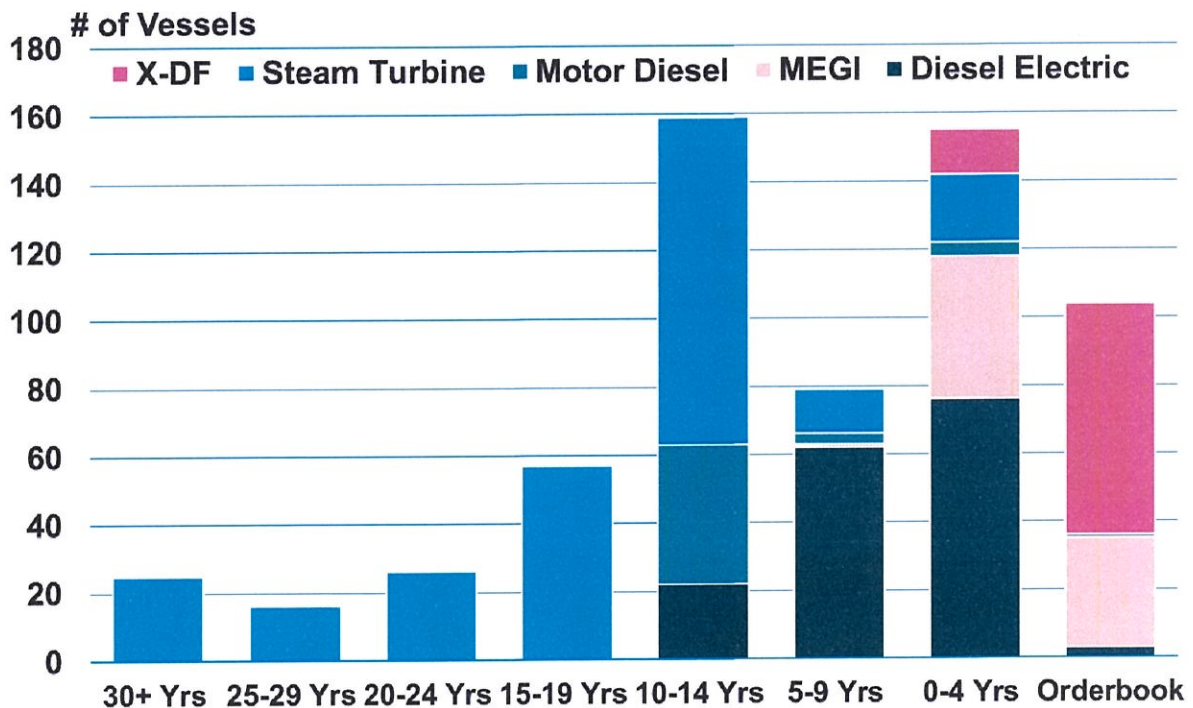
Current signatories:

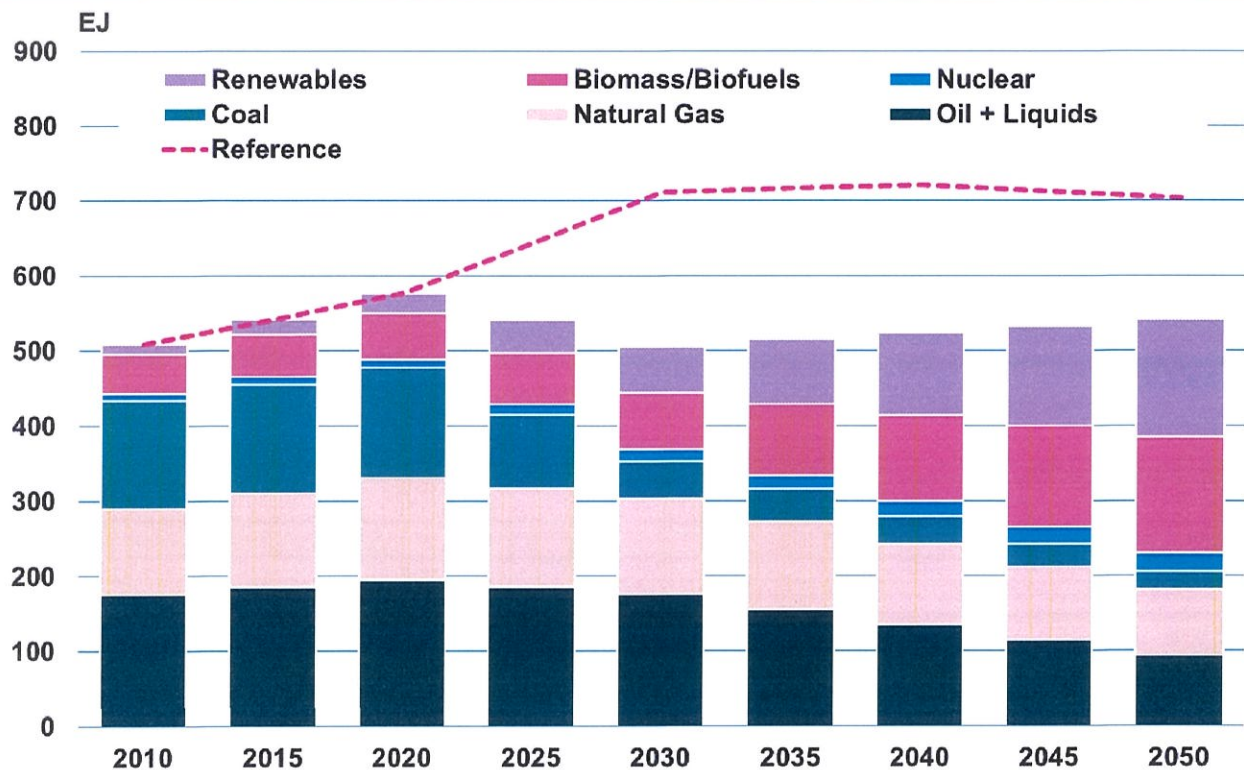


Sparebanken Vest

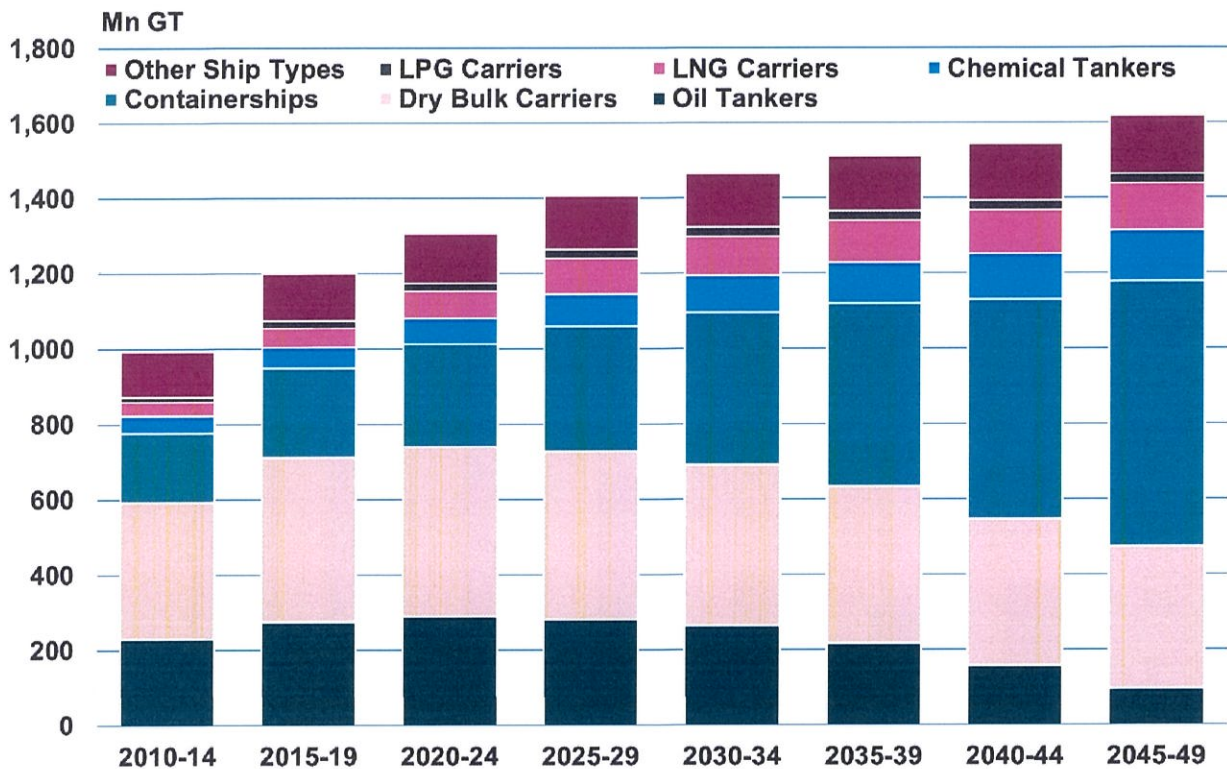


Lessons to be Learned from New Technologies






*IPCC SR1.5 scenario – Limiting warming to 1.5°C above preindustrial levels and related global emission pathways



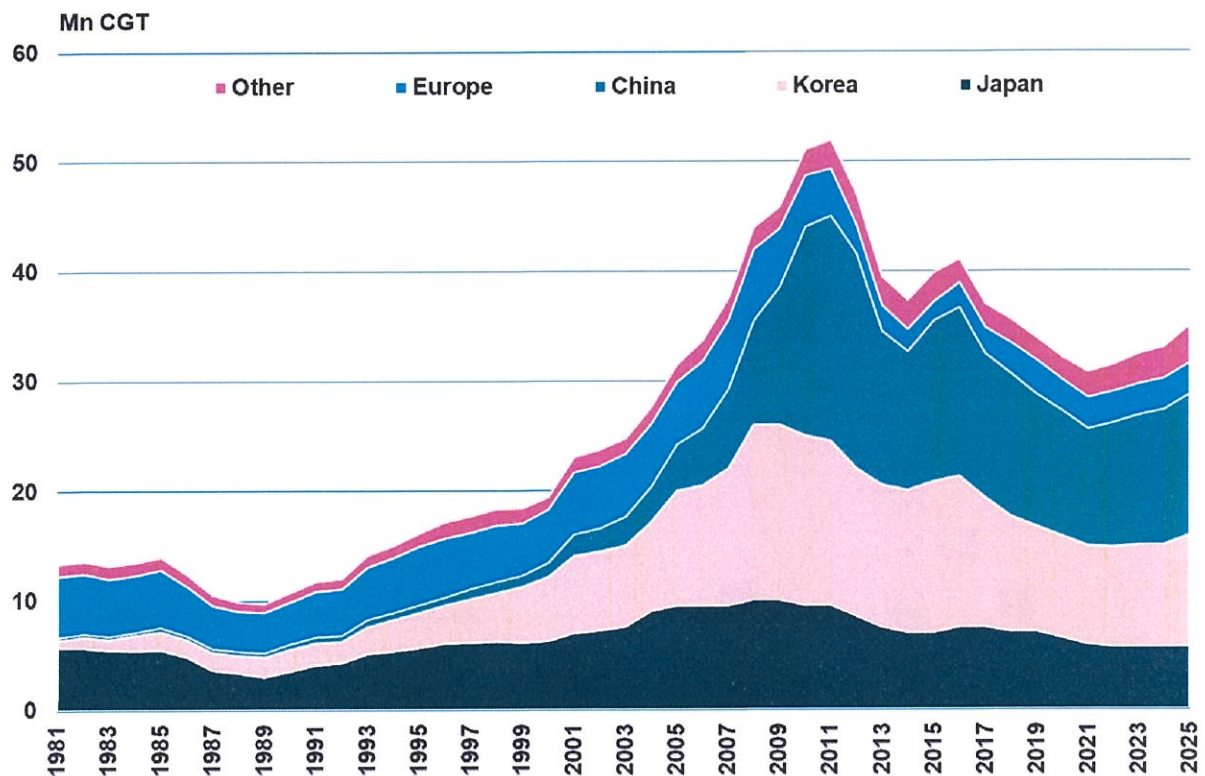


Shipbuilding Evolution

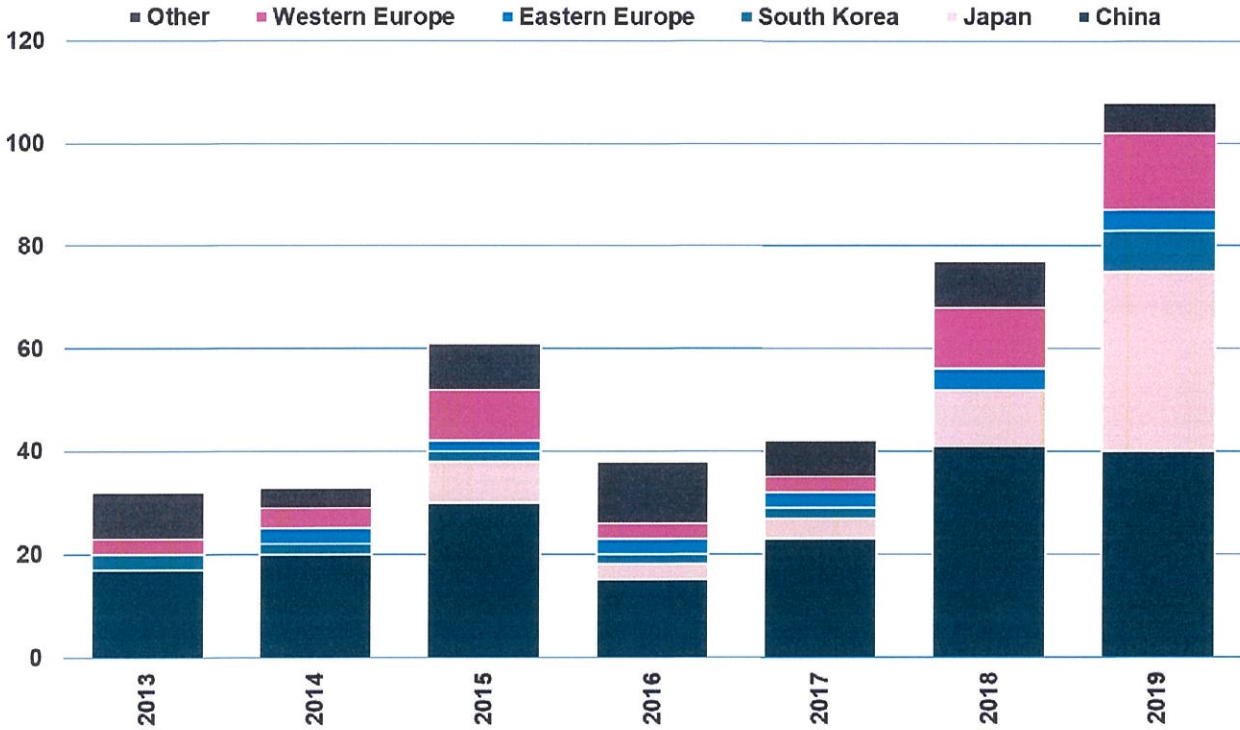
Future tendencies in the global shipbuilding market

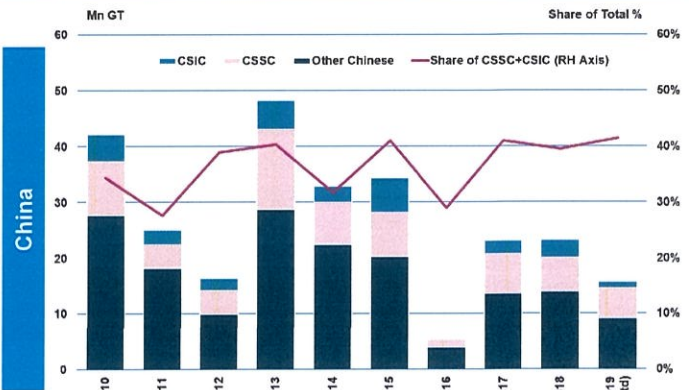
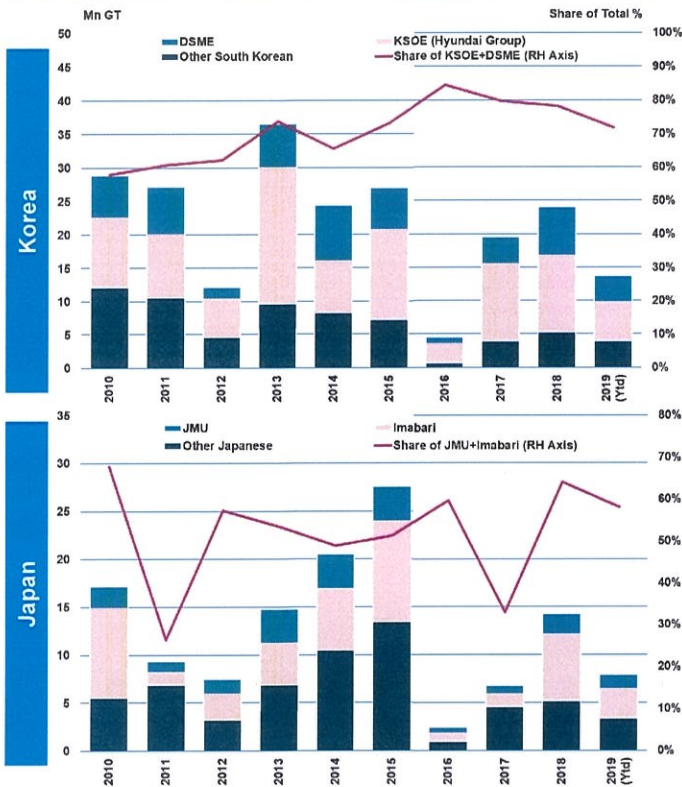
Shipyards Capacity Evolution



Yards

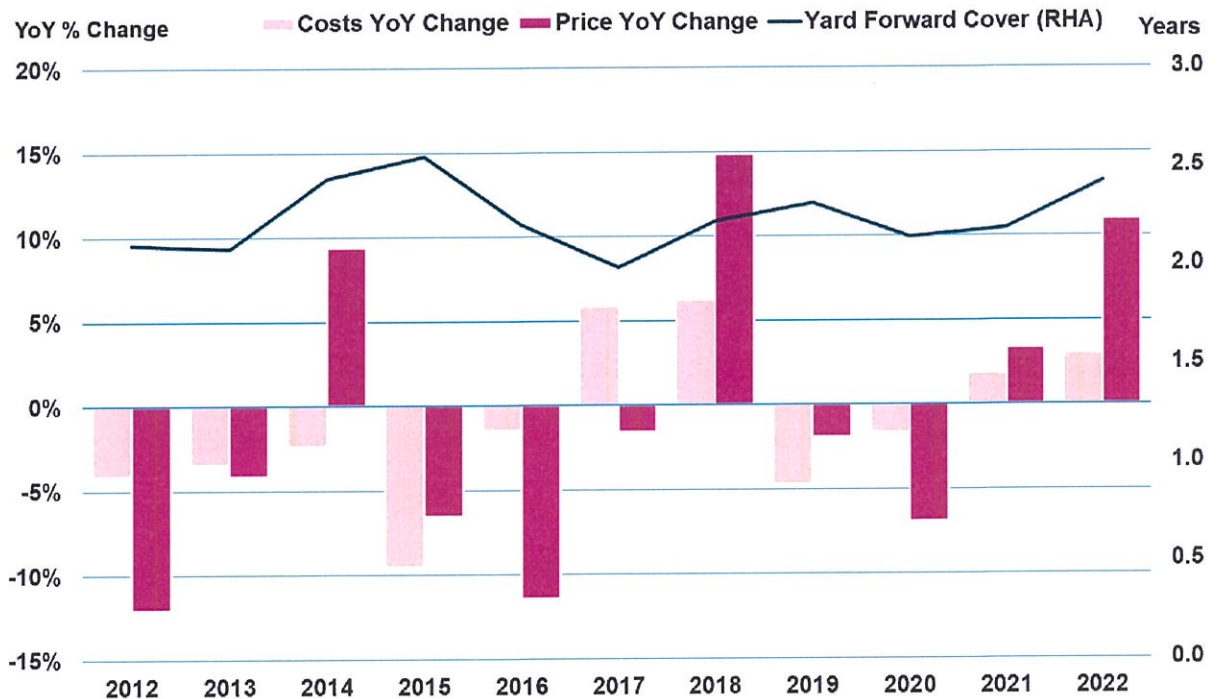
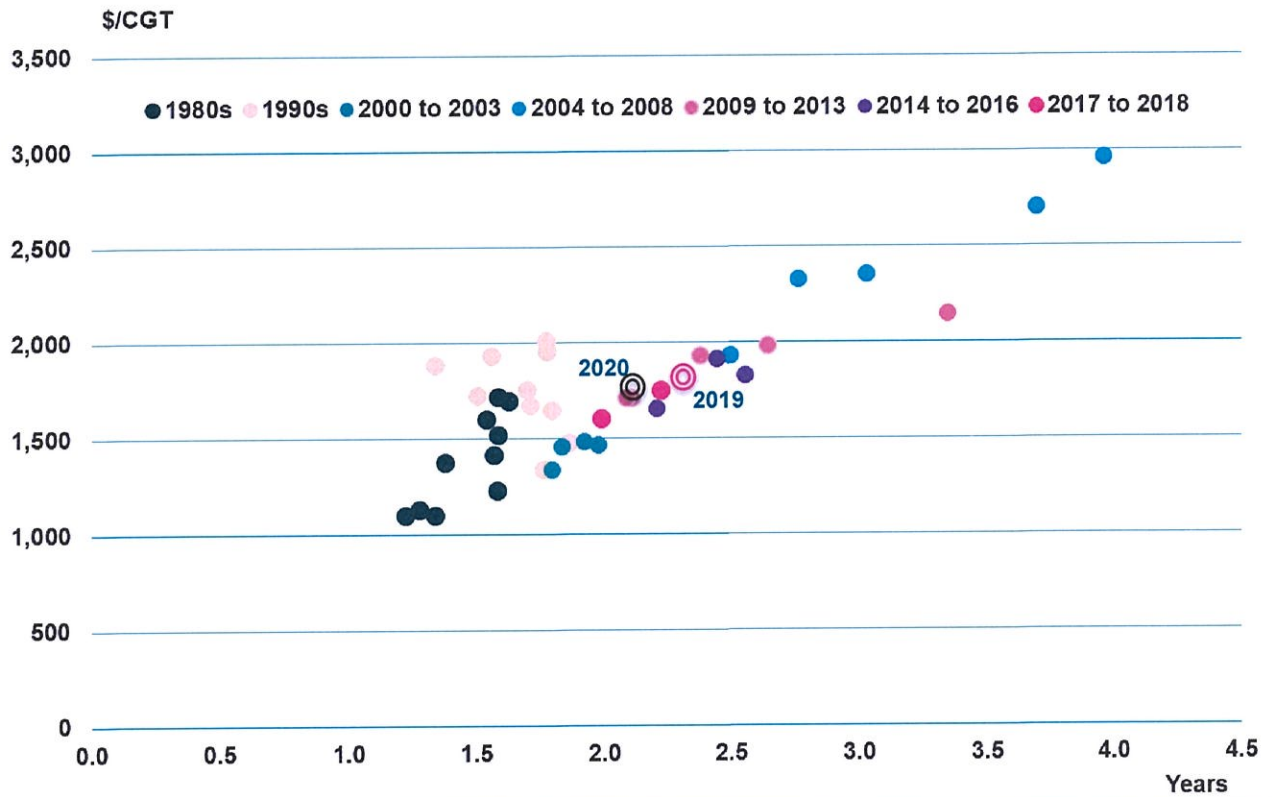


Recent Wave of Yard Consolidation



Shipyards Country	Average Share* of Country Output* of "Super Yard"
Korea	77%
China	38%
Japan	53%

* Over last 5 years





MSI Background & Disclaimer

For over 30 years, MSI has developed integrated relationships with a diverse client base of financial institutions, ship owners, shipyards, brokers, investors, insurers and equipment and service providers.

MSI's expertise covers a broad range of shipping sectors, providing clients with a combination of sector reports, forecasting models, vessel valuations and bespoke consultancy services.

MSI's team is comprised of professionals with extensive academic credentials, deep industry knowledge and many years experience of delivering successful client projects.

MSI balances analytical power with service flexibility, offering a comprehensive support structure and a sound foundation on which to build investment strategies and monitor/assess exposure to market risks.

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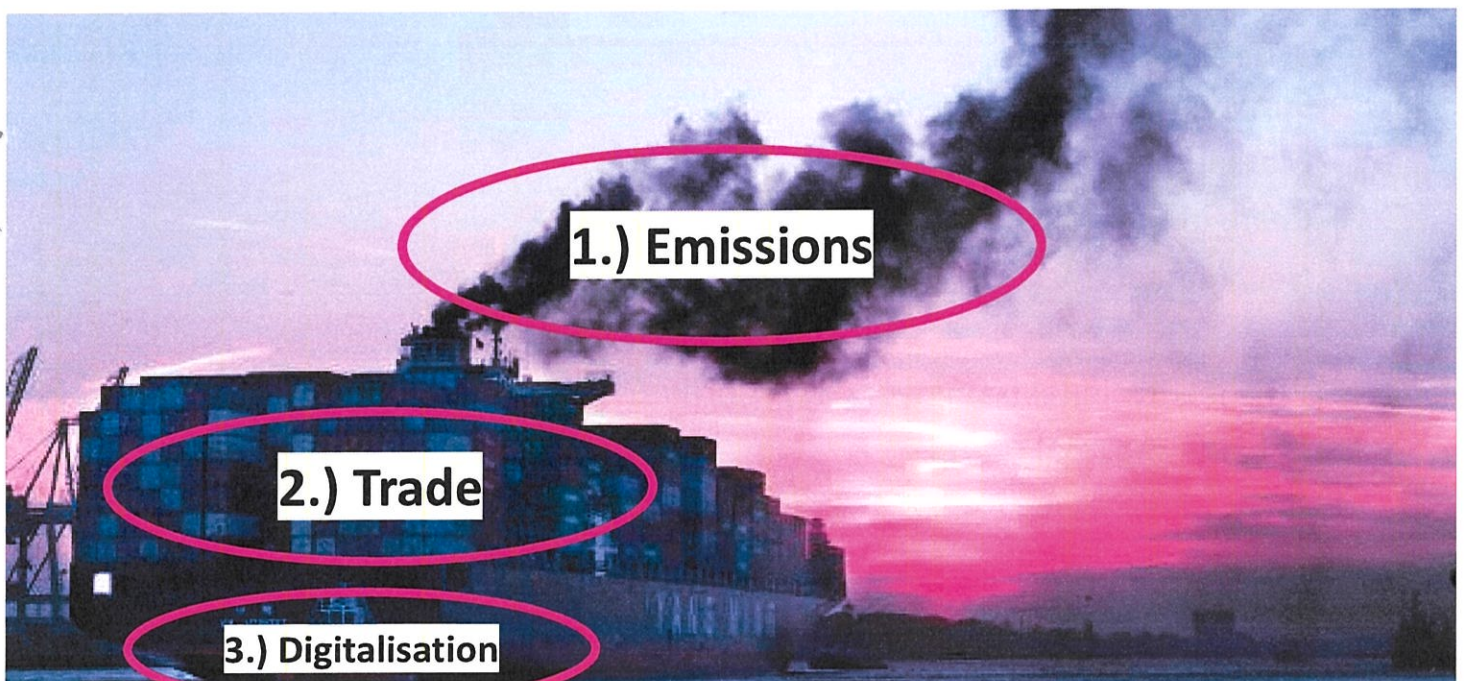
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Outlook: Medium-Long-term Perspectives and Challenges for the Shipbuilding Industry

SEA Europe
Shipyards' & Maritime Equipment Association

Long-term Perspectives?



Challenges Anno 2019

1. Emissions reduction

- Greenhouse Gases
- Air pollution
- Invasive species
- Water pollution
- Noise

⇒Regulation?

⇒Technology?

⇒Finance?

Challenges Anno 2019

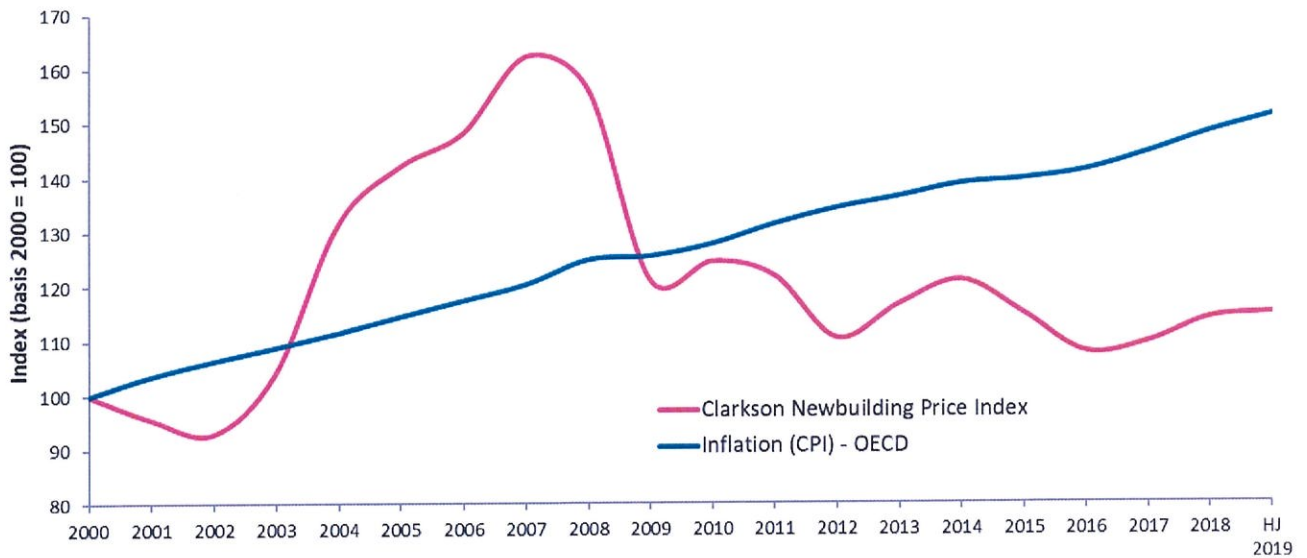
2. Trade

- Supply & demand imbalance
- Market distortions & growing trade conflicts
- Changing cargo patterns
- New markets?

⇒Is the institutional framework appropriate?

⇒Global or regional rules?

Prices / Cost Development



Challenges Anno 2019

3. Digitalisation

- IPR
- Security
- Business models

⇒ New players?

⇒ Impact on cargo-volumes?

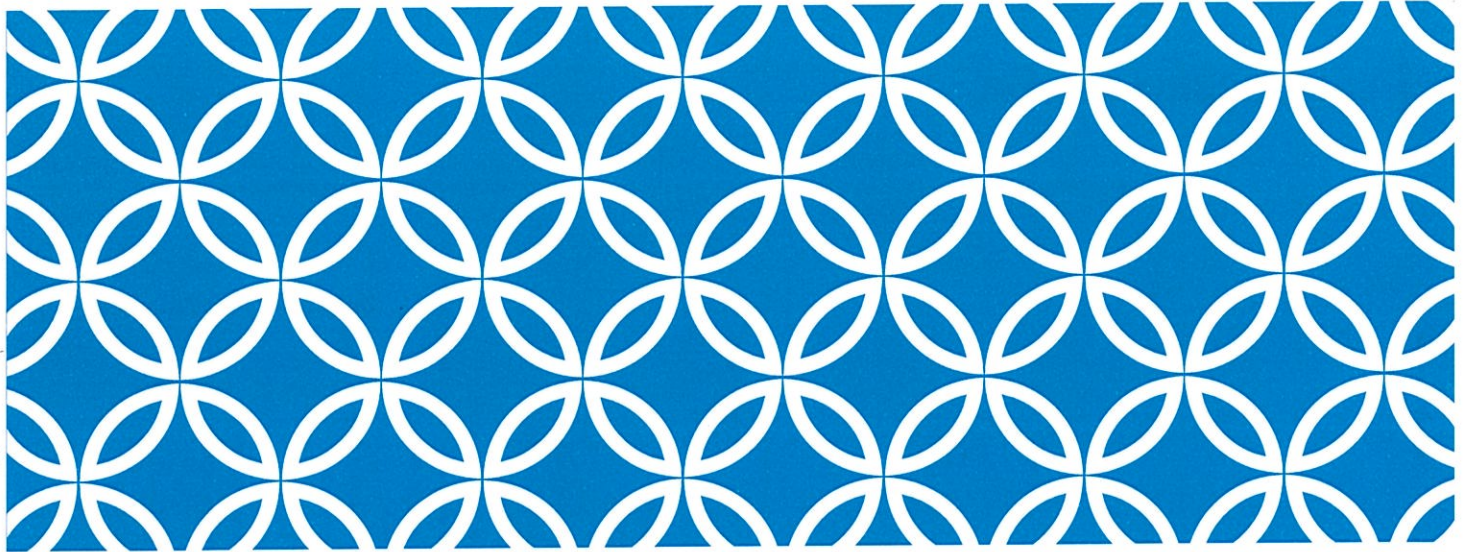
⇒ Regulation?



71%

Thank You!

More info:
www.seaurope.eu



What are the Challenges the Shipbuilding Industry is Facing?

Hiroshi (Dave) Iwamoto
Council Member
Active Shipbuilding Experts' Federation (ASEF)



Workshop on Trends and Challenges in Shipbuilding | 12 December 2019 | OECD Conference Centre, Paris, France

SAJ and ASEF



SAJ: The Shipbuilders' Association of Japan	
Established	September 1947
IMO NGO	Not obtained
Objectives	To promote the sound and sustainable development of shipbuilding industry, thereby to contribute to enhancing the domestic and international economies and public welfare
Members	17 Japanese shipbuilders and an association

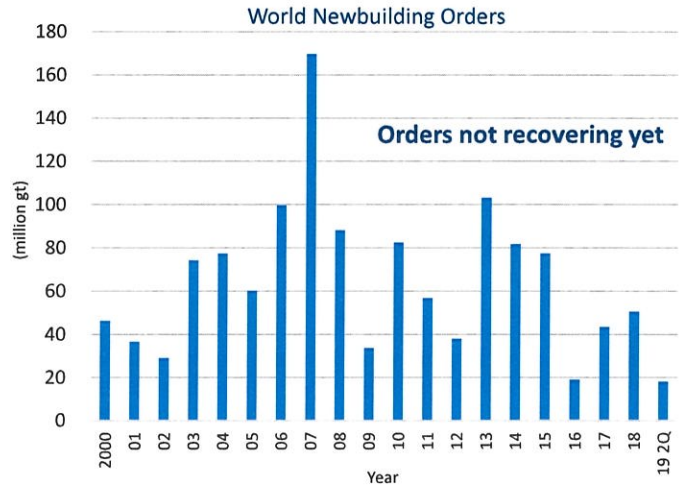


ASEF: Active Shipbuilding Experts' Federation	
Established	November 2015
IMO NGO	Since December 2017
Activities	Technical contributions for sound development of international maritime transportation and further enhancement of the world maritime safety, marine
Members	10 Shipbuilding Associations from Japan (SAJ), China, India, Indonesia, Korea, Malaysia, Sri Lanka, Thailand, Turkey and Vietnam



Workshop on Trends and Challenges in Shipbuilding | 12 December 2019 | OECD Conference Centre, Paris, France

Shipbuilding Market

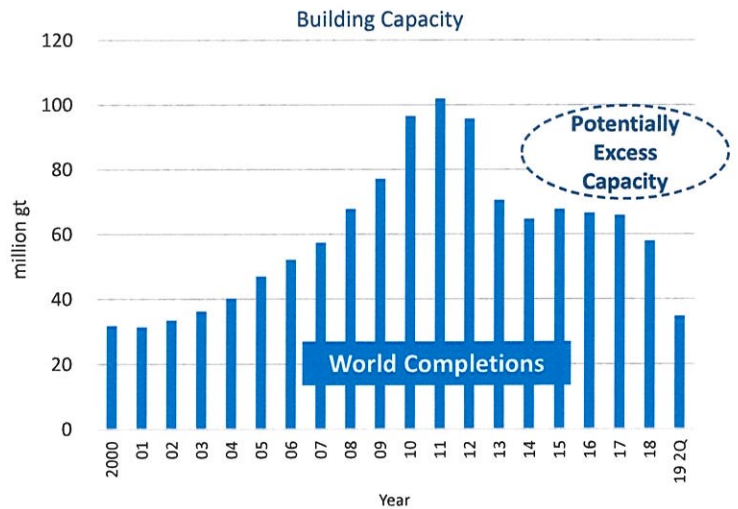
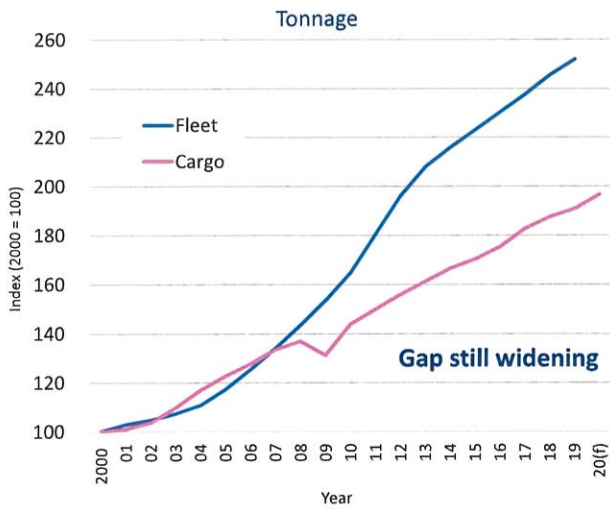


Clarkson

IHS Markit



Over-capacity



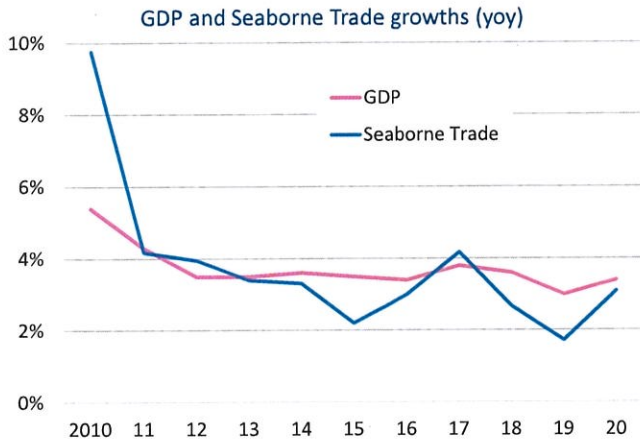
Clarkson

IHS Markit (completion graph)



The future market is not so bright

Routinised market assessment relying on GDP may be too naïve.



Clarkson

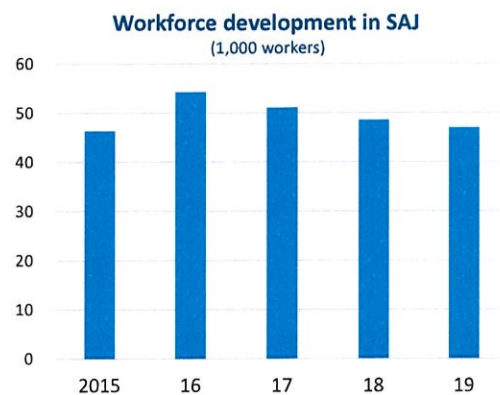


- Recovery cycle expectations falling behind
- Overcapacity situation still prevailing

Relations with outsiders

Relations with industries and associations outside the marine industry have become more complex and more influential.

- Regulatory developments addressing matters beyond the industry's control
- We of course realise the necessity to deal with such matters but human resources are limited



Technological development: A big challenge

- Cumulative building capacity utilised to seek economies of scale kept the demand and ship prices low, compressing margins for the needed for technological developments
- More new technologies outside of traditional shipbuilding technologies are in the focus, needing more financial strength for technological development
- But the industry is, in general, worn out by the thinning profits and extremely conscious about taking risks for large investment, and tend to overlook opportunities

Environmental regulations are becoming stricter

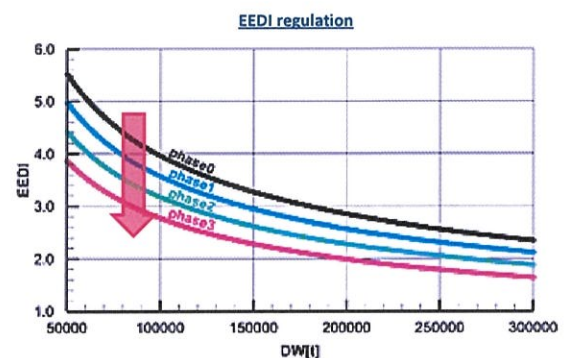
- We need to be able to comply with such regulations.

Reduction of environmental load in maritime logistics

- ✓ **Increase of public pressures**
 - Regulations strengthened
 - 30% reduction of EEDI from 2025
 - SOx global cap starts from 2020
- Increase of public concern
- Prohibition of cars using gasoline or light oil in UK and France from 2040



- ✓ **Using alternative fuels (LNG, H₂, etc.)**
- ✓ **Efficient ship operation in maritime trade**



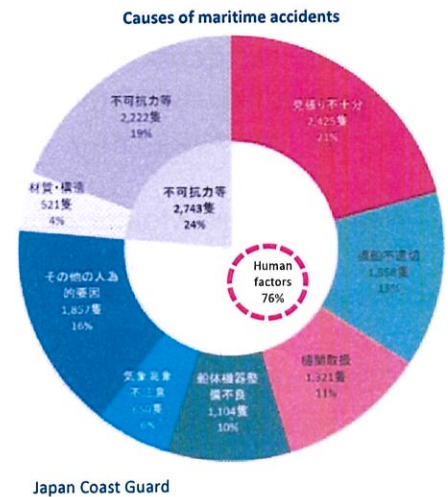
How could we be able to overcome those challenges?

Improving ship's safety

- ✓ Shortage of ship's crew vis-à-vis ship's tonnage increase
- ✓ Relative erosion of crew's skill due to enhancement of functionality of ship's equipment



- ✓ Support system for ship's crew
 - Ship's maneuvering support
 - Support of operation and maintenance of machinery plant
 - Autonomous ship



Application IoT in Shipbuilding

- Many workers move and many components are assembled in shipyard.
- There is much room for improvement in ship's quality and building cost.
- Studies are ongoing, such as:-
 - ✓ Monitoring technology of works and workers in shipbuilding
 - ✓ Welding Robots which do not need NC data
 - ✓ Improving quality and productivity of One-side Submerged Arc Welding Method

Purposes for using ICT on board

ICT can realise highly developed vessels

- ✓ **Avoid accidents caused by human error with maneuvering support**
Eg. watching and warning around ships
-> improve ship's safety
- ✓ **Reduce crew's load through plant operating support**
Eg. prediction and prevention of troubles
-> improve quality of ship's operation
- ✓ **Optimize ship's operation by using monitored data in actual ship's operation**
-> reduce operation cost

Using ICT on vessels . . .

Step I (Now) - Improve efficiency of ship's operation

Weather routing, trouble prediction, etc.

Step II - Advanced support to ship's operation

Monitoring, improving prediction accuracy by AI, etc.

Step III - Reduce ship's crew

Partially automated system, Collision avoidance system, etc.

Step IV - Autonomous ship

Required ship's technologies

What are the challenges of the shipyards in maritime logistics?

- ✓ **Reduction of Environmental Load**
- ✓ **Improving Ship's Safety**
- ✓ **Support to reduce Operating Cost in actual operation**

Volume strategy v. Quality Strategy

- Data based engineering for enhancing ship operational performance in actual seas using advanced digital tools to evaluate the design
- Use of newer digital engineering knowhow and tools to improve operation to improve safety and operational costs
- For environmental regulations, which will need the support from various related industries, and a more cooperative framework needs to be structured with those industries to promote new measures, where shipbuilders with basic design expertise can become the system integrator.
- Close coordination with related administration would be the key
 - Need of healthy, sustainable and growing market operating under fair market principles

Thank you for your attention.