



## BEYOND THE HORIZON: FUTURE TECHNOLOGIES TRANSFORMING MARITIME NAVIGATION

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**Abstract** : The shipping industry is constantly evolving to meet today's demands and challenges. This article explores how innovations and trends in shipping are influencing the efficiency, sustainability and competitiveness of this vital sector of the global economy. Analysing technological transformations and emerging practices, the paper reveals how new technologies and cross-company collaborations are shaping the future of the maritime industry. The example of the BYD Explorer fleet, the first Ro-Ro vessel specialised in transporting electric cars, underlines the adaptability and innovation in response to the current needs of the automotive industry and sustainability requirements. At the same time, the collaboration between MOL and Bearing, which has led to the development of advanced solutions based on artificial intelligence, demonstrates the positive impact of innovation in optimising maritime operations.

**Key words** : artificial intelligence , competitiveness , efficiency , emerging technologies , globalisation , innovation, ports , shipping industry, sustainability.

### 1. INTRODUCTION

In a world of constant transformation, the shipping industry is constantly adapting and innovating to meet modern demands and challenges. In this context, emerging technologies and current trends are leading to a revolution in shipping, influencing not only the efficiency and safety but also the sustainability of this vital sector of the global economy. This article explores these innovations in depth, looking at how they are redefining the way ships move, how port operations are managed and how environmental issues are handled. Through a magnified perspective, we discover how these transformations are helping to shape a more efficient, sustainable and interconnected future within the maritime industry.

The purpose of research is to analyse and highlight the impact of current innovations and trends in shipping on the efficiency, sustainability and competitiveness of this vital sector of the global economy. By exploring new technologies, practices and collaborations between companies, the paper aims to provide a deeper understanding of how the maritime industry is adapting to the demands and challenges of the modern world and how these changes influence the global economy and the environment.

The research methodology involves analysis of current trends in shipping, case studies, collection and analysis of relevant data, and assessment of the impact

and future prospects of the identified innovations. This approach provides an in-depth and comprehensive understanding of industry developments and future directions for the development of technologies and practices in shipping.

### 2. RESEARCHES AND INTERPRETATIONS

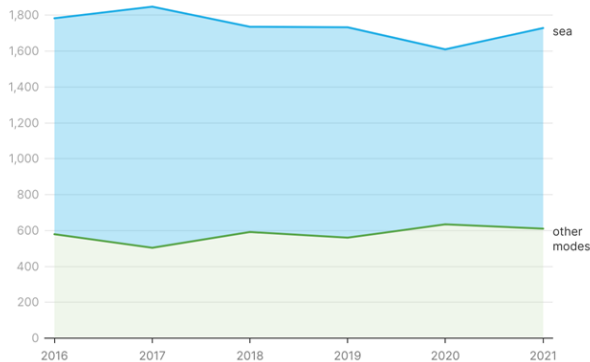
The transport industry is certainly undergoing a profound transformation, adapting to the new demands and challenges of the modern world. One of the most notable trends is the increasing demand for autonomous operations, digitisation and sustainability.

In terms of autonomy, we are seeing a proliferation of technologies that allow operation without direct human intervention. For example, drones, robots and driverless trucks are increasingly present in the transport landscape, facilitating autonomous last-mile deliveries. This not only improves efficiency and speed, but can also reduce the costs and risks associated with human intervention.

On the other hand, digitisation has become a key element in optimising the entire transport chain, from planning and management to monitoring and tracking of deliveries. Emerging technologies such as artificial intelligence, the Internet of Things (IoT) and block chain are increasingly integrated into transport systems to improve visibility, efficiency and security.

In terms of sustainability, there is an emphasis on reducing the negative environmental impact of transport. A major solution in this respect is electrification, which allows a shift from fossil fuel vehicles to electric or other clean energy vehicles. This change not only reduces carbon emissions and other pollutants, but can also help increase energy efficiency and reduce dependence on non-renewable resources.

Figure 1 illustrates that around three quarters of the European Union's total international trade and its trade with non-EU countries is carried by sea [1].



Sea transport mode dominates EU international trade especially in terms of transported weight and its impact on maritime transport economy

Chart: EMSA • Source: EC (Statistical Pocketbooks 2017 to 2022, Section 2.1)

Figure 1 EU external total merchandise imports and exports in million tonnes from 2017 to 2021 [1]

With 77% of Europe's external trade and 35% of the total value of trade between EU Member States transported by sea, maritime transport is a key link in the international supply chain. This underlines the vital importance of the maritime industry in maintaining trade flows and ensuring economic connectivity between regions and countries.

Figure 2 shows the number of passengers embarking and disembarking at all EU ports over the period 2007-2022 [2], [3].

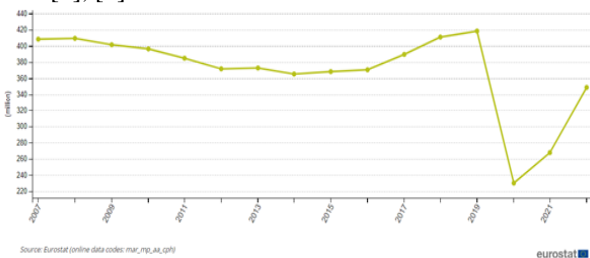


Figure 2 Seaborne passengers embarked and disembarked in all ports, EU, 2007-2022 [2],[3]

There is a significant decrease in the number of passengers in 2020, when the number of passengers was 230 million compared to 420 million in the previous year. This decrease can mainly be attributed to the

restrictions imposed by the COVID-19 pandemic and social distancing measures that have severely affected the transport industry. However, in the following year, 2021, passenger numbers increased slightly to 270 millions, indicating a beginning of recovery in the industry. This positive trend continued in 2022, when passenger numbers increased to 350 millions. Therefore, a gradual recovery of maritime passenger activity after the negative impact of the pandemic is observed.

### 2.1 Interpretations of data:

Even with a decline in shipping activity in 2020 due to the effects of the COVID-19 pandemic, the sector is expected to grow strongly in the coming decades.

This growth is driven by a number of factors, including increased demand for primary resources and containerised shipping. In an increasingly globalised world, where international trade and interconnectivity are vital for national economies and global prosperity, shipping remains an important driver for development and economic growth.

### 2.2 The adaptation of the maritime industry to the new demands of sustainability and advanced technology:

In addition, the adaptation of the maritime industry to the new demands of sustainability and advanced technology is helping to strengthen its position in the international supply chain. Implementing environmentally friendly practices and innovative technologies in shipping not only helps to protect the environment, but can also support the efficiency and competitiveness of the entire supply chain.

Thus, the shipping industry is not only an essential component of the global economy, but also an important catalyst for progress and sustainable development in the 21st century. It is essential that governments, international organisations and industry players work together to promote safe, efficient and sustainable shipping that serves the current and future economic needs of our interconnected world.

Known for manufacturing electric cars, BYD Company Limited or BYD is a Chinese multinational conglomerate based in Shenzhen, Guangdong province. Founded by Wang Chuanfu in February 1995, the company brings a new perspective to the shipping industry. Given the growing demand for its cars, BYD made the decision to develop its own port to facilitate trade. To meet demand, the company invested in building a maritime fleet tailored to its needs.

Currently, BYD owns one vessel and has plans to purchase 7 more.

This ambitious venture's estimated total cost was nearly 5 billion yuan (approximately 700 million USD). With an impressive capacity to carry 7000 cars, these vessels are tailored to the company's specific requirements, including advanced on-board fire monitoring and warning systems. Specialised equipment



enables rapid response to any fire, ensuring safe and efficient transport.

### 2.3 *New standard in shipping:*

The ship, officially named BYD Explorer 1, represents a new standard in shipping. As the world's first Ro-Ro vessel specialised in transporting electric cars, it offers an innovative solution to the needs of today's automotive industry.

At 200 metres long and 38 metres wide, the BYD Explorer 1 is designed for a cruising speed of 18.5 knots. Advanced propulsion systems, including a generator connected to a propeller, ensure efficient and sustainable operation of the vessel. It can operate predominantly on liquefied natural gas (LNG), minimising emissions and environmental impact.

Although building a ship takes time, BYD has found alternative solutions to meet immediate demand. Through strategic partnerships and adaptability, the company has been able to develop its own fleet and strengthen its position in the global market.

Future Ro-Ro ships built for BYD will be even larger, with a capacity of 7,700 cars. With these initiatives, BYD aims to become a major player in shipping, helping to increase exports and promote electric vehicles worldwide.

The use of shipping and its adaptation to consumer requirements are crucial for the efficiency and sustainability of global transport. The example of the BYD Explorer maritime fleet underlines the importance of adaptability in the shipping industry, highlighting the need to respond to market demands and promote innovation for a more sustainable future.

Another example that requires our attention is the collaboration between Mitsui O.S.K. Lines, Ltd. (MOL) and Bearing, Inc.

The year 2021 marked an important milestone in the collaboration between Mitsui O.S.K. Lines, Ltd. (MOL), a global leader in shipping, and Bearing, Inc. an innovative AI technology company in Silicon Valley. The expansion of their partnership initiated in 2019 demonstrated the power of innovation in transforming the maritime industry.

The main aim of the partnership was to optimise shipping efficiency. By combining the maritime expertise of Mitsui O.S.K. Lines (MOL) with Bearing's state-of-the-art AI-based infrastructure, a number of innovative products were developed. A prime example is the AI-powered Intelligent Routing Engine, which provides optimised routing recommendations for each voyage. This system automatically analyses multiple potential routes and evaluates them based on factors such as fuel consumption, emissions and weather conditions.

Bearing technology, based on highly accurate vessel performance models, provides state-of-the-art forecasting of key metrics such as fuel consumption. This valuable information enables MOL to make more

operationally efficient decisions, reducing costs and improving sustainability.

The collaboration between MOL and Bearing is an outstanding example of how innovation can transform an industry. MOL's reputation as a technology leader in shipping, combined with Bearing's AI expertise, has led to the creation of innovative solutions that have a significant impact on the efficiency, sustainability and profitability of maritime operations.

### 2.4 *Other significant results*

In addition to the Intelligent Routing Engine, the partnership has generated other significant results:

- Development of advanced marine weather forecasting systems
- Optimising port operations
- Improving navigation safety
- Reducing greenhouse gas emissions

The partnership between MOL and Bearing demonstrates the enormous potential for innovation in the maritime industry. As companies continue to invest in AI-based solutions and other advanced technologies, we can expect to see even more significant transformations in the coming years.

Mitsui O.S.K. Lines and Bearing provide an inspiring example of innovative collaboration that is propelling the maritime industry towards a more efficient, sustainable and prosperous future.

## 3. CONCLUSIONS

The shipping industry is in the midst of an accelerating transformation and adapting to new demands and challenges is essential to maintain competitiveness and sustainability. Recent examples, such as the BYD Explorer fleet and the collaboration between MOL and Bearing, highlight the main directions of this transformation.

The BYD Explorer fleet is an outstanding example of adapting to changes in the automotive industry and sustainability requirements. By building the first Ro-Ro vessel dedicated to transporting electric cars, BYD affirms its commitment to innovation and environmental protection. Its capacity to carry 7000 cars and the use of advanced technologies to secure the transport demonstrate a focused effort towards a more efficient and environmentally friendly maritime operation.

On the other hand, the collaboration between MOL and Bearing, two leaders in the fields of shipping and AI technology, highlights the power of synergy in optimizing maritime operations. By developing innovative AI-based solutions such as the Intelligent Routing Engine, this collaboration demonstrates how technology can improve efficiency, safety and sustainability in shipping.



Overall, these examples underline the need for innovation and collaboration in the shipping industry to respond to market demands and contribute to sustainable development. Investments in technology and strategic partnerships are essential to build a competitive and sustainable future in this vital industry for the global economy.

#### 4. ACKNOWLEDGMENTS

Thank you for support to publish my article by Constanta Maritime University, Scientifically Session of Students , May 2024.

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