



Decarbonisation in maritime logistics, as one of the major challenges and trends in the industry

By [Ricardo J Sanchez](#) & [Rodolfo Sabonge](#)

The challenges of maritime logistics are directly linked to the changes that occur during related activities which, in turn, can be analysed at different levels.

In the context of a study on decarbonisation, it is necessary to review the main changes that have taken place in recent times in maritime logistics, and those that could be foreseeable in the future. The rationale behind this statement is that nature, man's action on it, the interaction in societies, not to mention other factors that make up the world, cannot be considered in isolation, since the changes that occur in behaviors and actions throughout the planet have multiple repercussions, and there are no sectors of the world exempt from such influences.

The changes can be categorized into three main groups, together with others which may be associated or complementary.

Among the main ones are those originating from global shocks, those that are part of global or regional trends, and others that are purely national, which we will not address in this article.

The following chart shows the changes associated with the various categories:

| Shocks | |
|---|---|
| COVID-19 | Armed Conflicts with global impact |
| Climate change – recurrence of extreme natural phenomena | |

| Trends | |
|---|--|
| Green Transition | Industrial recomposition of shipping activities |
| Energy Redefinition | Financial ebbs and flows |
| Volatility in demand | Change in globalization and the growing importance of regionalization |
| Technological Revolution | Changes in Consumer behavior |
| Changes in the functioning of the maritime cycle | Redefinition of overseas trade routes |
| Changes in the ESG position | Changes in the tourism industry |
| Highly Relevant Occurrences: | |
| Brexit | Trade “wars” |
| Monetary and Fiscal Policies | Industrial Policies |
| Migration Processes | Cultural Transformations |

The authors

Global shocks are events which alter the course of things in an abrupt manner and although they may be of diverse origin, their effects are experienced throughout the world. Moreover, they stand out for having a strong impact in the short term, and because they leave their mark on major trends that are consolidated over time.

Among shocks, the following stand out: (a) those caused by the COVID-19 pandemic; (b) those resulting from armed conflicts that have global repercussions; c) those associated with climate change and the high recurrence of extreme natural phenomena.

The impact of COVID-19 and the Russia-Ukraine war have been repeatedly analysed and thus, will not be further discussed in this article. However, the recent addition of the conflict in the Middle East which has been expanding, has led to a high level of regional insecurity in commercial shipping, coupled with the virtual closure of the Suez Canal due to Houthi attacks from within Yemeni borders. Several shipping companies have already announced that they will not continue to pass through the canal until security conditions are improved. Added to this situation is the threat that the closure will extend to the Mediterranean Sea, an Iranian reaction to the United States military operation which leads a group of 20 countries in the Red Sea with the aim of restoring security. [1]

Associated with global shocks are some events external to the industry, which are highly relevant, although having different levels of impact, such as Brexit, trade "wars", monetary and fiscal policies in large economies, and industrial policies that are redrawing the global

map of manufacturing for export. Furthermore, this set of factors should also include the impact of migratory processes originating in internal problems, or occurring as a result of major armed conflicts, as well as certain cultural transformations taking place in developed countries.

Trends in the maritime industry

Associated with global shocks are trends which appear in the maritime industry.

As is currently the case with many other human activities, maritime logistics is also experiencing – or is beginning to experience – a green transition which involves a variety of actions necessary to increase the sustainability of the industry, attaining common objectives of preserving life and nature.

Within the green transition which in itself constitutes a key challenge, climate change has given rise to the initiative to decarbonise maritime transport. This also implies changes in designs, in marine technology and in cleaner fuels, leading the industry to "green" ships and ports. Consequently, the supply and distribution systems of traditional fuels such as Bunker-C and Diesel will be affected and require relevant transformations both at the global and individual country levels. Notwithstanding, energy redefinition of the industry is not only related to the introduction of new technologies and fuels, but also to the entry into the energy business by parties in the maritime industry.

From a corporate point of view, an industrial reconfiguration of shipping activities has been taking place, with greater concentration concomitant with vertical and horizontal integration and expansion into other industries (energy, aviation, logistics, finance, etc.). Similarly, a period of glaring financial swings is being experienced: evident in periods of mediocre – or even negative growth - followed by others of high profits, particularly since the COVID-19 pandemic.

The always dynamic trade context, in which ports and maritime logistics are strongly influenced by global, regional or national factors, is also concurrent with high volatility in demand (closely related to global shocks or certain pertinent events) and a significant sequence of trade frictions (originating in the aforementioned "trade wars", etc., not to mention a growing geostrategic confrontation).

In the same framework, two concurrent phenomena are noted: 1) changes in globalization, and a growing importance of regionalization, which is evidenced by the relative advance of movements on the great east-west routes vs. the intra-regional ones, starting with those in Asia; 2) changes in consumer behaviors, some of which are part of the *green transition* while others represent the boom in e-commerce and increased freight splitting, which in some cases improve the competitiveness of air transport.

In line with this, it is important to highlight the redefinition of overseas maritime trade routes (*long-range*), the greater relative importance of intraregional routes in Asia and Europe, and a reevaluation of older routes (in the case of Good Hope, associated with the blockade of the Suez Canal as a result of the accident of the Ever Given, and more recently owing to the insecurity of transit due to attacks from Yemeni borders), or even the irruption of new routes, such as through the Arctic.

On the other hand, the aforementioned short-term fluctuations in demand, added to the inelasticities of supply, also suggest a certain change in the functioning of the maritime cycle, which has an impact on transport prices and profitability. However, unlike other historical experiences, the application of measures that tend to counteract the effects of the traditional maritime cycle (laid-up practices, blank sailings, skipping ports, navigation speed, etc.) has recently been noticed; said measures have even managed to reverse cycles from loss to substantive gains.

Maritime logistics, of which maritime transport is a fundamental component, are sensitive to global shocks, given its centrally international character. In the most recent shocks, a first and important impact was the additional borrowing that countries needed, in addition to the fiscal and monetary expansion they resorted to, in order to deal with the crisis generated by the lockouts. These issues were of such magnitude that even the strongest economies in the world have not yet managed to regain a sense of normalcy in this regard.

In addition, and beyond short-term effects, the recent conflicts, commencing with that between Russia and Ukraine, have led countries to re-evaluate the importance of security and self-sufficiency in respect of food, a criterion which produces practical impacts on supply chains. Food security is part of a broader consideration within the overall topic of security, which also covers the physical security of goods and people, digital security of transactions in the face of growing cybercrime, legal and institutional security, as well as financial security.

A recent study conducted in 29 countries around the world, including the G20 and other major countries, indicates that people's top concerns are currently inflation (37%), poverty and social inequality (31%), crime and violence (30%), lack of employment (27%), political and financial corruption (27%), health care (21%) and climate change (18%), inter alia. Other areas which give rise to anxiety include threats of war, extremism and terrorism, and the loss of moral values.

Digital security is a special case. The increasing digitalisation of logistics extends to both the various means of transport and goods-handling facilities, including port infrastructure and financial transactions. Shifting part of the logistics activities to the digital domain entails exposure to new threats emanating from the IT environment. This digitalization involves the adaptation of infrastructures, their tasks and processes so that they support digital sophistication, and demands the specialization of qualified labor. Technological inequality and the inadequate skills of the workforce in charge of data centers fuel security

breaches in the systems. The characteristics of logistics activities make ports and other facilities like infrastructure, particularly vulnerable to cyberattacks from a dual perspective. On the one hand, they can become direct targets of any cyberattack directly aimed at countries or companies already exposed to cyberattack due to the impact of their activities. By way of example, the numerous cyberattacks on shipping companies in recent years, generating direct impacts throughout their logistics chain, are noted. On the other hand, the critical information that is housed in ports and other logistics facilities, the volume of data held by digital devices in their facilities, expose them to cybercriminal activity. To mitigate these risks, some countries in the region (such as Mexico and Brazil, to name a few) have implemented national strategies regarding ICT training.

Simultaneously, recent conflicts have reinforced the importance of accelerating the revision of the energy matrix, so that it comprises mostly renewable energy. While this is an ongoing issue closely related to the fight against climate change, it has become even more pressing since the beginning of the conflict between Russia and Ukraine. This shift will also have consequences for transport, as the replacement of petroleum products, and the places where they are produced, bring about changes in trade routes and exchange patterns.

As is the case in other industries, the maritime industry is also changing its orientation in ESG terms (i.e. the environment, society and governance), given that there is a growing demand for greater depth in this approach, which in turn has increasing importance in the economic and social panorama, while trying to make such a reorientation beneficial also in private terms. In any event, it is clear that it is necessary to improve world-wide services towards sustainability, taking social considerations into account, and to accomplish this, governance must be adapted.

The impacts on marine ecosystems also generate dynamism in maritime transport, mainly in the design of vessels, port infrastructures, technology and routes. Since 2010, in order to prevent air pollution from ships, the IMO has revised the MARPOL regulations, with a focus on reducing SO_x and NO_x emissions and having greater control over the extension of Emission Control Areas (ECAs). Also included in the IMO regulations are the Particularly Sensitive Sea Area (PSSA).

Finally, of far more significant relevance given its interseasonal nature, is the impact that climate change exerts on atmospheric events and the fact that it has already demonstrated that these could have a devastating effect on life on the planet. Rising sea levels, rising temperatures, changes in rainfall patterns, and changes in the intensity and frequency of natural phenomena make regions more vulnerable. It is therefore urgent that precautions be taken to improve the resilience and sustainability of maritime infrastructures which are among the most susceptible to the impact of climate change.

Global shocks and trends are largely reflected at the regional level. The trade friction between China and the United States has resulted in the relocation of part of the productive

capacity and some of the beneficiaries of this relocation are in the region, starting with Mexico, followed by some countries in Central and South America and to a lesser extent in the Caribbean. The relocation of productive capacities is having a direct impact on trade routes (for example, a land connection has recently been inaugurated in the Isthmus of Tehuantepec, which seeks to take advantage of this trend, although for the moment it is too recent to assess its actual effects).

The technological and digital revolution can be seen not only in the well-known technical progress of the industry (changes in propulsion, autonomous vehicles, intelligent navigation systems, etc.), but also in consumer habits. These have been disruptive for supply chains, given that commercial transactions carried out via e-commerce follow very different patterns when considered from a logistical point of view. In fact, distribution centers can be located in different locations. [2] Maritime cargo or passenger transport grows and evolves according to drivers and changes in its capital, operation and maintenance costs, and the infrastructures designed for this purpose. Ports, land transport, distribution, and connectivity, are crucial components of the supply chain and all depend on multiple variables, although within this set, the origins and destinations of cargo/passengers, as well as traffic density are of special relevance. This can be clearly understood as regards any change in trade, for example, between China and the United States (given that there is a direct effect on the density and frequency of maritime transport services between the two countries). It would also apply to internal traffic in a country.

In summary, given the challenges and trends discussed so far, it is possible to apply the criteria of the blue economy to guide recommendations and future action in the broad spectrum of maritime logistics [3]. A recent study (Kavita Sethi, 2023) argues that "blue ports" that are part of the blue economy should support their socio-economic and environmental objectives through various activities and partnerships, addressing adaptation and remediation. In this sense, the ideal port "would be climate-resilient, with high levels of connectivity in maritime transport services and a well-developed system for environmental and emissions management" (op. cit.)

The study develops a comprehensive assessment tool using key maturity indicators, in order to analyze the state of port operations and infrastructure resilience. The assessment tool that was developed includes three baseline criteria and nine key maturity indicators that address issues of sustainability, connectivity and resilience:

| Sustainability | Connectivity | Resilience |
|------------------------------|--------------|---------------------------|
| Energy Efficiency | Digital | Addressing Climate Change |
| Environmental Administration | Physical | Disaster Preparedness |
| Impact of Emissions | Social | Commercial |

It should be noted that, although the study was carried out for a group of Caribbean countries, the methodology applied and the tools developed are more universal in nature; indeed, they are suitable for analyses of, and recommendations for, ports throughout the region.

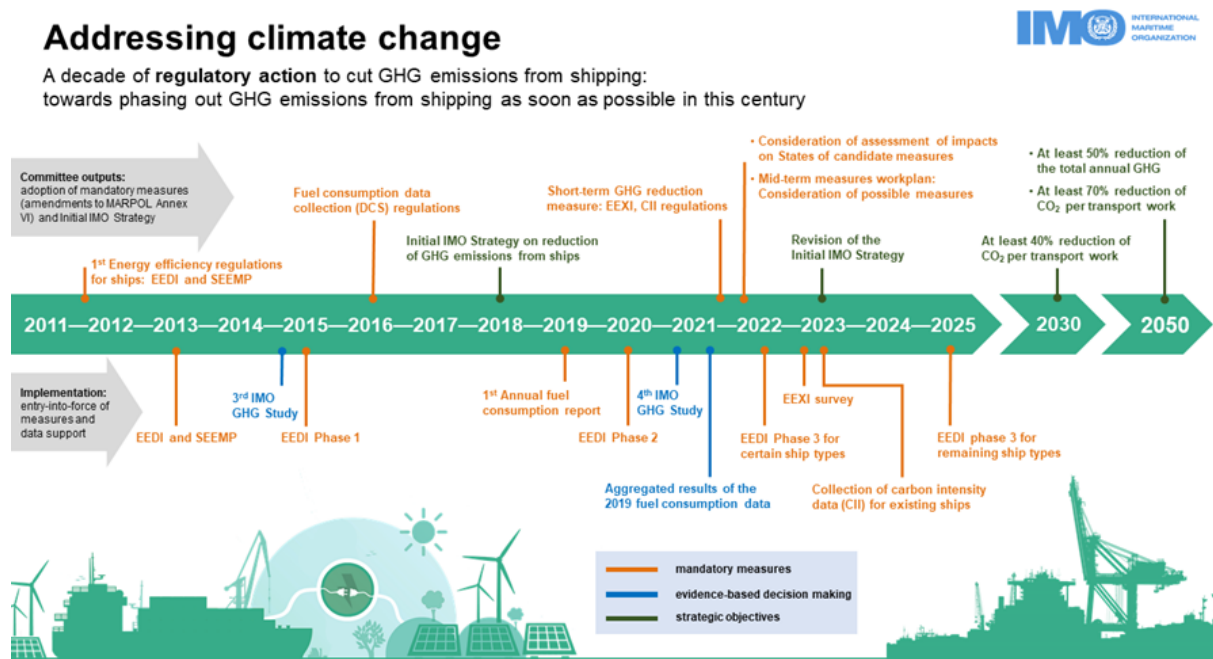
Global shocks, especially COVID-19, had a noticeable impact on another global trend, the growth of tourism. In a world in which international tourism was markedly growing, the pandemic caused a sudden drop with protracted effects. In fact, in 2019 the number of international travellers for tourism had reached 1,465 million, but plummeted to less than a third in 2020. By 2019, that figure meant a weighted average annual growth of almost 4%, higher than the rate of increase in output. Data for 2022 showed a recovery to 960 million, and preliminary figures for 2023 show a high recovery, according to estimates by the World Tourism Organization. International tourism is progressing at a good pace towards a return to pre-pandemic levels" (OMT, 2023). Overall, international arrivals reached 80% of pre-pandemic levels in the first quarter of 2023. In the Americas, as of March 2023, up to 85% of tourist movement had advanced in relation to the levels recorded in 2019. It is estimated that by the end of 2023 full recovery would be achieved. Also to be noted is that the cruise industry is growing at even higher rates. If the base of 2019=100 is considered, the Cruise Lines International Association (CLIA) has estimated that in 2023, pre-pandemic levels will be exceeded, with a value of 106 (6% more than in 2019) and 120 by 2024 (CLIA, 2023).

In other words, international tourism remains a trend with strong growth, which points to major challenges for tourism and the cruise industry, all of which have implications for port infrastructure, the interface with destination cities, and land tourism services.

Decarbonisation in maritime transport

The process of decarbonization of merchant fleets began with mandatory measures implemented by the International Maritime Organization in 2011, to improve the energy efficiency of ships. This, despite the fact that the International Convention on the Prevention of Pollution from Ships (MARPOL), which entered into force on May 19, 2005, had already included in its Annex VI the reduction of emissions of SO_x, NO_x, SDGs, VOCs and carbon intensity. The measures adopted in 2011 were mainly operational in nature and sought to improve the energy efficiency of ships. Among them, the Energy Efficiency Design Index (EEDI) was implemented for new vessels and the Ship Energy Efficiency Management Plan (SEEMP) was in operation. These measures came into force in 2013. The fact is that it was not until 2015 that the International Maritime Organization, at its MEPC 69 (Marine Environmental Protection Committee) meeting, incorporated the Paris agreement. MEPC 70 adopted mandatory measures concerning ships over 5,000 GT in respect of their recording and documenting the consumption of each type of fuel used. At MEPC 72 in 2018, IMO adopted the Greenhouse Gases (GHG) Emissions Reduction

Strategy, which represents the framework for action to reduce by 50% by 2050. This strategy included measures to be taken in the short, medium and long term. The global shock we are referring to comes from the IMO's Revised Strategy, published in 2023.



In anticipation of COP28, shipping companies MAERSK, MSC, CMA CGM, Hapag-Lloyd and Wallenius Wilhelmsen issued a joint statement on measures to decarbonise shipping. In the declaration, they established the need for four standards:

1. Agree on a close-off date for the use of ships whose propulsion system is exclusively fossil-based;
2. Approve life-cycle emission measurement standards and emission reduction schedules that would lay the foundation of confidence for investment in dual ships and in the manufacture and distribution of new fuels;
3. Define an effective pricing system for those emissions, so that it is more attractive for shipowners to invest in dual engines and alternative fuels than to pay emission penalties;
4. Complementary measures, highlighting those using the proceeds from the carbon price for research and development of new fuels; also allowing ships to group together in order to achieve these objectives.

With regard to the latter, attention will have to be paid to the industrial consequences that this could have in terms of restrictions being placed to bar entry.

The most significant modification presented in the strategy posed by the IMO at COP28 is that it sets targets and dates by which the industry must adopt the changes. The most ambitious goal is to reduce CO₂ emissions by at least 40% by 2030, compared to 2008 levels!

And adopt zero or near-zero-emission GHG energy sources, fuels and/or technologies to reach 10% by 2030! With the objective being that zero emissions will be attained by 2050!

The way to achieve the new goals includes significant and accelerated investments that will be required by the industry. On issues such as improvements in hull design, recovery and use of heat emitted by engines, reducing electricity consumption, reducing operating speed, reducing wind resistance, optimizing propeller design, use of alternative fuels. And all of this will be subject to regular inspections and verifications.

The most controversial and expensive issue will be the transformation of the industry to the consumption of alternative fuels. Firstly, because of the lack of availability, which will result in very high prices, and secondly, because in many cases the conversion will require a comprehensive review of the global fuel supply chain.

The lack of availability is due to the fact that at this point there are few alternative fuels that are being mass-produced economically. This brings us to the core issue. The transformation of the industry to the point where greenhouse gas emissions are cut in half, converts into costs, additional investment, or penalties. It is logical to think that if transformation does indeed redound to the benefit of society as a whole, incentives should also be provided by the respective countries or cargo owners. It is one thing that the objectives to be achieved are technologically difficult in themselves, but quite another for them to be economically unviable.

Another mechanism to achieve this could be the application of the concept of green bonds (or blue bonds), which is already being used in other industries. These bonds can help finance part or all of the shipping industry's energy transformation. Blue bonds are meant to protect the oceans and ecosystems through their preservation, while green bonds are usually employed as an investment in sustainable and socially responsible assets in areas such as renewable energy, energy efficiency, clean transport or responsible waste management.

[1] El Español, accedido el 23 de diciembre 2023: https://www.elespanol.com/mundo/oriente-proximo/20231223/iran-amenaza-cerrar-mediterraneo-respuesta-operacion-eeuu-mar-rojo/819418172_0.html

[2] The impact of digital transformation on supply chains must be taken not only in relation to trade and transport facilitation, but also to the reduction of the carbon footprint.

[3] The Blue Economy refers to the sustainable use of ocean resources for economic growth, better livelihoods and jobs, as well as the health of ocean ecosystems. The driving principle behind the concept is that all economic activities that depend on the ocean are linked

and a coordinated approach must be adopted to carry out this regional agenda. Among others, the Blue Economy encompasses renewable energy, fisheries, maritime transportation, tourism, climate change, and solid waste management

(Kavita Sethi, 2023).
