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« Maritime transport over the long term : historical perspectives and future prospects »

The maritime transport sector and global ports evolve within an economic context that has been structurally shifting across decades and centuries. This macroeconomic landscape, which fundamentally drives international trade pipelines, is tightly intertwined with volatile national and institutional political climates. To these core dynamics must be added the pivotal role of technical and technological breakthroughs, which progressively reshape the planet, explicitly encompassing the maritime industries. Finally, any rigorous analysis must factor in the changing paradigms of energy utilization, now defined by greenfield variables: global warming and strict carbon footprint decarbonization targets.

This study provides a retrospective review of 175 years of shipping history, mapping out its integration across consecutive political, economic, and technological eras, while ultimately evaluating whether the contemporary maritime industry is crossing the threshold into a completely new historical epoch.

1850–1910: The Dawn of the First Globalization Era

During the second half of the 19th century, the developed world entered a completely unprecedented phase of international commerce, characteristically marked by the emergence of free trade. Originally catalyzed by the political victory of the British Liberals in 1837, the free-trade doctrine expanded across the English Channel, fundamentally reshaping Franco-British commercial relations through the landmark Cobden-Chevalier Treaty of 1860.

Concurrently, the industrial standard of Napoleon III's France, industrialized Belgium, and the Netherlands consolidated their economic statures, most notably as a newly unified Germany required unassailable access to the maritime and port outlets of the Rhine River corridor. A symmetric integration path unfolded across a newly unified Italy, which rapidly asserted itself as a primary incubator for industrialization and technological innovation. Across these diverse nations, political liberalism steadily gained ground via democratization, while social progress and labor rights were forcefully driven forward by the growing leverage of organized working-class movements.

Nevertheless, this liberal free-trade expansion repeatedly collided with mounting geopolitical friction. The Franco-Prussian War of 1870 locked France and Germany into a lasting, structural opposition. The fierce colonial race tearing through Asia and Africa, the intense rivalries pitting imperialist superpowers (such as the United Kingdom and the Russian Empire) against one another, and the intricate territorial entanglements fueled by nationalist independence movements across the Balkans rendered international relations profoundly chaotic and frequently warlike.

On the global stage, Imperial China operated as a coveted prey for all imperialist powers, including a rising Meiji Era Japan, which successfully projected its military and industrial ascension by triumphantly defeating Russia in the Russo-Japanese War of 1905. As for the United States, its military conflict with Spain in 1898 coupled with the assertive extraterritorial interventionism of the Monroe Doctrine permanently established Washington as a top-tier global superpower.

From an industrial standpoint, the 19th century witnessed the dramatic acceleration of the First Industrial Revolution, primarily spearheaded by the steel manufacturing and textile sectors. This was the undisputed era of coal and steam propulsion, whose most structural landside application manifested as the rapid expansion of railway grids grid-locking entire continents over successive decades. Concurrently, information technologies recorded the historical birth of photography and the electrical telegraph.

A Second Industrial Revolution emerged at the close of the 19th century, characterized by the widespread rollout of electricity grids, breakthrough advancements in chemistry and pharmaceuticals,

and the engineering of the internal combustion engine. Powered by refined petroleum hydrocarbons, this engine propelled the very first automobiles, followed at the dawn of the 20th century by the extraordinary advent of aviation. Simultaneously, the telephone and the deployment of the first transoceanic submarine cables completely revolutionized both personal and collective communication streams.

Maritime transport was fundamentally transformed by these macroeconomic and technological cross-currents. Economically, the expansion of free trade, the consolidation of colonial empires, and the deep commercial integration of remote ranges (including South America, the Far East, and Australia) exponentially multiplied global shipping requirements. Concurrently, the merchant vessel itself evolved at a radical pace, driven by subsea engineering breakthroughs: including the transition to metallic iron and steel hulls, the adoption of steam reciprocating engines followed closely by the diesel internal combustion engine, the implementation of the screw propeller, and the rollout of marine radiotelegraphy. Next-generation cargo vessels, commanding significantly higher freight capacities, enhanced speeds, and unmatched transit regularities compared to legacy merchant sailing ships, began crisscrossing the global trade lanes. For passenger transits, ocean liners connected continents, carrying a monumental headcount of Western migrants alongside Chinese and Indian indentured laborers.

Auditing the control of the maritime world at the beginning of the 20th century delivers an unassailable diagnostic regarding the geographic concentration of economic and political power. In **1914**, while Western Europe (spearheaded by the United Kingdom, Germany, Norway, France, Italy, and the Netherlands) heavily dominated the global merchant fleet rankings, the top-tier of the matrix already featured the United States and Japan. This distribution reflected raw macroeconomic realities: the United States had structurally ascended as the world's premier economy, while Japan had already firmly locked in the 8th position globally.

For port complexes, this global expansion mandated an aggressive structural adaptation to unlock space, tailored both for bulk commodities and upsizing vessel drafts. Depending on localized coastal or estuarine configurations, port authorities engineered extensive networks of enclosed tidal basins, maritime locks, heavy quaysides, and stone moles. While individual cargo ships remained small by contemporary standards, they were exceptionally numerous.

To stock freight assets—which were initially lower in volume but high in financial valuation—port planning prioritized constructing multi-story dock warehouses located in the immediate vicinity of the berths. Their distinctive architectural footprints remain preserved today as highly revalued urban waterfront spaces in Liverpool (Albert Dock), Hamburg (Speicherstadt), and Marseille (Docks de la Joliette).

To absorb greenfield storage requirements, however, the industrial standard rapidly shifted toward the single-story cargo transit shed—the absolute zero-degree of architectural design, yet highly practical and cost-effective. Quaysides were made directly accessible to railway tracks, and primitive mechanical handling hardware accelerated stevedoring productivity, which nonetheless required the manual labor of thousands of registered dockers in every gateway. Finally, the port infrastructure operated as a highly productive industrial space, hosting active shipbuilding yards within virtually every major maritime city.

1910–1950: Eras of Total War and Global Macroeconomic Crises

It goes without saying that the first half of the 20th century was fundamentally cataclysmic. The world collided with two world wars alongside the rise of authoritarian regimes executing infinite violence against their proprietary populations and adjacent neighbors. The colonial order that European powers had spent a century building was on the verge of fracturing permanently. China endured a thousand storms—revolutions, civil war, and foreign invasion—while the Arab world initiated a profound structural mutation that the discovery of oil was poised to accelerate. Amid the ruins of Berlin and the ashes of American atomic bombs in Japan, an entire world came to an end.

Economically, World War I operated as a brutal ordeal that dragged on for Germany throughout the 1920s. On a global scale, however, prosperity eventually reclaimed its rights, and international trade flourished. The "Roaring Twenties" were identically driven forward by rapid advancements in mechanized transport and labor assets, including automobiles, commercial trucks, tractors, and aviation. Radio broadcasting and cinema transformed into widespread cultural items, while television began its historical narrative. By the 1930s, the baseline foundations of our contemporary technical and technological landscape were firmly locked into place.

Yet, the celebration ended abruptly in 1929. The Great Depression violently disrupted the global economy and contaminated the shipping sector, which experienced a severe contraction. Every

sovereign State implemented aggressive protectionist measures, shielding domestic coal and oil networks alongside strategic colonial supply chains. For maritime assets, this remained overwhelmingly the era of conventional cargo ships, while transatlantic ocean liners—still powered by coal—competed to deliver ever-increasing speeds.

Under the absolute imperatives of World War II, merchant vessels gained the structural efficiency of next-generation naval architecture; the automated welding of American *Liberty Ships* henceforth established itself as the global industrial norm. Concurrently, on the navigation bridges, the introduction of marine radar and high-performance telecommunications dramatically reinforced safety at sea.

Nevertheless, the most structural paradigm shift stemmed from a single commodity: **crude oil**. Extracted from remote basins, it mandated long-distance seaborne transportation. Tankers discharged their "black gold" into a new wave of downstream heavy industries: oil refineries. Consequently, port complexes, which had historically remained weakly industrialized, initiated a completely greenfield phase of their economic and spatial history.

1950–1990: The Formidable Momentum of Global Expansion

The collapses of Nazi Germany and Imperial Japan opened a new historical era dominated by two conflicting systems of values, economics, and geopolitical power. The second half of the 20th century was structured by the intense systemic rivalry pitting the Western bloc, masterminded by the United States, against the Soviet Union and Mao's China (following the 1949 revolution). While this Cold War flared into hot, violent conflicts in Korea and Vietnam, it also accelerated through decolonization movements. In practice, France, the Netherlands, and the United Kingdom lost their colonial empires, along with the captured captive shipping trades rattachés to them.

This bipolar East-West world was nonetheless pluralistic. What Nasser's Egypt resoundingly refused, Sadat's administration was mandated to accept: the inescapable existence of Israel, without resolving the core Palestinian question. Concurrently, the Gulf States discovered themselves as global energy superpowers, India and Pakistan operated as hereditary enemies, and Africa stood gorged with raw mineral commodities. Meanwhile, Japan woven a structural economic partnership with the United States that became exceptionally beneficial over subsequent decades—a development model later emulated by South Korea and Taiwan.

Once the initial reconstruction phase concluded, a historic era of prosperity unlocked for Western economies: the famous "Thirty Glorious Years", characterized by sustained demographic growth and breakthrough technological advancements. From the 1950s onward, television, automobiles for the masses, and commercial aviation formed the unassailable benchmarks of a world increasingly interconnected from all standpoints. Within nutrition, equipment assets, and leisure, the consumer society triumphed, driving a rapid expansion of urban centers and heavy infrastructures.

Maritime transport and ports changed radically once more. This new world commanded an immense volume of raw materials; the West imported coal, iron ore, bauxite, manganese, and nickel to feed its metallurgical furnaces. Crude oil was required for fuels, but also to supply the petrochemical and plastics industries invading daily lives.

Consequently, tankers evolved into supertankers (VLCCs and ULCCs) to exponentially scale up liftings on each voyage, and dry bulk carriers rapidly followed this movement. This initial frenetic race to gigantisme culminated in the engineering of true sea monsters during the 1970s.

Concurrently, agriculture underwent a profound mutation; heavily mechanized and accompanied by chemical inputs (fertilizers, pesticides), it transformed into a productivist industry. North American, Argentinian, Australian, and French grains were systematically directed toward Third World nations experiencing high demographic growth, but also toward a Soviet Union suffering from chronic agricultural deficits. Giant grain silos became the dominant landmarks of global agribusiness ports.

For the shipping world, the era of colonial trades and passenger ocean liners came to an end. Maritime commerce now demanded highly specialized fleets: alongside tankers and bulkers emerged car carriers, cellular container ships, refrigerated cargo ships (*reefers*), and ro-ro ferries.

While historical port nations preserved their ranks (Hamburg, London, Marseille, Genoa), the Greeks, Danes, and Norwegians carved out massive market shares thanks to highly ambitious, family-owned shipping empires. They successfully capitalized on the internationalization of the maritime world, leveraging open registries and flags of convenience (Panama, Liberia, Malta) coupled with low-cost Filipino seafarers. In Asia, giant Japanese conglomerates (*Zaibatsus* / *Keiretsus*) managed their

proprietary shipping divisions, while Hong Kong and Singapore firmly established themselves as premier global maritime hubs.

This was the golden age of Industrial-Port Complexes, which hosted heavy steel mills and a new wave of coastal refineries. Engineered on massive polders in Japan and the Netherlands (Rotterdam Europoort), or on virgin plots along the great global estuaries elsewhere, these extensive industrial waterfronts were designed to accommodate giant vessels serving massive, waterbound heavy industries.

As containerization began to emerge, it initially identified operational spaces within legacy port infrastructures. Rotterdam took a structural step ahead by developing its first major container terminal on a massive plot originally scaled for a steel mill that never materialized.

By the mid-1970s, the macroeconomic atmosphere shifted abruptly across the Western world under the pressure of multiplying factors. For raw geopolitical reasons, in 1973 and 1979, the price of crude oil skyrocketed. These consecutive energy shocks (*chocs énergétiques*) were accompanied by a form of technological trough within manufacturing modes and transport assets. The West suffered a severe contraction in productivity and innovation, leaving expanding space for Japan, which South Korea would emulatingly follow. A deep industrial collapse struck the United States and Western Europe, contaminating the shipping world as cargo volumes shrank. Consequently, legendary Western shipping lines entered a phase of terminal decline.

1990–2020: The Era of the Second Globalization

Politically, international relations evolved along a completely different trajectory. Structural reconfigurations within the USSR led to a progressive cooling of the Cold War, prior to the fall of the Berlin Wall and the collapse of the socialist system itself. With the rivalry of the blocs dead, a greenfield world order emerged, albeit plagued by civil wars in a dozen states and punctuated by multilateral international interventions in the name of peacekeeping. The world transformed into a multilateral space; with the dawn of the new century, global governance had to factor in a rising Communist China, the economic assertion of India, a Middle East disrupted by multi-layered crises (the Israeli-Palestinian conflict, Iraq, Iran, and the rise of Islamism), and the return of Russia under Vladimir Putin.

Economically, deep scars of the 1970s structural crisis persisted. In the United States, once the initial momentum of Reaganite economic liberalism faded, each growth cycle triggered an economic overheating that culminated in more or less severe crises (the 1987 Black Monday crash, the 2000 Dot-com bust, and the 2008 Subprime meltdown).

Nevertheless, fundamental elements had changed. The premier shift was tied to the resurrection of free trade; broken by the Great Depression, the free-trade doctrine recovered its strategic relevance under American hegemony, fueled by a highly developed Asia and Western Europe (which launched its own deep economic integration via the EEC).

The 1947 GATT structurally transitioned into the World Trade Organization in 1994. This new era of unrestricted free trade unlocked exponentially multiplied horizons for the maritime shipping industry. The freedom of cross-border investments combined with sweeping customs facilitations allowed multinational corporations to fully exploit global labor cost differentials, igniting the massive phenomenon of offshoring (*les délocalisations*) throughout the 1970s and 1980s.

The manufacturing of consumer goods within countries commanding low social costs identified an unassailable operational tool: containerization. Nothing stood better engineered to repatriate these mass-consumer commodities along with the high-tech marvels of Japanese engineering back to Western consumer markets. From the 1990s onward, containerized volumes expanded at an exponential velocity, and within three decades, cellular container ships quadrupled in physical size.

A milestone historical event thoroughly reshaped global trade: the official accession of China to the WTO in 2001. In a matter of years, the demographic giant transformed into a macroeconomic juggernaut. Beyond Beijing, the entire Asia-Pacific range was swept into this upward spiral. Concurrently, Africa, Brazil, Australia, Canada, and the Gulf States converted into super-exporters of raw materials and mineral commodities. Dozens of nations entered economic emergence, generating immense infrastructure and consumption requirements.

Globalization did not merely manifest as a higher volume of commodities routed toward Europe and the United States; it forged a greenfield world order characterized by multi-directional, cross-border flows of containers and raw materials threading a deeply integrated world (regulated by the WTO, EU, NAFTA, Mercosur, and ASEAN).

In 1995, mainland China captured a minor 3% share of global exports; by 2020, it masterminded 20% of the worldwide total. The *Made in China* trademark, channeled through container shipping, literally invaded the planet. The country concurrently sucked in unprecedented, historical volumes of raw materials (including soybeans, iron ore, nickel, bauxite, crude oil, and natural gas). China successfully locked in total command over the absolute bulk of its seaborne trade pipelines through the state-backed expansion of COSCO and China Merchants. Finally, the New Silk Roads (Belt and Road Initiative) materialized as a sweeping politico-economic master plan dedicated to constructing heavy transport infrastructures and global port networks tailored to align with shared interests across the Global South. This era operated as a golden age for the shipping industry, which progressively scaled up to handle a monumental 12 billion tonnes of annual seaborne freight. Naturally, the Great Recession of 2008 and the Eurozone sovereign debt crisis of 2011 delivered a stark reminder that unbridled global expansion commands structural limitations. Over-offshoring industrial employment toward emerging economies carried a severe macroeconomic price in the West. Within democratic frameworks, this friction nourished political populism on both the right and left wings, resoundingly contesting free-trade frameworks. The initial presidential victory of Donald Trump, the Brexit referendum, and the electoral success of populist coalitions already raised deep structural warnings.

Crucially, the world would not have transformed during the close of the 20th century without the exponential breakthroughs achieved in computer science. With it came the wholesale digitization of physical processes, the computerization of human workflows, the *dématérialisation* of shipping documentation, and the remote real-time monitoring of heavy machinery. Beyond transforming society, it unleashed immense productivity gains and multiplied high-tech solutions.

These emerging technologies successfully reinvigorated industrialized economies, ultimately preserving the dynamic drivers of the consumer society. Consequently, to the hyper-exchange of seaborne trade and aviation was added the hyper-connectivity of the Internet—channeled through transoceanic submarine cable networks—propelling an absolute hyper-consumption of energy.

Everything would have appeared flawless without the systemic consequences of early 21st-century human development: anthropogenic climate change. The massive burning of fossil fuel hydrocarbons emits catastrophic volumes of greenhouse gases (GHGs), triggering global warming. While Western Europe actively curtails its ecological footprint, the rapid industrial development of the rest of the planet mechanically erases these local advances.

The world must change, yet the structural question remains: can it? In the immediate term, the international community has chosen to strictly target the environmental impacts of maritime transport—which nonetheless accounts for only 3% of global GHG emissions—to the point of projecting its absolute total decarbonization by the 2050 timeline. Consequently, the 60,000 commercial merchant vessels that physically keep the global economy turning will be statutorily mandated to green their fleets at a breakneck velocity.

The maritime shipping industry has identically undergone a radical transformation; everything has scaled up. Merchant vessels have all experienced an intense race to gigantisme that collides only with physical infrastructure constraints. Deepwater container ports expand steadily in every nation across the globe, while the Suez and Panama Canals are continuously reformatted to absorb upsizing drafts. Concurrently, global ocean carriers and port handling corporations have heavily consolidated, leaving only a handful of key countries commanding the game—Western Europe, Japan, South Korea, China, Taiwan, and Singapore—operating through a sophisticated matrix of family-owned empires alongside private and state-backed conglomerates. The maritime infrastructure serving the globalized economy is locked in an iron grip.

The core question thus arises: Are we crossing the threshold into a completely new historical epoch?

The world has recently collided with singular, high-impact events that thoroughly disrupted the established order of things. The premier shock manifested as the COVID-19 crisis—ultimately less through its immediate public health footprint than via its macroeconomic cascading effects. Maritime transport was mechanically penalized across sectors tied to heavy raw material industries, yet experienced an unprecedented boom within trade lanes dedicated to the importation of consumer goods. To be entirely objective, over the long-term cyclical arc of history, this will likely remain merely a curious episode of collective lockdown policies.

Can Russia's war against Ukraine be analyzed as a historical fracture point (*une césure*)? Enacted as early as 2014 by the annexation of Crimea, Moscow's aggressiveness toward Kyiv erupted into a full-scale conventional armed conflict. Its primary macroeconomic consequence stems from Western

sanctions regimes, triggering a severe energy price crisis and historic inflation throughout Europe. This inflationary phenomenon identically struck the United States, albeit driven there by economic overheating tied to post-pandemic recovery packages, while mainland China is mandated to confront deep structural bottlenecks within its own hyper-development model.

Concurrently, the Middle East is once again engulfed in war; Lebanon and Syria have been violently disrupted, Iran emerges strategically weakened, and Yemen's Houthi rebels have forcefully demonstrated that they operate as armed gatekeepers to a vital choke point of global seaborne trade. Fortunately, maritime supply chains possess the technical capacity to bypass Africa via the Cape of Good Hope, and commercial fleets will simply wait for calmer horizons before reclaiming the Suez Canal route.

Ultimately, political imperatives override pure economic logic. The structural decoupling of Russia from the Western world resurrects a contemporary iteration of the legacy East-West confrontation. Under intense geopolitical pressure, Moscow is turning toward alternative allies—China, India, and the wider Global South—fostering the conceptual emergence of an *alternative globalization*. Looking toward the Far East, can China and the United States, despite being intimately intertwined economically, slide into an armed conflict over Taiwan? This is without even mentioning the highly unpredictable actions of North Korea.

This greenfield world order remains fundamentally multilateral, yet translates into a multi-conflictual spaces where each individual State acts out its proprietary, siloed interpretation of the world, driven by localized alliances and deep-seated rivalries. The ultimate cohesive binder remains the architecture of the globalized economy, which renders all actors deeply interdependent through the macroeconomics of trade. Yet, Russia has resoundingly demonstrated that raw political ideology can triumph over rational economic logic.

Most decisively, a paramount variable has completely changed the game: the presidential victory of Donald Trump in November 2024. The Republican administration, in its initial months of executive exercise throughout 2025, shattered two foundational pillars of global stability: the historical role of the United States as a geopolitical stabilizer and its systemic commitment to multilateral free trade.

The return of Donald Trump's aggressive commercial and tariff wars was highly anticipated by macroeconomists; if pursued with high intensity, it will permanently signal a decelerated globalization—a "slowbalisation"—unfolding within a fragmented landscape of state individualism and weaponized regional trading blocs. This structural fragmentation of the world closely mirrors the closing decades of the 19th century.

Consequently, a maritime transport apparatus currently calibrated for hyper-exchange will be forced to reformat its logistics, scaling down to more localized trade corridors driven by nearshoring and friendshoring dynamics. Under the geopolitical weight of the war in Ukraine, the legal and economic doctrine of "economic sovereignty" has ascended to the forefront, mandating the strict preservation of industrial tools vital to a modern nation, including energy self-sufficiency, naval shipbuilding bases, and cutting-edge tech supply chains. The strategic counterpart is "derisking"—the deliberate corporate policy of systematically avoiding "problematic" commercial relationships plagued by trade wars, international sanctions, or political degradation.

To this matrix are added two contextual pillars characteristic of every great historical transition: the energy equation and technological breakthroughs. While the second half of the 21st century was historically mapped out to witness the gradual decline of fossil fuel reserves, the paradigm has shifted toward their outright prohibition and banishment due to accelerated global warming. How will our contemporary civilization generate sufficient clean electricity to power the absolute entirety of human activities, including the shipping sector via synthetic e-fuels? We do not yet know the definitive industrial answer, but the required volumetric capacity will be monumental.

The industry must place its confidence in technological innovation. While past breakthrough innovations relied on computerization and communication networks to drive hyper-connectivity, Artificial Intelligence (AI) is henceforth making its grand entrance into contemporary civilization. This machine capability stands poised to assist and ultimately surpass human workflows, unfolding against a background screen dominated by American *techno-libertarianism*, European regulatory delays and reservations, and Chinese state-backed ambitions. Maritime shipping lines and port infrastructure networks will be directly confronted with the disruptive advancements of AI.

It remains deeply intricate to serenely assess one's proprietary historical era, and infinitely more complex to precisely isolate defining historical fracture points. In this year 2025, what structural realities do we

see? We observe the hyper-complexity of global geopolitics, active fractures slashing through historical hyper-exchanges, the relentless reinforcement of digital hyper-connectivity, and, above all, profound, existential questions regarding our collective capacity to stem the ecological disruptions of our planet. As for maritime transport, it will execute what it has always achieved across centuries: adapt and rewrite its models under the aegis of an inventive capitalism and of sovereign States fiercely protective of their blue economies.

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