Macro Advisory Partners

Shipping: A Strategic Industry in a More Competitive World

February 2025

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EXECUTIVE SUMMARY

The maritime industry has always been a critical strategic industry, serving as the backbone of global trade, a key driver of economic growth and technological innovation and, through the strategic control of shipping lanes and ports, a crucial factor in geopolitics. It facilitates over 80% of global goods trade, while countries with large domestic shipping industries can exert significant influence over global trade routes and ensure more resilient supply of critical goods in the face of increasingly frequent economic and geopolitical shocks.

Danish shipping companies play a pivotal role in this globalised industry, not only bringing substantial benefits for the domestic economy but also providing a major strategic asset with the ability to enhance Denmark and Europe's global influence.

Danish shipping companies are, however, now operating in a more competitive and volatile global environment. **In a fragmenting and more volatile global economy, governments are recognising the influence and security benefits created by a strong domestic shipping industry and shaping their maritime industrial strategies accordingly.**

Rising geopolitical tensions – particularly between the US and China – **and the resulting structural strategic competition over trade, technology and who governs the world's values and standards will impact all parts of the shipping industry.**

Shipping companies will have to adjust to changing patterns of global trade and capital flows as the nexus between geopolitics, government policies and economic outcomes tightens and the structure of supply chains increasingly prioritises resilience over efficiency. **Meanwhile, more frequent geopolitical shocks affecting major shipping lanes increasingly threaten the principle of freedom of navigation** – previously a firmly established global 'public good' maintained and reinforced by naval power.

Against this more competitive and uncertain global backdrop, the shipping industry also faces significant structural changes from the energy transition and technological developments. Shipping companies face a shifting volume and location of demand for fuels and other commodities at the same time as they have to adopt technological solutions to improve efficiencies and utilise new green fuels to meet net zero targets. Both digital technologies and green fuels create new vectors for strategic competition over the manufacturing, ownership, maintenance and operation of the assets and infrastructure necessary to the transformation of the industry (from shipyards and vessels to fuels and ports).

China in particular has long recognised the strategic importance of developing a strong shipping industry, a resilient maritime supply chain and influence over global trade routes – which are now being brought into focus by rising trade tensions and competition over industries of the future. Through its 11th and 12th Five Year Plans and Made in China 2025, China has provided large-scale industrial policy support for shipping, helping it to develop the world's largest maritime fleet, half of global shipbuilding capacity and operational stakes in 115 ports globally. Notably, it is now the global leader in producing green maritime fuels – as well as the renewable energy feedstocks they require – and building the vessels on which they run.

As such, **Danish framework conditions are being set at a time when the strategic benefits provided by the Danish shipping industry are becoming increasingly important for ensuring national and economic security** in a more competitive and fragmented global environment. Yet other governments' recognition of shipping's importance has created **supply chain**

vulnerabilities and threatens Denmark's ability to compete in future as shifting trade flows, new fuels and technological developments reshape the industry.

Shipping companies and Danish policymakers face key market risks to mitigate arising from these structural trends. These include:

- The scale of China's industrial policy support and its shipbuilding and maritime value chain presence creating leverage over Danish shipping firms that will be amplified if China can assert a lead in green fuels and vessels.

- Fragmented capital markets and potentially tighter lending conditions leading to the relocation of ship finance to other jurisdictions and undermining financing for the upscaling of green fuels.

- Higher frequency geopolitical shocks, shifting geopolitical alliances and competitors' control of critical port infrastructure creating a risk of Danish shipping having less preferential access to strategic waterways than its competitors outside Europe.

- Data vulnerabilities created by increased software usage and China's presence in port infrastructure reassert the need for shipping companies to implement security by design.

Nevertheless, shifting global trade routes and the imperative of the energy and digital transitions also create significant opportunities for Denmark to enhance its existing maritime competitive advantages and improve their competitiveness going forward. These include:

- Utilising the EU's Global Gateway to expand trade ties and green and digital port infrastructure in Middle Powers and developing economies.

- Providing policy support and leveraging the EU and Denmark's advanced green fuels regulatory framework to overcome cost barriers and ensure stable demand for upscaling European green fuels production.

- Expanding Denmark's presence in manufacturing advanced maritime equipment and vessels to service the low-carbon economy.

- Integrating new technologies, data-sharing and digitalisation to enhance the productivity of Danish shipping, shipbuilding and port infrastructure, as well as the shipping industry's adaptability to more frequent shocks.

Different policy actions and strategic investment decisions by shipping companies will be required depending on the nature of the challenges faced: multilateral policy solutions need a comprehensive stakeholder strategy of engagement while 'single agency' technical solutions require a targeted focus by industry players to identify and capture opportunities or reduce risks.

A **fragmented and increasingly competitive global policy environment** amplifies the status of the **Danish maritime cluster as a key strategic asset. Ensuring the best possible framework conditions** to leverage its competitive advantages and address vulnerabilities therefore **requires executives and policy makers to approach decisions with a strategic perspective.**

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A STRATEGIC INDUSTRY IN A MORE COMPETITIVE WORLD

A driver of global, European and Danish growth

Shipping has long been a key driver of trade, economic growth and technological innovation, while the strategic control of shipping lanes and ports has been a crucial factor in geopolitics. Over the past two centuries the British Royal Navy and later the United States Navy have been instrumental in shaping the global maritime order, protecting trade, guaranteeing freedom of navigation, supporting the new international economic order, securing vital shipping lanes, and ensuring global energy security and trade flows. **The shipping industry therefore has always been a key strategic industry as well as a key contributor to economic growth.**

In fact, maritime shipping continues to be a key pillar of global prosperity, carrying over 80% of global trade volume and underpinning a multi-decade globalisation process that supported the development of integrating free markets and a stable and disinflationary global economy.

The growth of the shipping industry and global trade are mutually reinforcing. As global output, goods and commodities demand increases so too does shipping demand – and therefore demand for the outputs of the whole maritime cluster.[1] Over the last three decades, seaborne containerised trade has expanded at around 7% annually (UNCTAD), helping to facilitate annual global trade growth of 4.7% and annual global output growth of 3% (World Bank). **Shipping also maintains the global energy system** – transporting around 64% of oil and petroleum products and 17% of natural gas produced globally (Clarksons).

European and particularly Danish shipping companies play a pivotal role in this globalised industry, bringing substantial benefits for the domestic economy. Sea transport currently accounts for over 17% of total Danish exports (Statistics Denmark) – making it **Denmark's largest export industry and a key driver of the Danish current account surplus.** Within Europe, only German and Greek operators and groups have a larger global presence.

A strategic source of security in a competitive world

Now, the global economy is moving towards a new, fragmenting and more competitive phase of globalisation in which political considerations and interventions increasingly drive market outcomes. Governments and shipping companies face a changing risk and opportunity set as US- and EU-China tensions rise due to growing national and economic security concerns, goods and capital flows reorient with rising trade and investment restrictions, the global energy system is overhauled and new technologies increasingly drive digitalisation and automation.

Fragmentation's threats to European prosperity are high, given its economic openness. Trade represents 97% of European GDP and 128% of Danish GDP, compared to 63% of global GDP (World Bank). Shipping transports almost 72% of European external trade (Eurostat).

As a result, within this more competitive environment, the Danish shipping industry is a strategic asset with the ability to enhance Denmark and Europe's global influence. Denmark is the world's 52nd largest economy by purchasing power parity GDP (CIA), but its shipping industry is the

[1] The maritime cluster is made up of the following components: shipping companies as the central element, with other components revolving around shipping company operations; offshore vessels; shipbuilding/shipyards; shipping fuels; port management and operations; and maritime services, equipment and products.

world's 10th largest by operator domicile (S&P). Similarly, the European fleet controls 39.5% of global tonnage (ECSA) while the EU's share of PPP global GDP is only slightly above 14% (IMF). Beyond its direct benefits for the Danish and broader EU economy, **the maritime cluster can be considered a geostrategic asset in a more competitive global economy.**

Furthermore, shipping is essential to efforts to enhance European and Danish security across multiple domains in an era of heightened volatility. Shipping facilitated the growth in European LNG imports following Russian gas cutoffs. It securely transports the necessary materials for the energy and digital transitions – which themselves will enhance European economic security – as well as maintaining agricultural imports, transporting up to 90% of imports of critical raw materials and 97% of copper ore and 93% of cereals (Eurostat). Moreover, in a more uncertain geopolitical climate, shipping is key for delivering defence materials, while high-tech shipbuilding is critical in maintaining or expanding the European defence industrial base.

Many governments now view the development of the maritime cluster through this strategic, security-enhancing lens. China's prioritisation of shipping in its industrial policy has helped it become the world's largest shipbuilder – producing around half of commercial ship tonnage – up from 5% in 1999 (CSIS). Meanwhile, the UK government announced £4 billion of shipbuilding support in 2022; the South Korean government is increasing investment in core technologies' development and human capital; and the US is bringing shipping into its efforts to protect strategic industries by imposing tariffs on Chinese cranes, pledging $20 billion of new investment in port infrastructure and potentially imposing levies on Chinese-built ships docking at US ports.

As the shipping industry becomes increasingly security-driven, green, and digitalised, Europe and Denmark risk being outcompeted if do not view it with the same strategic importance. These structural trends will affect all parts of the maritime cluster, requiring significant capex against a backdrop of rising uncertainty. The EU's "industrial maritime strategy" (forthcoming under the new European Commission) and Danish framework conditions represent an opportunity to capitalise on the opportunities these structural trends bring for Europe – for example in offshore infrastructure, high-tech ship equipment and green fuels.

MAP has identified for Danish Shipping five macro trends likely to impact the shipping industry's development over the next decade and beyond. Effective adaptation to these trends will be crucial to continue to facilitate global trade despite rising policy barriers, drive sustainable economic development and protect against rising national and economic security threats.

1) **Global economic rewiring.** Shipping will play a pivotal role in facilitating shifting trade flows. Port investments in rising Middle Powers can enable strong trade ties with Denmark.
2) **Structural strategic competition.** Reinforcing leadership on higher knowledge shipbuilding sectors and increasing connectivity can maintain Danish shipping competitiveness.
3) **Shocks and weaponised chokepoints.** A flexible shipping industry will enable Danish trade to adapt to increasing disruptions in key waterways and avoid an outcome where European trade costs more to transport than competitors' trade.
4) **Energy transition.** European leadership in innovation and development of the e-fuels supply chain can securitise future energy supply in a more competitive energy transition. The shipping industry is key for transporting critical minerals for renewable electricity generation.
5) **Technological developments.** First movers on new technologies will secure competitive advantages, increasing Denmark's centrality to global trade. Eventually, investments by Danish firms can help Denmark to lead in emerging technologies like autonomous shipping.

#1. GLOBAL ECONOMIC REWIRING

KEY TAKEAWAYS

⇒ The global economy is seeing a rewiring of trade routes, supply chains and financial and data flows, as the nexus between economic policy and geopolitics tightens.

⇒ Rising trade and industrial policies will reinforce a broader shift from efficiency to resilience in business supply chains and global energy systems.

⇒ **Shipping implications:** Economic rewiring will alter trade routes for shipping firms as supply chains lengthen, requiring new infrastructure investments.

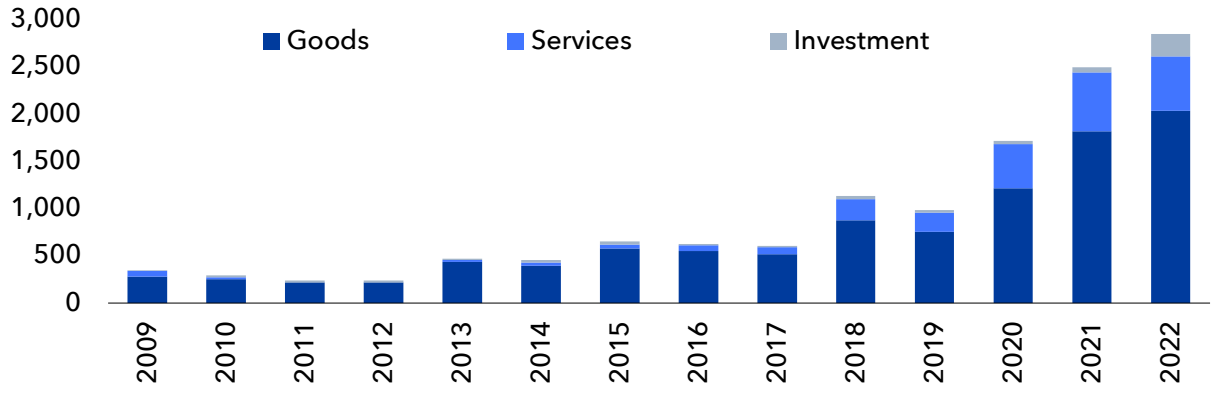
The global economy is undergoing a fundamental rewiring as energy and digital systems are overhauled, goods and capital flows are reallocated and the role of government in economic decision-making increases. This is transforming the global business environment. **The nexus between geopolitics, government policy and economic outcomes will tighten over the next decade**, as strategic competition between Great Powers in industries of the future intensifies, and as 'Middle Powers' assert themselves more in pursuit of national economic objectives.[2]

For shipping companies, trade routes may change even if goods trade as a share of GDP remains consistent, as political tensions and trade and industrial policy interventions reorient goods flows in strategic industries. China's share of US imports has fallen from 22% to 14% since the beginning of the US-China trade war in 2018, shifting especially fast in strategic industries like pharmaceutical ingredients, green energy, semiconductors and telecoms equipment. A significant amount of this trade has been reoriented through third countries – notably Vietnam and Mexico – with value chains lengthening as those Middle Powers increase their share of US imports as well as Chinese FDI and exports.

This rewiring will also affect supply chains across the maritime cluster – pushed by increasingly restrictive Western trade and investment policies towards China (see section on Strategic Competition). Vietnam and India, for example, have the potential to add significant shipping container production capacity, with almost all global production currently located in China.

FIGURE 1. TRADE AND INVESTMENT POLICIES: A LEADING REWIRING INDICATOR

Restrictive global trade policy measures imposed annually, number



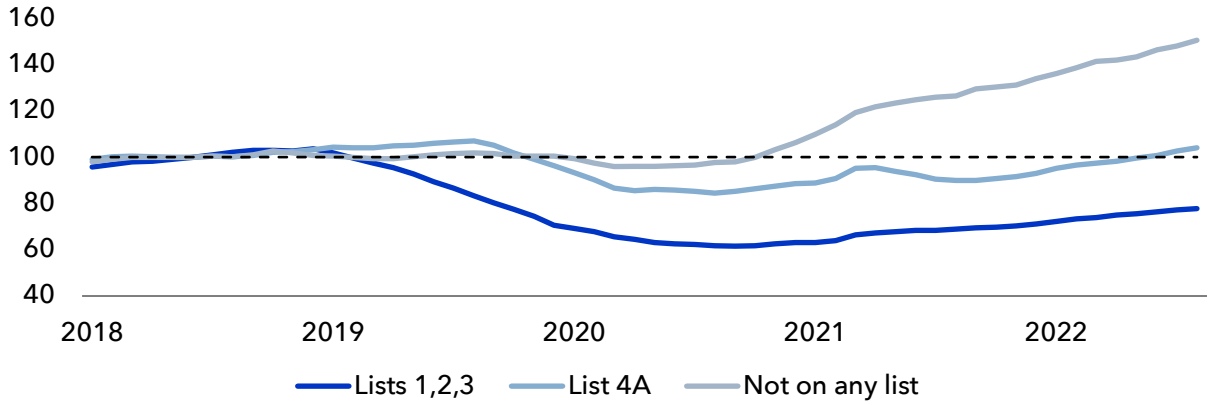
Source: International Monetary Fund, Global Trade Alert

[2] MAP defines Middle Powers as actors who heavily influence their region through politics, economics, military or soft power. Examples of Middle Powers include Turkey, Saudi Arabia, South Korea, Japan, Indonesia, India, Brazil and South Africa, among many more.

The election of US President Donald Trump in November threatens to significantly expand both the scale and scope of US-China trade decoupling, with Trump already imposing 10% additional tariffs on all Chinese imports with potential to go further. Trump likely views his first term trade measures as a floor, not a ceiling, for his second term. While the EU seeks to maintain trade links with China, even as its trade policies become more assertive – with low-cost Chinese green tech imports deemed critical to achieving the bloc's climate ambitions – **it is possible that Trump could step up pressure on the EU to also take a tougher line on Beijing.**

FIGURE 2. TRUMP'S FIRST-TERM TARIFFS HAVE MATERIALLY IMPACTED US-CHINA TRADE

US imports of Chinese goods by tariff category, index



Source: Peterson Institute for International Economics.

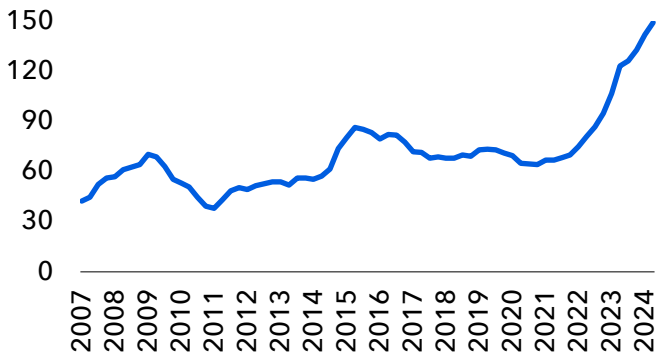
Notes: Goods on lists 1,2 and 3 are subject to a 25% import tariff, goods on list 4A are subject to a 7.5% tariff. US-China trade war began in July 2018. List 4A tariffs introduced September 2019. June 2018=100.

Globally, trade and industrial policies will reinforce a broader shift from efficiency to resilience in business supply chains and global energy systems. This will drive a more investment-intensive – and therefore more structurally inflationary – global growth path, as capex on supply chain replication, clean energy and digitalisation rises significantly. In Europe, for example, former Italian Prime Minister Mario Draghi's September report on European competitiveness calls for an increase in bloc-wide investment of 5% of GDP (€750-800 billion) per year – though it remains to be seen how far the report's recommendations are implemented. More concretely, the European Commission expects Recovery and Resilience Facility spending to raise EU aggregate public investment to 3.5% of GDP by 2025, from 3% in 2019.

These investment drivers are being supported by the proliferation of industrial policy. According to the IMF, more than 2500 industrial policy actions were taken by governments globally in 2023, with the US, China and EU accounting for around half of these measures. The Trump administration will continue to push for supply chain reshoring, not least through its tariff policies. **Firms will pay insurance premia against future political and policy volatility**, both through increasing supply chain redundancies and investing at a higher discount rate to do so.

FIGURE 3. US INDUSTRIAL POLICY IS ACCELERATING MANUFACTURING INVESTMENT

Quarterly US private investment in non-residential manufacturing structures (Inflation-adjusted USD)



Source: US Bureau of Economic Analysis

KEY FEATURES: SHIFTING FLOWS OF GOODS, COMMODITIES, CAPITAL AND DATA

	**Trade rewiring**. Businesses' investment decisions will be increasingly influenced by policy. Businesses will be key in determining sites for state 'friendshoring' efforts.
	**Financial rewiring**. The West's freezing of Russian reserves following Moscow's invasion of Ukraine has raised fears in non-aligned countries and China that payments infrastructure may one day be weaponised against them. Dollar dominance will likely remain given few alternatives, but payments infrastructure will fragment – raising transaction costs across markets.
	**Digital rewiring**. The scale of data centre, compute and digital infrastructure spending on AI is growing rapidly, running at almost 25% compound annual growth rates. This will boost clean energy demand and investment – as well as potentially providing significant productivity gains towards the end of the decade.
	**The energy transition.** Most of the investment in the global energy transition is yet to come. Global investment will likely have to rise by two percentage points of global GDP by 2030 to be on track for net zero 2050. This would fully restore the fall in the share of output made up by investment since the 1980s.
	**Industrial policy**. While China has long deployed industrial subsidies across industries, the US Inflation Reduction Act (IRA) and the EU Green Deal Industrial Plan marked the return of government activism in the West. Modern industrial policy is used by Western economies to 1) promote national competitiveness; 2) defend national and economic security interests; and 3) address the climate crisis.
	**Demographic shifts**. Around two-thirds of global population growth will take place in Africa, where countries will need to balance demographic opportunities with fiscal and development policy challenges. Elsewhere, a rising middle class in the Asia-Pacific, which the UN Development Programme calculates will account for two-thirds of the global middle class by 2030, will likely boost shipping demand.

IMPLICATIONS FOR SHIPPING AND THE MARITIME CLUSTER

- **Periodically higher freight rates.** Trade policy uncertainty that causes customers to frontload orders and periodic bottlenecks as governments and companies look to diversify from China will create periods of excess demand for shipping services.

- **Regionalised trade routes.** Supply chain diversification, FDI by Chinese firms in Europe and Mexico to avoid rising tariff barriers, and domestic content requirements in US and EU industrial policy will regionalise trade blocs, with shipping routes reflecting this. Purchases of the largest oceangoing vessels are already declining.

- **New demands on Middle Powers' port infrastructure.** The lengthening of value chains in US-China trade may increase traffic through ports in connector countries (e.g., Vietnam, India, Saudi Arabia, Mexico) requiring significant new investments. This will be exacerbated by Middle Powers' domestic industrial strategies promoting manufacturing and critical mineral production (e.g., Make in India, Saudi Arabia's Vision 2030), which will require larger and deeper ports.

- **Higher discount rates on ship financing.** Fragmenting capital flows and energy, digital and friendshoring investments are likely to keep interest rates higher than in the pre-pandemic period. This may be compounded by higher term premia (from inflationary pressures) and geopolitical risk premia.

#2. STRUCTURAL STRATEGIC COMPETITION

KEY TAKEAWAYS

⇒ The US and China are in intense competition over trade, technology and standards. This will shape industrial policy across both countries and in the EU.

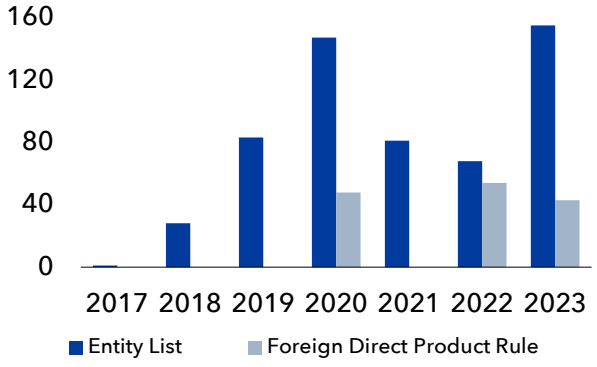
⇒ China has the world's largest merchant fleet, a large international strategic port presence and is the world's largest shipbuilder, supported by large-scale strategic industrial policy.

⇒ **Shipping implications:** Shipping companies can capitalise on new trade corridors but will face continued vulnerabilities from China's prominence in the maritime value chain.

The US-China relationship is in structural decline. In Beijing and Washington, **decision-making is increasingly designed to advance a long-term strategy of intensified competition** – on trade and technology, as well as around which superpower dictates the world's governing values, standards and systems. Shipping – the primary facilitator of global trade – will be a key part of this intensified competition, driving **the establishment of new trade corridors, port renovations and a race to lead in future shipping fuels (see Trend 4).**

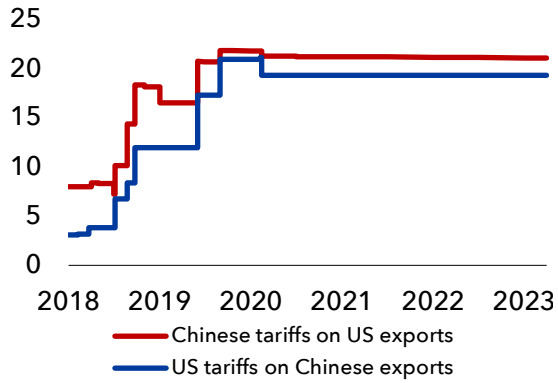
FIGURE 4. US-CHINA OUTRIGHT TRADE RESTRICTIONS AND TARIFFS HAVE INCREASED

US entity list designations of Chinese companies



Source: Centre for New American Security

US-China average tariff rates on each other



Source: International Monetary Fund, Global Trade Alert

The EU, meanwhile, seeks to balance **maintaining trade relations with the US and China, accelerating the green transition and increasingly asserting its own strategic autonomy** through trade and industrial policy interventions where European industrial competitiveness is threatened by unfair competition and where national security threats are present.

KEY FEATURES: MORE ASSERTIVE POLICIES ON SECURITY AND COMPETITIVENESS

Active economic statecraft. While more aggressive US sanctions policy will shape market access, this will likely be coupled with new forms of positive economic statecraft from the EU in particular aimed at Middle Powers and emerging markets to counter Chinese economic influence (e.g., the Global Gateway).

Trade restrictions. Existing US-China tariffs and export controls on strategic goods are highly likely to remain, with room to tighten further as Trump seeks to build leverage over China. EU restrictions on China are more targeted but are becoming more assertive (e.g., by targeting Chinese EVs). China is likely to continue to

retaliate by targeting supply chains in which it is dominant (e.g., critical minerals), and where the costs to China of countermeasures are lower.

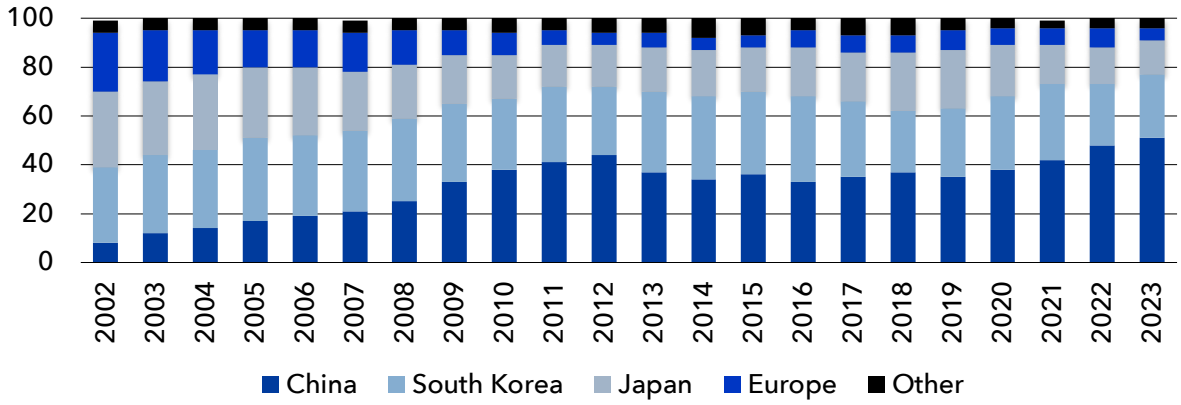
Investment restrictions. FDI is becoming increasingly securitised as the US looks to stay several generations ahead of China in strategic technologies and national security risks of adversaries' investment in critical infrastructure become clearer.

Chinese shipping supply chain dominance

The Chinese government views shipping as a key strategic industry, due to the geostrategic benefits of controlling the infrastructure necessary for facilitating global trade, the domestic economic benefits of lower freight rates for other sectors of China's export-oriented economy and the domestic demand benefits shipping can provide to upstream strategic industries (e.g., steel). As such, in China's 11th and 12th Five-Year Plans (2006 and 2011), shipbuilding was identified as a sector in need of industrial policy support.

This support – alongside low labour costs – helped China to become the world's largest shipbuilding economy globally by 2010. China now wants to expand its presence in higher tech shipbuilding. **Made in China 2025 categorises "maritime equipment and high-tech shipping" as one of ten priority sectors for the Chinese leadership.** These, notably, are the areas from which the EU, South Korea and Japan currently derive most of their global shipbuilding market share.

FIGURE 5. CHINA MANUFACTURES THE MAJORITY OF THE WORLD'S SHIPS
Country shares of global shipbuilding 2002-2023 (%)



Source: Clarksons

China's extensive industrial policy support for shipbuilding and related industries (e.g., containers, cranes) has enabled its companies to **exert control over the shipping value chain and over global port infrastructure and ownership.** According to CSIS data, policy support for Chinese shipping and the shipbuilding industry totalled $132 billion between 2010 and 2018. Support is now focused on supporting large state-owned enterprises (e.g., COSCO) through concessional loans from state banks, subsidised land provision (e.g., for port construction), direct subsidies, encouragement of horizontal mergers and other means. China now:

- **Has the world's largest merchant fleet** by group owner domicile. This includes the world's **fourth largest shipping company COSCO**, which possesses 10.9% of the global container fleet, the world's largest dry bulk cargo fleet, 50% of the container manufacturing market and the world's second largest container leasing business.

- Produces 96% of shipping containers used globally.

- **Accounts for around half of global shipyard output and aims to build over half of lower carbon fuel ships by 2025.** Research by Myrto Kalouptsidi indicates that Chinese industrial policy has led to an overall increase in shipbuilding, but three-quarters of its increased market share has come at the expense of other actors, including Japan, South Korea and the EU.

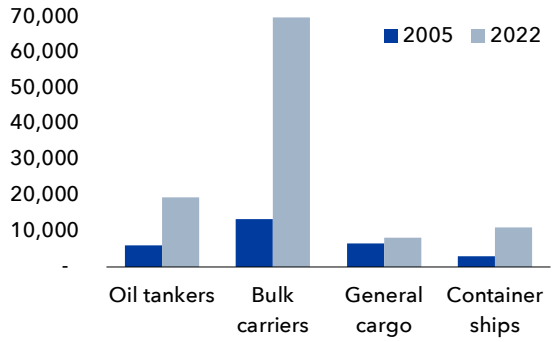
- **Has three of the top ten global ship finance banks** (two of which are state-owned – China Exim Bank and Bank of China).

- Controls around 70% of the market for ship-to-shore port cranes through state-owned ZPMC.

- **Has operational or ownership stakes in 115 port projects, including 17 with majority Chinese ownership.** Five majority-held ports are in the EU and involve state-owned enterprises: Piraeus in Greece (COSCO, 67% holding); Zeebrugge, Belgium (COSCO, 100%); Dunkirk, France (China Merchants Ports, 91%); and Valencia and Bilbao, Spain (COSCO, both 51%).

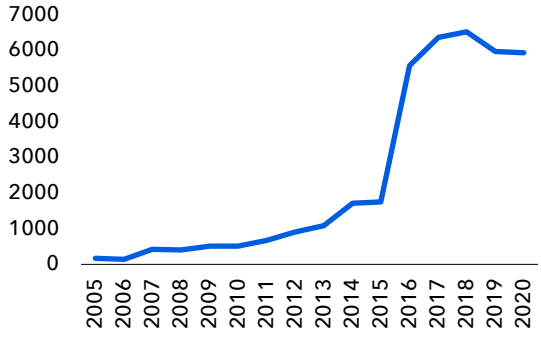
FIGURE 6. CHINA'S PROMINENCE IN KEY PARTS OF THE SHIPPING INDUSTRY IS GROWING

Chinese merchant fleet growth 2005-22 (DWT, Thousands)



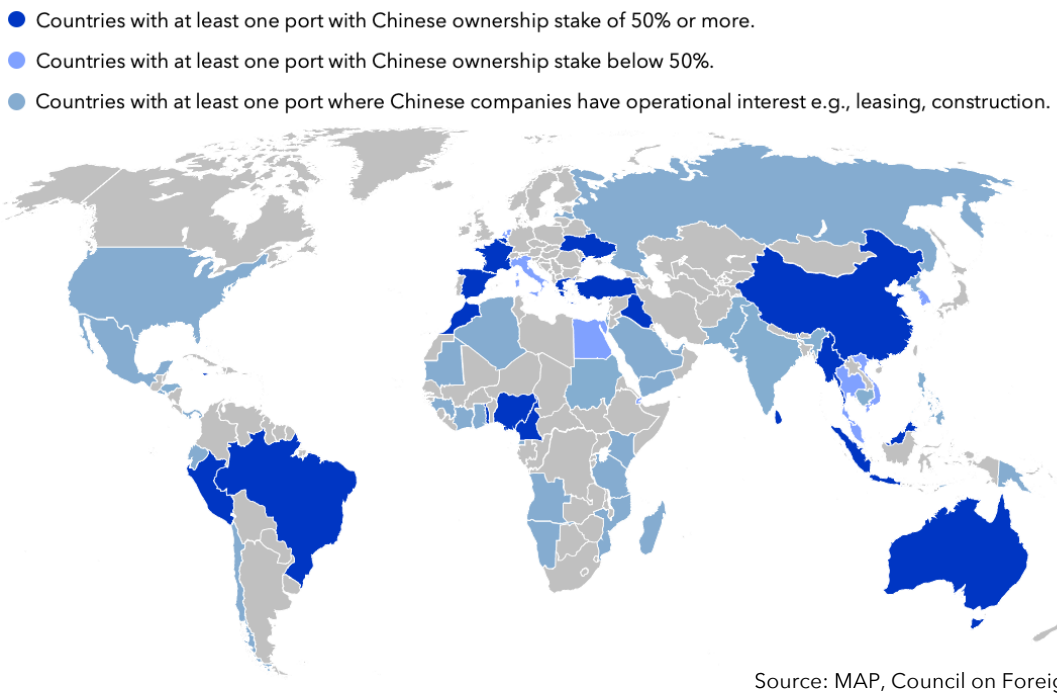
Source: UNCTAD

Chinese port investment in low- and middle-income countries (5-year average, USD mn)



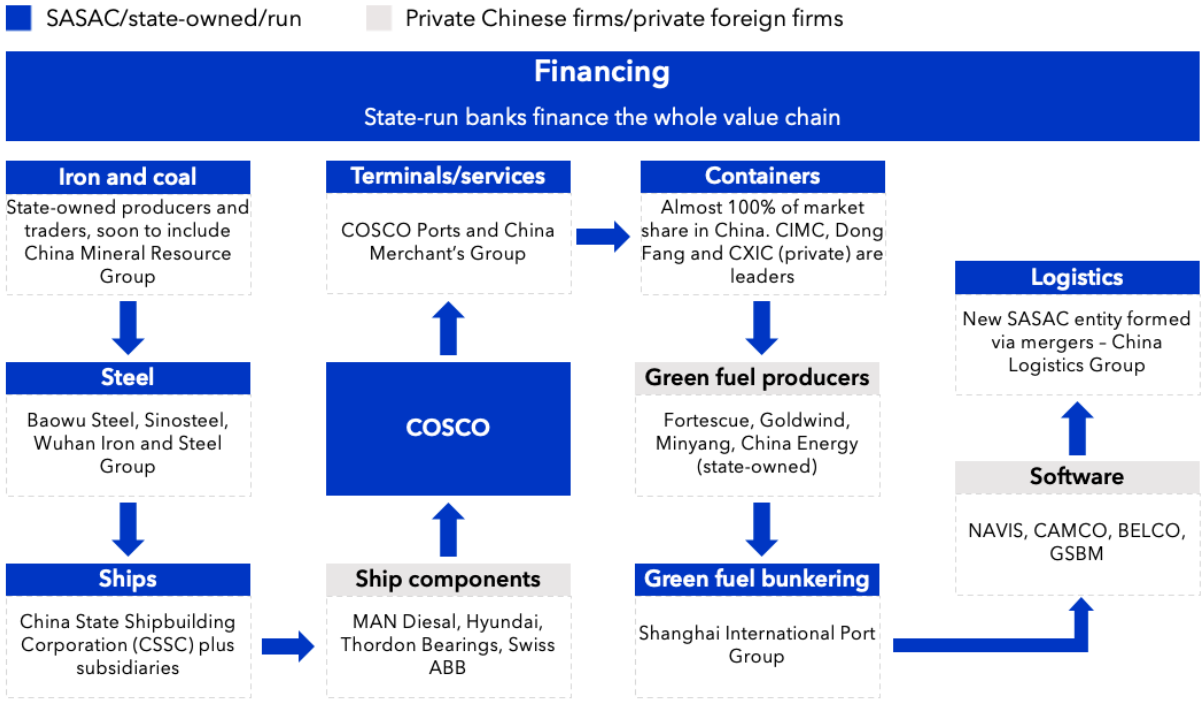
Source: AIDDATA, MAP calculations

China's international port presence



Source: MAP, Council on Foreign Relations

FIGURE 7. CHINESE STATE FINANCING DRIVES END-TO-END DOMINANCE OF THE SHIPPING VALUE CHAIN



Source: MAP, MERICS

European vulnerabilities

China's end-to-end presence in the shipping value chain has provided it with significant resilience in the face of growing trade restrictions. Chinese Academy of Engineering research suggests that China now only faces high supply chain risks in large LNG carriers and luxury cruise liners, though Chinese shipping equipment lags European versions in many cases.

As a result, Chinese shipping supply chain influence raises security concerns for Western economies. Beijing most frequently uses financial, economic or state pressure tools to target companies and countries where there are readily available alternatives to their supply. **The costs to China of leveraging Western shipping companies' Chinese dependencies may recede if China can expand its autonomy in higher-tech shipbuilding, ship equipment, new shipping fuels and the vessels that depend on them (see Trend 4).** This could make Danish shipping companies more vulnerable to retaliatory trade actions across these domains should Sino-Danish or China-EU relations deteriorate e.g., due to more assertive EU/Danish trade and investment actions aimed at diversifying supply chains from China.

Five forms of Chinese leverage, with recent examples, could impact China's approach to European shipping dependencies in a more strategically competitive environment:

- **Passive:** Established foreign economic interests pressure home governments for stable ties with China e.g., the German auto industry's exposure to the China market.

- **Active:** Beijing uses its economic power, or the lure of Chinese FDI, to lock in its political and economic preferences, and potential advantages for Chinese firms e.g., Honduras severing diplomatic ties with Taiwan.

- **Exclusionary:** Beijing grants, denies or makes conditional access to China's domestic market to ratchet up pressure on foreign countries and corporates e.g., China requiring some foreign firms to form JVs with local partners.

- **Coercive:** Beijing attempts to inflict discrete punishments tied to discrete offences or slights by foreign countries and their businesses e.g., China banning Norwegian salmon after a dissident won the Nobel prize.

- **Latent:** Beijing uses the threat of playing the coercive cards it holds e.g., China enacting an export control law in response to US actions.

Increased Chinese self-sufficiency, decreased marginal gains from passive leverage or an increasingly zero-sum view of US or even EU-China trade ties **could push China to be more willing to activate exclusionary or coercive forms of leverage going forward, including potentially targeting European shipbuilding, ship finance or green fuel dependencies.**

Chinese port ownership within Europe also raises data leakage concerns, as well as concerns around the ability of the Chinese government to utilise port infrastructure to its strategic advantage in potential future diplomatic disputes or conflicts.

Furthermore, Chinese commercial shipyards are dual-use, constructing commercial and naval vessels alongside one another. Commercial and military shipbuilding can be complementary, though it may be more difficult to translate commercial expertise for naval vessel construction as naval vessels become more complex. As such, **Chinese shipbuilding predominance undermines European shipyards' ability to build and maintain warships, while European shipping companies' orders at Chinese shipyards risk indirectly contributing to the PLA navy's expansion.**

EU response: Improving connectivity and accelerating decarbonisation

While Europe remains a global leader in higher knowledge segments of the shipping industry – notably offshore, ship equipment, software and cruise liner construction – geostrategic vulnerabilities are created by its falling market share elsewhere, including ship financing. Among banks, European institutions still hold the highest market share of global ship finance, according to Petrofin data. But the rise of nonbank alternative forms of ship financing, stricter European prudential regulations compared to other jurisdictions and favourable lending schemes in Japan and China have led to Europe's overall lead in global ship financing being degraded. In Europe, banking makes up 70% of total lending to companies (versus, for example, 20% in the US).

The EU response to Chinese dominance of the shipping value chain will likely be oriented towards bolstering domestic decarbonisation and innovation capacity (see Trend 4) **as well as enhancing connectivity through new trade routes**, rather than significant deployment of trade tools to protect the industry. Shipping's inclusion in the EU emissions trading scheme will raise around €1.5-2 billion annually for investment in new fuels and shipping decarbonisation – though this remains low compared to the industry's total decarbonisation investment needs. Meanwhile, the EU's Global Gateway policy will provide support in developing transport links with developing countries.

EU member states' inbound FDI screening policies increasingly recognise the potential national security threats from Chinese involvement in critical infrastructure, making further acquisitions

of controlling Chinese stakes in many European ports unlikely. In some cases, existing Chinese ownership of port infrastructure may even be rolled back (e.g., at Gdynia in Poland). **Yet scrutiny of inbound FDI to European ports will ultimately remain a member state competence.**

US response: Revamping port infrastructure

Given the US's very limited role in global shipbuilding and ship ownership, the US response will likely centre on revamping port infrastructure and restricting investments in port ownership by potential adversaries. Danish companies are highly unlikely to be subject to these investment restrictions on national security grounds – which will focus mostly on China. Nevertheless, any restrictions imposed by the US on China's port presence, restrictions on Chinese software/hardware on board ships docking at US ports, or levies on Chinese-built ships **will increase pressure on European ship operators to comply and on European policymakers to pursue similar restrictions.**

Ports became a key part of the Biden administration's "small-yard, high fence" approach to protecting against national and economic security threats. US officials are highly concerned about the data collection capabilities of Chinese-made cranes and other port infrastructure – ZPMC manufactures 80% of ship-to-shore cranes used by US ports. In response, the Biden administration announced over $20 billion of investment in port infrastructure over five years, including to encourage greater onshore manufacturing of cranes. It also implemented a 25% tariff on imports of Chinese cranes. **Scepticism towards China's role in US ports will likely continue to harden, with potential for further investments to replace Chinese infrastructure, particularly as increased digitalisation and software reliance increase data vulnerabilities.**

IMPLICATIONS FOR SHIPPING AND THE MARITIME CLUSTER

- **Continued pre-eminence of Chinese shipbuilding.** China's industrial policy has entrenched the role of state-owned companies throughout the supply chain. Official targets to assert a lead in cleaner fuel ship construction are aligned with President Xi Jinping's desire to boost investment in "new productive forces" – and may portend further high levels of state support.

- **New trade corridors.** As the West looks to expand connectivity with Middle Powers and emerging markets, including through the Global Gateway scheme, demand for shipping through new corridors (e.g., the India-Middle East-Europe corridor) may emerge. This may be coupled with increased support for European shipping companies to invest in port partnerships in Africa and Asia, in competition with growing Chinese and Middle Power investments.

- **Fragmented EU port investment rules.** While EU FDI screening rules are tightening overall, screening remaining a national competency means rules on Chinese investment in European ports are likely to vary between member states. Germany may restrict Chinese investment stakes in critical infrastructure to below 25%, illustrated by COSCO taking a 24.9% stake in Hamburg's port in 2023 – a decision which drew criticism from France in particular for increasing European dependencies on China. Greece is one of only three EU economies to still not have passed inbound investment screening legislation.

#3. SHOCKS AND WEAPONISED CHOKEPOINTS

KEY TAKEAWAYS

⇒ Sudden disruptions from geopolitical shocks and weaponised shipping chokepoints are more likely against the backdrop of a structurally more competitive global environment

⇒ Market frictions from both Houthi attacks in the Red Sea and energy sanctions on Russia are likely to last longer than widely anticipated.

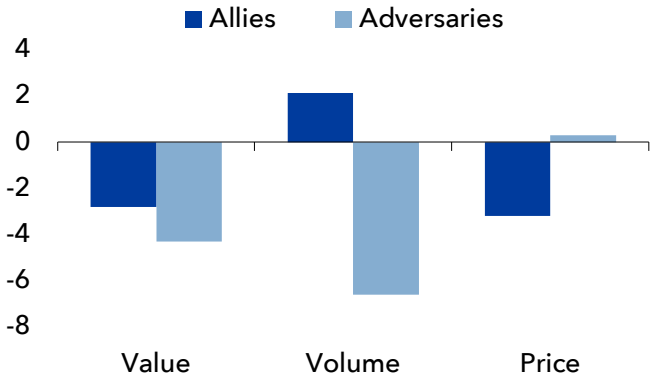
⇒ **Shipping implications:** Insurance premia at key chokepoints are likely to remain elevated, with insurers hedging against conflicts that could cause their closure.

Against the long-term backdrop of rising strategic competition, global shipping has faced a confluence of major and more sudden disruptions in recent years: COVID-19 disrupted port activities and raised goods demand relative to services; Western sanctions on Russia have fundamentally reoriented global oil, oil product and LNG flows; and the Houthis essentially closed the Red Sea to Western shipping companies in retaliation for the Israeli invasion of Gaza.

The Russia-Ukraine war has crystalised global fragmentation dynamics. IMF research shows that since Russia's invasion, trade and investment flows between US- and Chinese-led blocs fell significantly more than flows within those blocs (trade declined 12% more between blocs, while investment flows fell 20% more). European trade with members outside the US-led bloc has been particularly affected, driven by the sudden cut off from Russia's economy. This may be amplified by the US's June decision to expand extraterritorial sanctions power to enable targeting of any international firm transacting with Russian sanctioned entities – even absent a direct link to the Russian military-industrial complex.

FIGURE 8. RUSSIA-UKRAINE CRYSTALLISED FRAGMENTATION ACROSS BLOCS

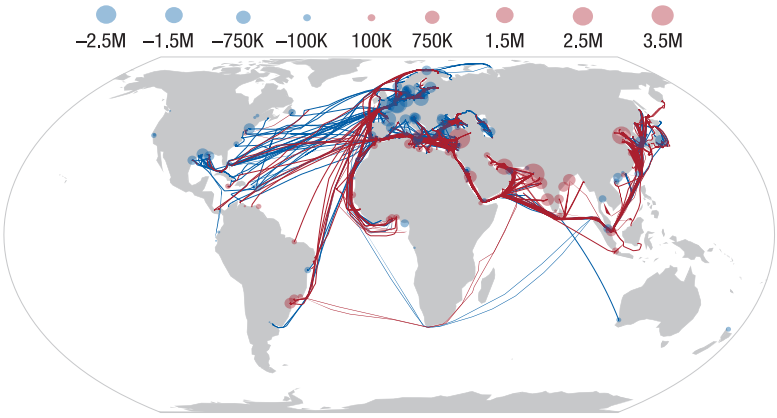
Changes in global goods trade between and within allegiance blocs in the year following Russia's invasion (%)



Source: Bank for International Settlements

FIGURE 9. SANCTIONS ON RUSSIA HAVE REWIRED GLOBAL ENERGY FLOWS

Changes in crude exports from Russian ports 2019 Q2-2023 Q2 (metric tons)



Source: International Monetary Fund

SPOTLIGHT: RUSSIA-UKRAINE AND TANKER SHIPPING

The war in Ukraine has reoriented global crude oil flows. The EU's December 2022 ban on Russian crude and crude product imports displaced around 4 million bpd of Russian supply to Europe. Jefferies estimates that effectively 5% of crude and product tanker capacity has been lost due to longer trade routes, placing significant upward pressure on freight rates.

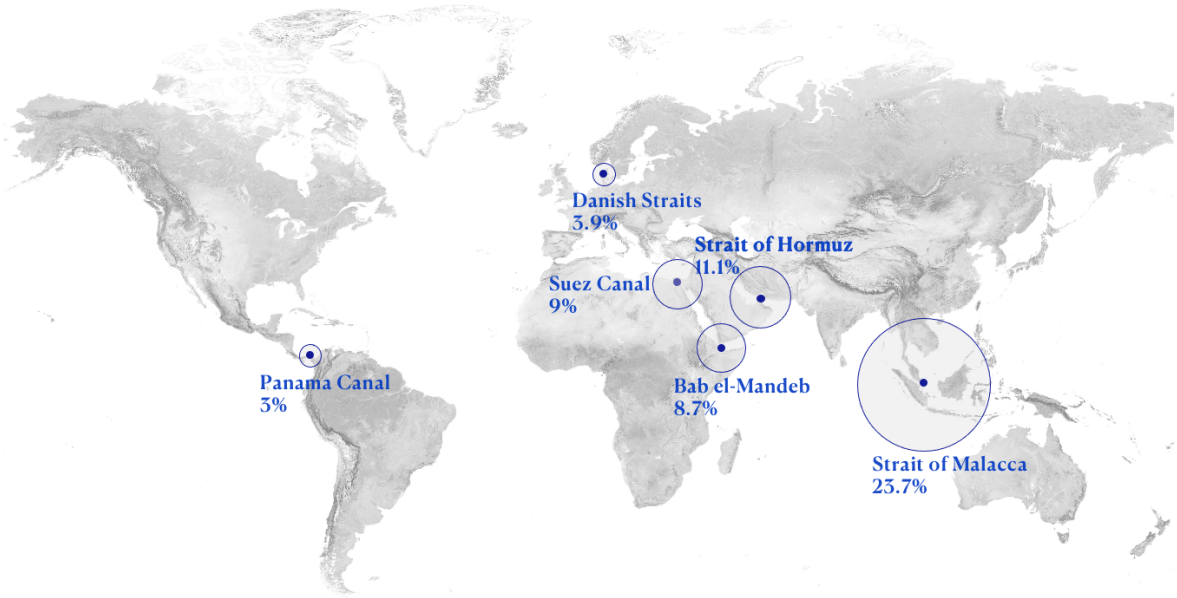
More recent US and EU sanctions efforts have looked to reinforce the G7 oil price cap by sanctioning specific Russian ships – with Russia undermining the cap by building out of a large shadow fleet. Kyiv School of Economics estimates suggest only 9% of Russian crude shipments and 61% of crude product shipments are covered by Western insurance – instead often being insured by Russian company Ingosstrakh. But **US oil price concerns and positioning on negotiations to end the war will likely prevent any new G7 actions that substantially increase market frictions.**

In LNG markets, a cut-off of Russian pipeline gas supplies for most countries has seen European LNG imports from the US treble. Despite Russia-EU LNG trade currently being above pre-invasion levels, **the EU's June 2024 ban on Russian LNG transshipment in EU ports will force Russia to reconfigure its Asian LNG trade, which had previously passed through hubs in Spain, Belgium and France.**

European sanctions on Russian oil are highly likely to remain in place even if a ceasefire deal can be struck. A stable, enduring and fully implemented peace settlement that is acceptable to both sides remains less likely than a frozen conflict in the medium-term; and Ukraine-sceptic member states (e.g., Hungary, Slovakia) already have sanctions exemptions, giving them less incentive to push for sanctions removal. **In the unlikely event that many EU countries are willing to lift legal oil sanctions under a ceasefire or peace settlement, political pressures and new sources of supply would still likely prevent direct purchase from Russia for some EU member states.**

FIGURE 10. KEY SHIPPING LANES ARE VULNERABLE TO GEOPOLITICAL DISRUPTION

Share of global shipping passing through key chokepoints



Source: Bloomberg

In a structurally more competitive global environment accompanied by heightened geopolitical risk, **the probabilities of existing disruptions to global shipping enduring for an elongated period and new disruptions emerging are elevated.** Global conflicts involving a state reached a record high in 2024 according to UCDP data, and Chinese military and maritime actions are provoking tensions with US-aligned countries (e.g., Japan, Philippines, India). Furthermore, the proliferation of uncrewed systems (i.e., drones) makes the Houthis' playbook easier to emulate. Iranian drones have been used by Russia in Ukraine, while the Houthis have also utilised missiles provided by Iran and potentially in the future by Russia – which could make them much more lethal in attacks against shipping and even potentially US warships. This higher volatility environment is reflected in shipowners purchasing larger tonnage to maintain flexibility in the face of shocks.

Compared to the integrating, free market-based globalisation that characterised the previous three decades, there now a higher number of tail risks which, although each individually unlikely to occur, would have significant impacts on shipping markets if they did. These include:

- Russian President Vladimir Putin escalating the war in Ukraine by extending attacks to a NATO member state or using a tactical nuclear weapon, causing the West to cut off Russia completely. This is highly unlikely as there are few strategic benefits to this for Moscow.

- The Trump administration ramping up sanctions on Russia further if it deems Moscow to be blocking the path to a peace settlement in Ukraine.

- The Houthis persistently extending the geographical scope of their attacks to the Indian Ocean should the war in Gaza restart – though their capacity to do so is questionable and they will likely remain focused on the strategic chokepoint of the Red Sea.

- Iran blocking the Strait of Hormuz, through which 20% of global seaborne oil passes. This would likely only occur in the case of a dramatic Middle East escalation.

- Aggressive Chinese actions in the South China Sea, triggering the US-Philippines mutual defence clause – though the Philippines currently has no plans to invoke this.

- In the most extreme case of escalating US-China competition, a Chinese invasion of Taiwan, causing the US navy to blockade the Strait of Malacca. Beyond major direct shipping disruptions, this would also severely deepen and broaden US and EU decoupling from the Chinese economy.

Recent disruptions have brought higher freight rates for shipping firms. But **there is a significant risk that weaponised chokepoints and geopolitical shocks elongate the trade routes of European shipping companies but not their non-European rivals, who continue to transit unaffected.** This risk is exacerbated by Chinese global port influence; with China controlling ports at the entry to and exit from the Panama Canal, for example, European vessels may face less preferential access, as passage through the Canal remains constrained due to drought.

SPOTLIGHT: RED SEA DISRUPTIONS

Houthi attacks on Western shipping companies in the Red Sea have reduced shipping through the Suez Canal by over half, with almost all Western companies choosing to transit between Europe and Asia via the Cape of Good Hope instead. The costs of this elongated route have effectively reduced global container shipping capacity by 12%, according to Jefferies estimates, causing global container freight rates to rise four-to-five times.

Many shipping companies have continued to avoid the Red Sea despite the Houthis halting their attacks following a ceasefire in Gaza – removing their justification for attacks. The Houthis maintain a low attack threshold, **threatening to restart targeting of ships if contentious talks over Gaza's future collapse.** Meanwhile, Trump's maximum pressure strategy on Iran or an Israeli strike on Iran's nuclear facilities (albeit unlikely in the near term) could push the Houthis to restart attacks as a counter-pressure.

As such, the current ceasefire in Gaza is a necessary but not sufficient condition for the sustainable return of safe shipping through the Red Sea. **The threat of Houthi attacks will endure for an extended period before shipping companies can be certain the Houthis have definitively ended their attacks.**

IMPLICATIONS FOR SHIPPING AND THE MARITIME CLUSTER

- **Fragmented shipping routes along geopolitical lines.** Houthi attacks have targeted Western vessels – which the Houthis deem to be linked to Israel – while Chinese ships have (mostly) been allowed to continue through the Red Sea unaffected. China has given diplomatic support to the Houthis, questioning the legality of US strikes and abstaining from a UN resolution condemning Houthi attacks. Countries' geopolitical alignment may continue to determine trade routes as tensions between major blocs intensify.

- **Higher insurance premia.** Red Sea attacks raised shipping insurance costs through the chokepoint by as much as 10-times, while longer journeys around Africa also bring higher premia. Even if the acute phase of hostilities subsides, greater awareness of regional conflict risks among insurers is likely to drive higher rates than the pre-war equilibrium.

- **Freight rate volatility.** Freight rates will move with geopolitical developments, as shocks and weaponised chokepoints translate to shipping capacity losses. This provides a competitive advantage to companies most able to anticipate geopolitical trends, such as the durability of Russia sanctions or the potential for the US-Philippines mutual defence treaty being triggered.

- **Sanctions compliance.** The Biden administration's January sanctions on Russia – all carrying secondary sanctions threats and likely requiring congressional approval to remove – marked a significant escalation, with many third-party financial institutions stepping away from engaging in oil trade. Now, with Trump looking to strike a deal to end the Russia-Ukraine war, the sequencing of any potential sanctions removal will be a critical issue for tanker markets. Any US sanctions removal is likely to be slow, partial and conditional on progress on the ground, with hardline congressional Republicans likely to frustrate this process.

- **Shadow fleets.** The size and market influence of the global shadow fleet is significantly expanding in the face of Western sanctions. This may impact the tanker market in particular – the shadow fleet is now potentially 20% of the global tanker fleet. This raises the risks of accidents and environmental disasters – Allianz data suggests Russian tankers have been linked to 50 incidents in the last three years including oil spills, engine failures and more for which they are uninsured – as well as having significant impacts on global oil market dynamics.

- **Potential for sudden breaks in port ownership.** In the extreme scenario of a US-China conflict, sanctions on Chinese companies would likely force the divestment of Chinese port ownership stakes in the US and EU, particularly where shipping companies are found to be linked to the Chinese military-industrial complex, as major players like COSCO likely would be.

#4. COMPETITIVE ENERGY TRANSITION

KEY TAKEAWAYS

⇒ The energy transition is increasingly defined by competition, not cooperation, as countries look to securitise their energy supplies including in e-fuels.

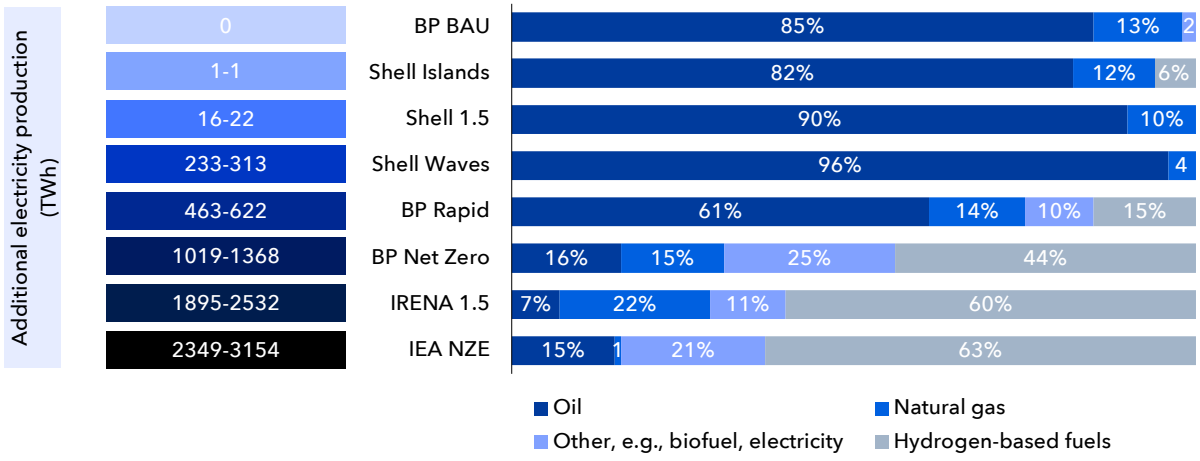
⇒ The shipping transition will require consistent regulatory and policy support, as it needs to accelerate to meet a pace consistent with global climate goals.

⇒ **Shipping implications:** Shipping companies face a shifting demand for fuel and other commodities and face high capex requirements to decarbonise their fleets.

The energy transition is being reshaped, as implementation shifts from the cooperation underpinning the Paris Agreement to competition characterised by green industrial policy and contested renewables supply chains. **Shipping companies face a shifting volume and location of demand for fuels and other commodities as a globally competitive energy transition alters trade flows. At the same time, they need to improve efficiency and overhaul their fuel sources to reach the International Maritime Organisation (IMO) target of net-zero emissions by 2050.**

Shipping companies face demands to commit to significant ship and port capex amid heightened uncertainty and competition around the supply of future fuels. Most ships purchased already need to be either LNG, dual fuel, or convertible to dual fuel to meet net zero targets – the average age of ships retired in 2023 was 27 years – while interim IMO targets require near-zero emissions fuels to make up 5-10% of the global shipping fuel mix by 2030, up from 0.5% in 2022. The Draghi report suggests that overall investment needs to decarbonise the European maritime sector total €39 billion each year.

FIGURE 11. UNCERTAINTY AROUND THE FUTURE USE MAKE-UP OF SHIPPING FUELS IS HIGH
Share of different fuel types in the maritime fuel mix by 2050 in different scenarios



Source: IEA, BP, Shell, IRENA

Green fuel upscaling will likely require intra-industry cooperation, coordination with other industries and government action, particularly facing higher interest rates that threaten to slow transition investment (see Trend 1). Yet high investment needs may come up against shipping companies' often low markups compared to large industrials, with inter-industry relations

regarding e-fuels upscaling currently characterised by competition over scarce resources. This reduces demand signals for suppliers to scale up production of new shipping fuels by reducing the number of long-term offtake contracts the shipping industry can reliably enter into. Recent decisions by Orsted to halt construction on its Flagship One e-methanol plant in Sweden and by Shell to scrap a biodiesel project in the Netherlands illustrate this dynamic. Orsted cited slower-than-anticipated market development as the key driver of its decision.

KEY FEATURES: GOVERNMENT INTERVENTION DRIVING ENERGY MARKETS AND TRADE

Competitive green industrial policy. The EU (Green Deal Industrial Plan), China (Made in China 2025) and many Middle Powers e.g., Saudi Arabia (Vision 2030), want to lead in green industries of the future through significant production incentives and subsidies including for hydrogen and hydrogen-based fuels.

Regulation driving fuel cost structures. Regulatory interventions to raise the relative cost of fossil fuels will be pivotal to driving new fuel demand. Maersk Mc-Kinney Moller Center for Net Zero Shipping estimates suggest the EU ETS and FuelEU could double conventional fuel costs by 2030 and multiply them by five by 2050.

Multi-fuel equilibrium. The shipping industry is shifting from reliance on heavy fuel oil to a range of cleaner fuels to meet net-zero, each with different supply chains and retrofitting requirements. These include: batteries for short regional routes and offshore; zero-carbon e-ammonia and e-methanol for ocean routes; LNG and biofuels to reduce emissions intensity at lower cost during the transition; and even on-board carbon capture and nuclear as currently experimental technologies.

The energy transition and strategic competition

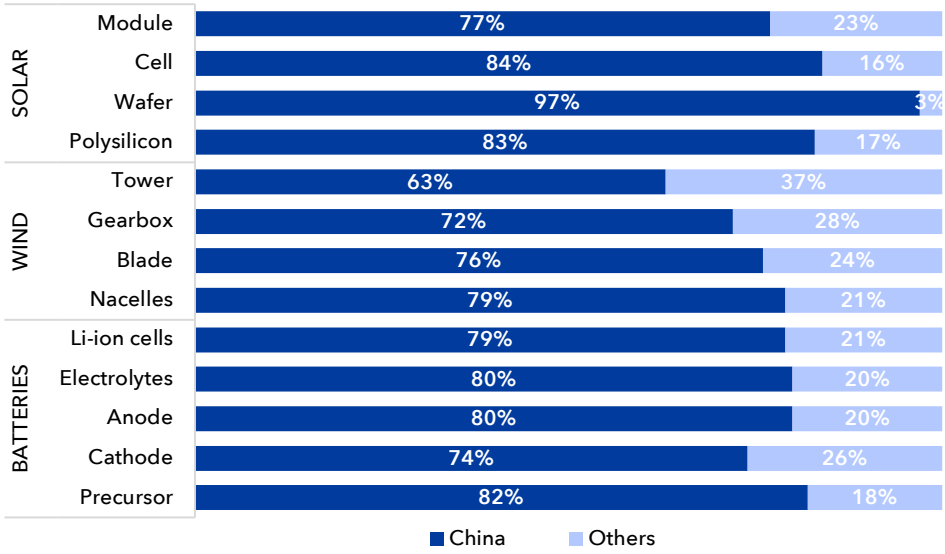
The Russian invasion of Ukraine confirmed energy security as a vital pillar of economic security. During the energy transition, **economic competition and supply-chain alliances will likely occur along existing geopolitical fault lines, creating demand for increased flows of critical minerals and fuels for the energy transition between geopolitically aligned countries.**

Already existing Chinese dominance of the supply chain for numerous green technologies (Figure 12) creates a difficult balancing act for the EU and emerging markets as they look to both accelerate their domestic green transitions and increase competitiveness in their own industries of the future. China also dominates strategic critical minerals refining – it refines 73% of global cobalt supply, 68% of nickel, 58% of lithium and 40% of copper.

With the Chinese economy facing structural challenges, China's export-led growth model is increasingly oriented towards reinforcing this manufacturing dominance, focusing on increased investment in "new productive forces," including green tech. Carbon Brief data suggests Chinese clean energy investment rose 40% year-on-year in 2023, accounting for all Chinese investment growth in that year. **These investments are supported by public subsidies as well as indirect support through subsidised upstream inputs.** For example, Minyang, one of China's largest wind turbine manufacturers, received subsidies worth 1.2-1.3% of its total business revenues in 2021 and 2022, according to the Kiel Institute for the World Economy.

Yet rising concerns about Chinese overcapacity, ESG, national security and unfair competition may limit the further expansion of Chinese market share in green industries in many countries:

FIGURE 12. CHINA DOMINATES GLOBAL GREEN ENERGY SUPPLY CHAINS
China's share across clean tech value chains, 2023 (%)



Source: Wood Mackenzie, IEA

- **US:** Foreign entities of concern (FEOC) terms in the US IRA severely limit the access of Chinese companies throughout green supply chains to US subsidies, while the Uyghur Forced Labor Prevention Act (UFLPA) is a potent tool for blacklisting Chinese solar suppliers. Prohibitive tariffs and import restrictions (e.g., on EVs) due to data security concerns will severely restrict Chinese expansion in the US market. Trump will likely continue these policies (for remaining IRA provisions) and ramp up similar supply-chain restrictions targeting Chinese goods for concerns including forced labour, overcapacity and – increasingly – embodied emissions.

- **EU:** Eagerness to avoid replacing the geopolitical vulnerabilities created by the EU's reliance on Russian natural gas with new vulnerabilities in clean energy supply is reflected in EU tariffs on Chinese EVs, an investigation into Chinese wind turbine production, ESG regulations including the Corporate Sustainability Due Diligence Directive (CSDDD) and Forced Labour Regulation (FLR) set to come into force in 2027, as well as support for upscaling domestic manufacturing capacity through the Net Zero Industry Act and the Critical Raw Materials Act.

- **Emerging markets:** Policymakers in some emerging markets will be content that China's export drive will cut costs. However, competitively priced Chinese exports could threaten ambitious industrial plans to bring value-added manufacturing onshore in markets like Brazil, India and Indonesia, some of which have imposed tariffs of their own on Chinese green goods. Each will manage this carefully, ensuring that there are sufficient incentives to bring in FDI that are highly specific to the context of their own economies.

The European shipping transition and strategic competition

The contours of the global energy transition matter for shipping because they will influence trade flows of green tech across markets (e.g., EVs) as well as the locations of future production of clean shipping fuels. The production of hydrogen-based shipping fuels is likely to be co-located near ports and similar infrastructure given the difficulty of transporting such fuels.

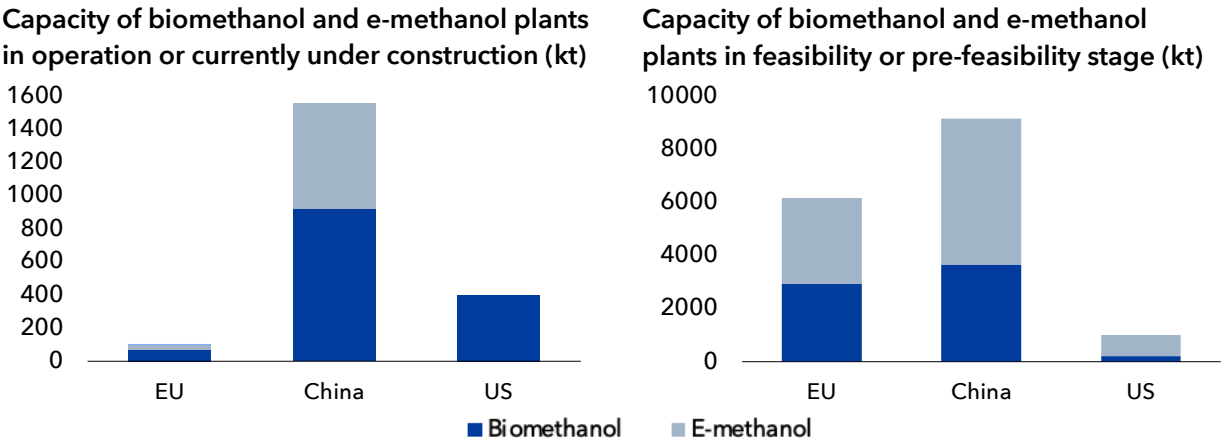
Major green shipping fuel producers (e.g., of e-methanol, e-ammonia) will need sufficient renewable energy supply to meet rising demand for domestic purposes (e.g., industry, data

centres) and clean shipping fuel production processes. SIA Partners' calculations suggest Danish announced e-fuel projects would require 17% of Denmark's renewable energy capacity in 2030.

The EU is in a strong position to lead on e-fuels innovation. EU companies hold 60% of high value patents in new fuels development; 30% of the most innovative electrolyser companies globally are European; its regulatory structure is well developed through the Renewable Energy Directive, FuelEU Maritime and shipping's inclusion in the EU emissions trading system (ETS); and the EU has expertise in carbon capture for blue ammonia. Furthermore, **the EU has adopted a target to match 40% of deployment needs for green fuels with EU production capacity** – with European Hydrogen Bank support for upscaling domestic production and imports.

Yet the EU's global competitiveness in green fuels will ultimately depend on reducing their production costs – including through policy support and significantly scaling up the supply of cheap renewable energy inputs. Maersk Mc-Kinney Moller Center for Zero Carbon Shipping calculations suggest energy costs accounted for up to 48% and 52% of the total costs of European e-methanol and e-ammonia production respectively in 2023. Major European projects are being explored – Maersk and the Spanish government are investigating the potential for producing 2 million tonnes of e-methanol per year – but these projects require guaranteed demand to become operational. On the other hand, shipping company demand for green fuels already outstrips supply, but this demand is price dependent. If shipping companies have to pay a significant premium to source green fuels from Europe, they will look elsewhere.

FIGURE 13. THE EU LAGS CHINA IN METHANOL PRODUCTION, BUT IT CAN UPSCALE



Source: MAP, Methanol Institute

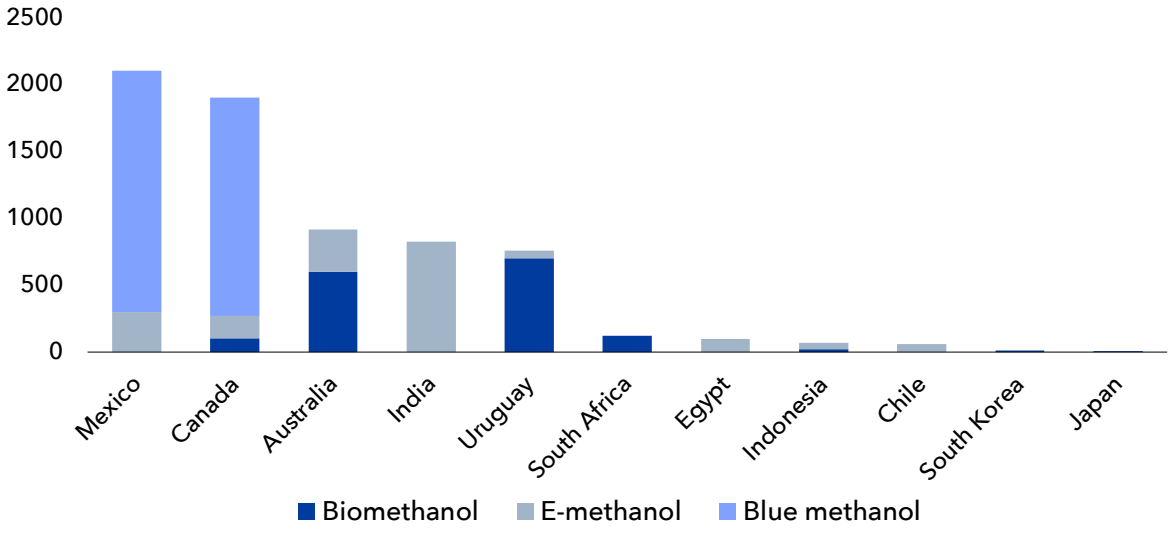
Meanwhile, the EU faces new supply chain vulnerabilities in upscaling the supply of e-fuels for shipping. Despite a strong electrolyser manufacturing pipeline likely to increase the EU's share of global electrolyser production (including through the Danish Power-to-X Strategy), the EU produces 1-5% of the raw materials required for electrolyser production, creating geopolitical exposures in the upstream supply chain. China is likely to develop a cost advantage in electrolyser production as mass manufacturing scales there. European shipping companies looking to accelerate their green transitions currently remain highly reliant on Chinese shipbuilding for dual-fuel vessels and green methanol produced in China to power them. Furthermore, **the build out of European renewable energy remains highly dependent on Chinese inputs at risk of EU trade measures and Chinese countermeasures.**

Yet the heterogenous nature of new fuels creates room for regulatory divergence that may reinforce existing geopolitical fault lines e.g., through differential definitions of 'green'

hydrogen across markets. The EU has leveraged this, commissioning a public consultation on defining clean hydrogen, preventing the Hydrogen Bank from lending to any electrolyser project with over 25% of its stack sourced from China, and imposing new import duties of up to 36.4% on Chinese biodiesel amid allegations that China was utilising banned products in its supply. European policymakers may opt to tighten standards to wall off the European market to foreign competitors with perceived weaker environmental standards.

Regardless, **significant EU imports of e-fuels will be required even if production targets are met.** As such, the EU may seek to expand partnerships with geopolitically aligned economies with significant e-fuels production potential given favourable renewable resource.

FIGURE 14. GLOBAL PARTNERSHIPS CAN HELP DIVERSIFY EUROPEAN COMPANIES' SUPPLY
Capacity of biomethanol and e-methanol plants in operation, currently under construction, or in the feasibility or pre-feasibility stage (kt)



Source: MAP, Methanol Institute

IMPLICATIONS FOR SHIPPING AND THE MARITIME CLUSTER

- **Potential trade-offs between cargo volumes and transit time.** New fuels including e-methanol and e-ammonia have a significantly lower energy density than traditional fuels. In the longer term, this may reduce ships' effective capacity, forcing companies to choose between carrying less cargo and refueling more often. Dual fuel ships will help to mitigate this in the short to medium term. Higher investment in development of engines capable of using e-fuels may be required to reduce transition costs, minimise trade-offs through efficiency gains and limit dependence on China for construction and renovation.

- **Regionalised energy markets.** A decarbonised world will rely more on electricity, organised through national and regional rather than global markets. The ability to produce clean electricity at low cost will be a significant competitive advantage in producing shipping fuels. The IEA projects that in a net-zero 2050 world, total energy-related trade will be 38% of its level on its current trajectory. Demand for new fuels with lower energy density than oil and the likely rising share of transported LNG in natural gas trade will likely reduce the impact of overall lower energy trade on global shipping volumes. IRENA estimates suggest half of net zero fuels will be transported by ship.

- **New financial instruments.** Higher investment in development of engines capable of using e-fuels may be required to reduce transition costs, minimise volume-time trade-offs through efficiency gains and limit dependence on China for construction and renovation. Maersk issued green bonds in 2021 and 2023 to finance its development of low-carbon methanol vessels.

- **Higher port investment requirements.** Bunkering capacity may become more dispersed should ships need to refuel more often, while overall bunkering capacity may need to be larger to accommodate lower density new fuels for shipping. Significant investment in pipelines will be required for countries to import net zero fuels once they have been delivered by ship. To this end, Western governments are aligning around coordinated investments in green shipping corridors. Within Europe, ports will have to invest in charging stations to enable ships to access onshore power supply when at berth in compliance with FuelEU, while shipowners will face high renovation costs to equip their ships to access onshore supply.

- **Substantial efficiency investments.** Given immediate cost barriers and uncertainty around both the future cost and speed of upscaling new fuel supply, efficiency investments will likely provide a substantial return. Early movers may see cost benefits as higher demand for retrofitting and streamlining ships to meet climate targets in the second half of the decade drives lower shipyard operational capacity.

- **Upstream supply chain investments.** With existing supplies of new fuels limited, major shipping companies with strong balance sheets can invest in upstream supply chains to secure new supply and shape their own geopolitical exposures.

- **Green premium.** Over the long-term, as companies target their scope 3 emissions to reach science-based emissions targets, a green premium is likely to gradually be built into freight rates even it does not yet exist in the market. This, however, will require tightening existing emissions targets for shipping at regional and global levels and a level of coordination with developing countries in particular to minimise carbon leakage towards lower standard freight operators.

- **Increased crew training requirements.** Bunkering and transporting ammonia and e-methanol create new safety concerns versus traditional fuels, creating the need for stronger training and safety standards.

#5. TECHNOLOGICAL DEVELOPMENTS

KEY TAKEAWAYS

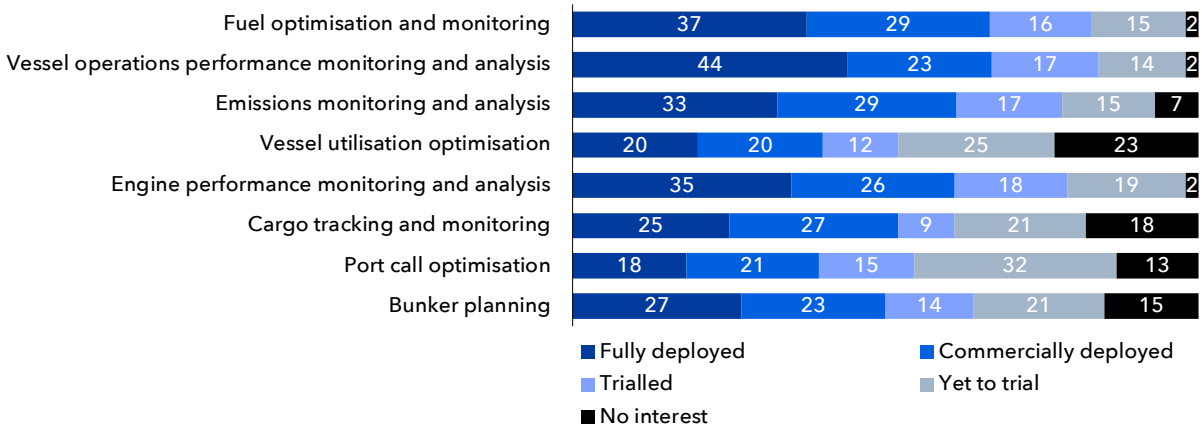
⇒ A range of emerging technologies have the capacity to increase shipping industry productivity and resilience as they scale-up in the coming years.

⇒ Tech developments may sharpen national security concerns around data and China exposures. Early adopters can place themselves at the centre of rewiring trade routes.

⇒ **Shipping implications:** To obtain the first-mover advantages associated with new tech, shipping companies will have to upscale their skills and cybersecurity investments.

Technological developments can significantly increase shipping industry productivity in the coming years. All parts of the maritime cluster may be impacted by emerging technologies – notably AI – that can optimise shipping routes, provide early warnings of ship repair needs, improve port organisational efficiency, digitise cargo documentation as well as automating parts of warehouse operations, cargo handling and shipping itself. McKinsey survey responses from shipping companies suggest that 87% have expanded tech investments since 2020, with 90% planning to at least maintain spending over the coming three years.

FIGURE 15. ROOM TO EXPAND THE USE OF DIGITAL SOLUTIONS FOR FLEET PERFORMANCE
Extent of shipowners' deployment of digital applications for fleet and vessel performance (%)



Source: Lloyd's List

Nevertheless, obstacles to implementation remain, including often significant capex requirements, higher skill requirements and the potential impact of labour-substituting versus labour-augmenting automation technologies on worker relations. Furthermore, implementation of innovative new tech is far easier for large shipping companies with stable balance sheets and large internal datasets than for smaller ship owners.

The 'softwareisation of everything' will be a key technological development for the maritime cluster. Systems maintenance will increasingly be carried out remotely. Yet this means more reliance on the software ecosystem, which often prioritises releasing a minimum working product and fixing flaws later. Remote accessibility may increase the vulnerability of shipping companies to cyber threats, meaning it is important for shipping companies to implement secure by design principles to minimise software vulnerabilities from the start as they upscale digital solutions.

First movers on new technologies may derive significant competitive advantages. For example, port owners implementing new processes to reduce berth times and better estimate ship arrival times will likely see increased throughput, attracting more business from shipping lines with cumulative benefits over time. Meanwhile, shipping companies utilising AI to improve traceability and reduce sales times will be able to offer more competitive rates. Optimisation of shipping processes and reducing berth times may be particularly beneficial as global supply chains rewire and trade route disruptions increase, creating new areas of demand and requiring shipping companies to rapidly optimise new routes under uncertainty.

KEY FEATURES: A RANGE OF TECHNOLOGIES WITH POTENTIAL TO INCREASE EFFICIENCIES AND RESILIENCE

Internet of things (IoT). Smart containers can boost supply chain visibility and enable centralised monitoring of container conditions. Drewry estimates that, by 2026, 25% of containers worldwide will be fitted with an IoT device.

Digitalisation. Shipping has been relatively slow to adopt digitalisation given high costs, industry fragmentation and high demand uncertainty. The Draghi report outlines that only 1% of European cross-border operations are fully digital. Improved European data sharing and standardisation, (e.g., through the European Maritime Single Window) will be key to successful deployment of other technological developments (e.g., AI), but raises cybersecurity threats.

Generative AI. AI is increasingly being used by shipping companies to optimise routes for safety and carbon-efficiency, improve onboard monitoring and safety as well as increase warehouse efficiencies. It is also being used to link data insights across the industry to predict port delays. Thetius data suggests that AI uptake in the shipping industry tripled in the last year. Maersk wants AI to handle up to 80% of its logistics tasks in the next 5-7 years.

Quantum computing. Though less developed than AI, some shipping firms (e.g., CMA CGM) are beginning to explore quantum computing uses for route and warehouse optimisation, future demand forecasting and contingency planning.

Blockchain. As digitalisation of maritime documentation is scaled up, blockchain can be used to connect data from across the maritime cluster to improve visibility and traceability of goods movement. Yet Maersk and IBM discontinued their TradeLens blockchain platform in 2022 due to lacking broader industry uptake.

Advanced automated systems. Automated processes can increase warehouse and port efficiencies – increasing port throughput. Only 8% of ports globally are at least partially automated. Within Denmark, LSP Ship Factory believe that they can increase Danish shipbuilding productivity by 60-80% as they look to automate the construction process. Furthermore, shipping companies may eventually be faced with the question of how far they can automate on-board operations, and how to eventually scale-up autonomous shipping, given progress made by companies including Orca AI, the IMO's forward leaning position on autonomous ships and the success of autonomous shipping operations e.g., Yara Birkeland (an autonomous and fully electric ship carrying fertiliser between ports in Norway).

Cybersecurity. Rising IoT data availability, increased software use and automated systems increase the maritime industry's vulnerability to cyberattacks. Yet new technological innovations (e.g., using AI and quantum computing for pattern recognition) can help to protect against them by providing early warnings and defences against unusual activity. Effectively implementing security by design is key to balancing the potential cyber risks and resilience rewards from new tech.

Technological developments may also influence the impact of other key trends on the shipping industry:

- **Strategic competition.** Increased software reliance may sharpen national security concerns, particularly if ports in Western countries rely on Chinese entities for these solutions. For example, many European ports (including Antwerp, Zeebrugge, Valencia, Le Havre, Amsterdam, Gdynia and Stockholm) use LOGINK, a trade and logistics platform subsidised by the Chinese Ministry of Transportation. The US banned LOGINK after the U.S.-China Economic and Security Review Commission flagged it a national security threat.

- **Weaponised chokepoints.** The proliferation of uncrewed weapons systems used by the Houthis may push shipping companies to explore technological solutions (e.g., electronic warfare installations on board vessels) to increase their safety.

- **Energy transition.** Route and cargo optimisation software can minimise disruption to routes from new fuels and reduce overall shipping times and distances, creating efficiency gains.

IMPLICATIONS FOR SHIPPING AND THE MARITIME CLUSTER

- **Skills investment.** To capitalise on the potential productivity benefits of new technologies, shipping companies will have to hire and train individuals with expertise and experience in operating AI systems, as well as reskilling workers at risk from automation. Potential job losses can be limited by shipping companies focusing on lowering operating costs through installing labour-augmenting rather than labour-substituting technological solutions where possible.

- **Cybersecurity investments.** Increased software usage amid rising strategic competition may require increased cybersecurity investments to protect against data leakage, ransomware and multiple forms of cybercrime. 64 maritime cyberattacks were reported in 2023 by the Netherlands' NHL Stenden University of Applied Sciences' Maritime Cyber Attack database, mostly attributed to Russian state-sponsored actors, versus 21 reported the year before.

- **Potential consolidation of competitive advantage.** The significant capital and data availability required to integrate technological innovations into ships, ports and warehouses, as well as the ability to bear the foregone revenues while renovations occur, favour large companies with more resilient balance sheets. Productivity gains and lower operating costs may entrench the dominant position of those most able to invest.

- **Legal battles over data ownership.** Complex ownership structures of many ports may come into conflict with many ports' increased data reliance.

MARKET OPPORTUNITIES AND RISKS FOR THE DANISH MARITIME CLUSTER

The fragmenting economic and geopolitical landscape together with a more competitive green transition and rapid technological developments creates a fundamentally different operating environment for the Danish maritime cluster.

Shipping is a key strategic industry and is increasingly viewed as such by Europe's partners and competitors. **Going forward, the Danish maritime cluster will increasingly be influenced by geopolitics and government policies. Adapting framework conditions and shipping company strategies to this new geopolitical world is of key importance to maintaining and developing the prominence of the Danish shipping industry.**

Across the five trends outlined in the section above, this section outlines opportunities to capitalise on and rising risks to mitigate to ensure the ongoing growth of the Danish maritime cluster.

#1. GLOBAL ECONOMIC REWIRING

Opportunities

- **Middle Powers' port infrastructure (port management and operations).**[3] The rewiring of global supply chains as well as the economic and demographic development of emerging market and developing countries will increasingly push global trade through economies able to position themselves as trade intermediaries or alternative manufacturing locations to China. Alongside connectivity schemes such as the EU's Global Gateway, European shipping companies can increase investment in the major ports of the future, tapping into developing global trade routes.

- **New financial instruments (maritime services – ship finance).** Growth in financial instruments to manage risks, increase resilience and develop new service offerings to oversee new routes and trade patterns could provide opportunities for European funds and insurance companies to expand their offering to shipping companies worldwide.

Risks

- **More competitive port infrastructure investments (port management and operations).** While global trade rewiring creates new opportunities for overseas port investments, European companies may also face stiffer competition for these investments by foreign companies also looking to exert greater control over shifting global trade routes. UAE-based DP World has announced $3 billion of investment over three-to-five years in African port and logistics infrastructure, while Africa overtook the Middle East as the overall beneficiary of the most Chinese BRI engagement in 2023 – with Chinese state-owned companies building, financing or operating 46 African ports.

[3] Parentheses indicate the parts of the Danish maritime cluster affected by each opportunity/risk. The maritime cluster is made up of shipping companies as the central element, with other components revolving around shipping company operations; offshore vessels; shipbuilding/shipyards; shipping fuels; port management and operations; and maritime services, equipment and products.

#2. STRUCTURAL STRATEGIC COMPETITION

Opportunities

- **High knowledge industry advantages (shipbuilding, offshore infrastructure).** European labour costs are likely too high to effectively compete with China on construction of less complex shipping models. But higher knowledge and R&D requirements for new dual-fuel engines, vessels to support the low carbon economy (including offshore wind, cabling, oil and gas exploration and now potentially carbon capture and storage), energy transport (e.g., LNG vessels) and higher-tech ship components can help European shipping companies maintain their lead in higher value-added manufacturing as the energy transition and technological developments increase demand.

- **Port revamps on national security concerns (port management and operations).** In countries growing increasingly concerned about the prevalence of Chinese infrastructure and investment in domestic ports (e.g., the US), there may be opportunities for European companies to expand their presence with government support.

Risks

- **High levels of Chinese state support (shipbuilding, shipping fuels).** The increasing orientation of the Chinese economy towards investments in "new productive forces", alongside the Chinese government's aim to build more than half of new ships powered by lower carbon fuels by 2025, may threaten European leadership in the higher knowledge areas of shipbuilding where it is able to maintain a competitive advantage. With the Chinese government covering 13-20% of the costs of building a cargo vessel according to LSE research, there is concern that industrial policy driven overcapacity could further damage European shipbuilders.

- **Geopolitical supply vulnerabilities (shipping company operations, shipbuilding, shipping fuels).** The predominance of Chinese companies throughout the shipping supply chain; Chinese dominance of oil tanker, dry bulk carrier and container ships' construction; and reliance on Chinese green fuels as well as Chinese supply chains for domestic clean fuel production create European supply vulnerabilities to the sudden implementation of trade barriers.

- **Fragmented capital markets in an age of growing non-bank lending (shipping company operations, maritime services: ship finance).** Europe continues to heavily rely on bank-based ship financing, given its fragmented capital markets. As European prudential regulations tighten further through the imposition of Basel III regulations and Europe's competitors (e.g., China, Japan) continue to offer favourable financing terms, Danish shipping companies risk having to further broaden their financing sources beyond Europe, despite the prominence of specialised Danish ship financing banks.

#3. SHOCKS AND WEAPONISED CHOKEPOINTS

Opportunities

- **Shifting demand sources (shipping company operations, offshore).** Re-routing due to weaponisation of chokepoints, shocks and the regionalisation of trade could create opportunities for an increase in volume of regional and/or specialised ships (including to service offshore facilities) and the creation of new regional hubs.

Risks

- **Employee safety concerns (shipping company operations).** The ease with which the Houthi playbook can be emulated increases the risks from state and non-state actors to personnel transiting strategic waterways.

- **Less price competitive trade routes (shipping company operations).** In shipping lanes affected by geopolitical conflicts (e.g., the Red Sea), European shipping companies may offer more expensive freight rates than their differently politically aligned competitors, having to travel further to avoid chokepoints. Chinese ownership of critical strategic ports, e.g., at either end of the Panama Canal, may also lead to European companies facing less preferential access when looking to pass through strategic bottlenecks.

#4. COMPETITIVE ENERGY TRANSITION

Opportunities

- **European regulatory framework (shipping fuels).** Europe's more advanced regulatory framework relative to other countries will be important to enable investors to upscale e-fuels production against a more stable policy backdrop. The Danish 2022 Power-to-X Strategy can play a key role in supporting the upscaling of e-fuels. Nevertheless, potential investment into e-fuels production from ETS revenues remains far below total investment needs for European maritime decarbonisation.

- **European (including Danish) leaders in planned projects (shipping fuels).** Danish shipping companies e.g., Maersk, are frontrunners in creating both demand for and supply of planned e-fuels projects. European Federation for Transport and Environment research identifies 17 maritime e-fuels projects in development in Europe (and 61 overall with the potential to provide maritime e-fuels). SIA Partners' data suggests Denmark alone can provide 793 ktoe/year of e-methanol and 252 ktoe/year of e-ammonia by 2030 based on existing active projects and projects under study.

- **Green financing (shipping fuels, shipping company operations, maritime services – ship finance).** If private investments into new maritime fuels can be appropriately de-risked through public and EU support, European ship financers could see financial benefits from being early movers on the green and digital transitions in shipping. The new EU Ship Financing Portal may decrease knowledge gaps between shipping companies and financers in this space, creating a more efficient use of European shipping capital.

Risks

- **Tighter lending conditions (shipping fuels, maritime services – ship finance).** Orsted's August decision to not pursue e-fuels production at its Flagship One plant in Sweden reflects the vulnerabilities of e-fuels projects in development to tighter financial conditions amid uncertain demand.

- **Carbon leakage (shipping company operations, shipping fuels).** Europe's regulatory structure, while positive for upscaling energy transition investments, also requires coordination with less developed regulatory regimes to prevent business shifting to foreign shipping companies with lower costs given weaker environmental standards.

- **Capacity issues and political conflicts from upscaling e-fuels production (shipping fuels).** While scaling up production of e-fuels to meet EU targets is technically feasible, it will require significant renewable energy inputs or substantially increased deployment of carbon capture. As scaling up production of renewable energy in Europe overall faces challenges and against potential consumer backlash to the costs of the energy transition, providing sufficient e-fuels supply risks being viewed as lower priority than providing clean electricity for people's homes and emerging industries, including AI. Yet shipping companies will still be obliged to meet their emissions targets.

- **China dependencies if projects are not realised (shipping company operations, shipping fuels).** If many of the European projects currently at the engineering, pre-feasibility or feasibility stage cannot make a strong business case for construction, European shipping companies' will likely be highly dependent on Chinese green fuels to meet energy transition targets. This raises risks for the security of Europe's energy transition, should fuel supplies ever be targeted in a diplomatic dispute or in the worst-case scenario of a China-Taiwan conflict.

#5. TECHNOLOGICAL DEVELOPMENTS

Opportunities

- **Technology-driven efficiency gains (shipping company operations, port management and operations).** Integration of data-sharing and digitalisation – especially through the European Maritime Single Window – and the integration of new technologies including AI can help to significantly improve the productivity of European shipping and port operations, with enhanced benefits for early movers.

Risks

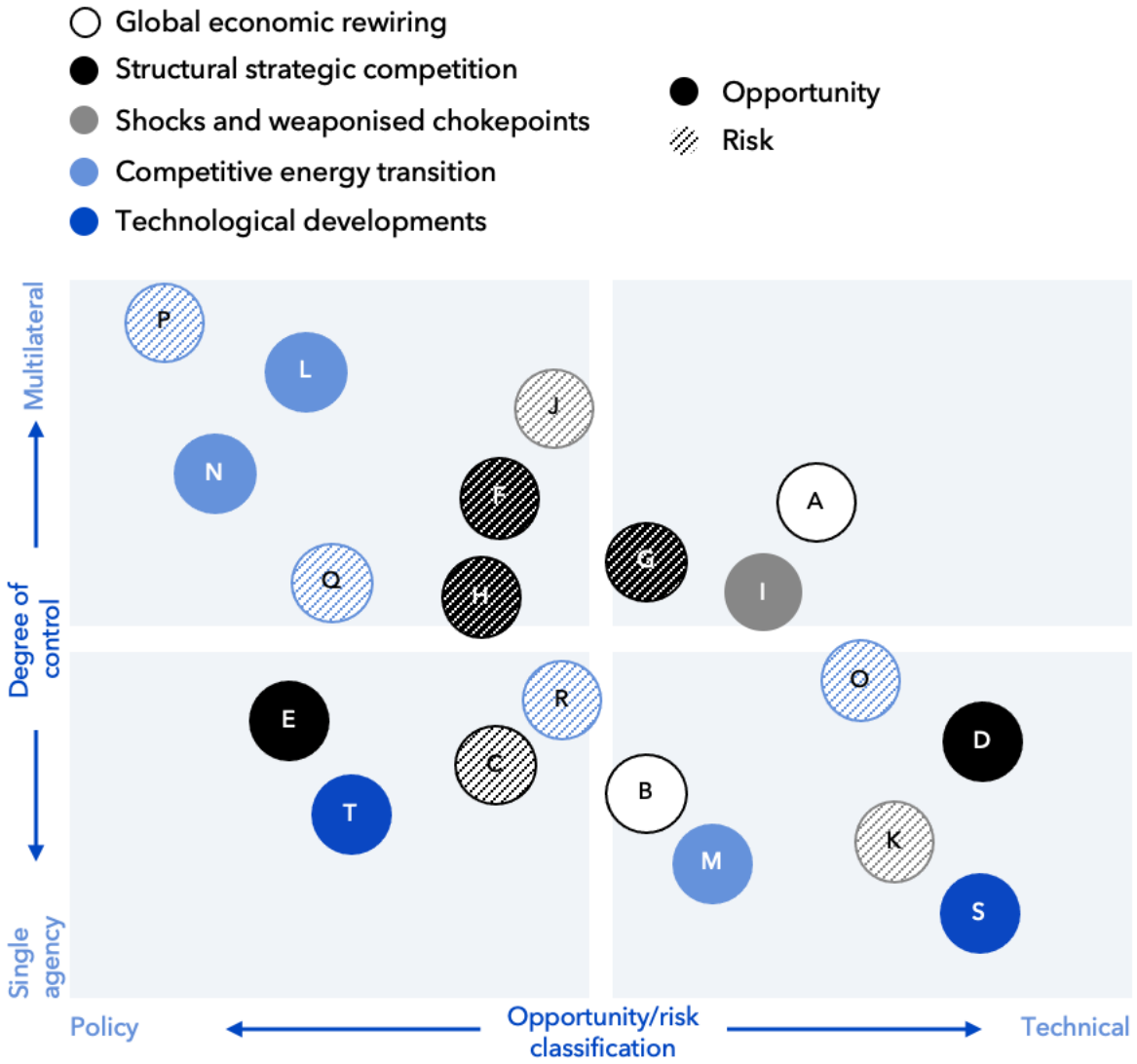
- **Weaponisation and data leakage (shipping company operations, port management and operations).** The significant presence of Chinese infrastructure in European ports – as well as majority ownership of numerous major European ports by Chinese state-owned companies – raises data security risks as port operations become increasingly digitalised, as well as raising operational risks that infrastructure could be weaponised in the extreme case of a US-China conflict.

CATEGORISING MARKET OPPORTUNITIES AND RISKS

As a guide for understanding possible responses, options and solutions, Figure 16 categorises opportunities and risks by whether they are policy related or technical/physical in nature, and by whether agency in addressing them is located within an individual entity or is multilateral in nature (i.e. how far a single actor, an individual company or government, can address them).

Different policy actions and strategic investment decisions by shipping companies are required depending on the nature of the challenge: multilateral policy solutions need a comprehensive stakeholder strategy of engagement (for example to derisk and upscale green financing and capitalise on the EU's green fuels regulatory framework), while 'single agency' technical solutions require a targeted focus by industry players to identify and capture opportunities or minimise risks (for example in AI-driven efficiency gains or in offshore vessels for the low carbon economy).

FIGURE 16. OPPORTUNITIES AND RISKS FOR THE DANISH MARITIME CLUSTER, CHARACTERISED BY LEVEL OF SINGLE AGENCY CONTROL AND POLICY/TECHNICAL NATURE



Global economic rewiring

A. Middle Powers port infrastructure
B. New financial instruments
C. More competitive port investments

Structural strategic competition

D. High knowledge shipbuilding
E. Port revamps on national security concerns
F. Chinese state support
G. Geopolitical supply vulnerability
H. Fragmented capital markets

Shocks and weaponised chokepoints

I. Shifting demand sources
J. Less price competitive trade routes
K. Employee safety concerns

Competitive energy transition

L. European regulatory infrastructure
M. European/Danish leaders in planned projects
N. Green financing
O. Tighter lending conditions
P. Carbon leakage
Q. Political conflicts from upscaling e-fuels production
R. China dependency if projects not realised

Technological developments

S. Tech-driven efficiency gains
T. Weaponisation and data leakage

Source: MAP

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