Thetius

BUREAU VERITAS

COMMON INTEREST

How the maritime industry can share data, collaborate with trust, and build a mutually beneficial digital ecosystem.

Matthew Kenney

CONTENTS

FOREWORD: CHARTING THE FUTURE OF DIGITAL COLLABORATION

The words collaboration and digitalisation are everywhere but hardly together. However, faced with the reality of climate change and the energy transition, it is imperative that we rethink our strategies for steering shipping towards a low carbon future. At Bureau Veritas (BV), we firmly believe that the industry's transformation will be facilitated through the digital transformation of ships, assets, and operations, throughout their lifecycle.

Shipping has always been and will remain a fragmented yet interconnected sector. Digitalisation offers us opportunities to find innovative ways of working that provide the necessary solutions to navigate shipping's energy transition. This is a collective challenge requiring new approaches, prompting the development of frameworks that encourage and reward collaboration. This demands a systemic shift in how we work together.

It is an opportunity that shipping is simultaneously confronting the challenge of decarbonisation while unlocking its digital transformation. At BV, we are deeply convinced that the energy transition and digitalisation go hand in hand.

SO, WHY DOES DIGITAL COLLABORATION MATTER?

Data-powered, collaborative innovation is the essential ingredient that can further accelerate the transformation of the industry. We witness the realisation of our vision for shipping's digital transformation through the numerous ambitious projects in which Bureau Veritas is actively involved. These include partnerships with prominent actors such as NAPA or Kongsberg. Notably, the incorporation of 3D models or the integration with client's Planned Maintenance Systems (PMS) into the class approval process enable ship designers, owners, and class societies to work together by establishing a "single source of truth". Moreover, we are revamping our historical production tools into a collaborative digital platform that

will be accessible to our clients and maritime stakeholders enabling digital connectivity through the integration of their existing systems.

We believe that digitalisation is a foundation for innovation as it allows for faster, richer, and more efficient collaboration. By partnering with like-minded individuals and companies, we can significantly accelerate our pace of innovation while working towards a common interest and benefitting from new perspectives.

DIGITAL COLLABORATION, POWERED BY CLASS

Bureau Veritas has played a pioneering role in validating the safety and performance of innovative technologies since 1828. Collaborating to bring novel ideas from concept to reality is in our DNA. For nearly 200 years, our approach has been exemplified by working with a global community of maritime stakeholders with a shared purpose and vision for shaping a better maritime world. Today, our goal is to follow that same ethos and spirit into the era of digital collaboration, using the latest advances in digital technology and data science to achieve our common goals.

It is also a field where we, as a classification society, play a fundamental role, bringing maritime stakeholders together and supporting the sharing of data and expertise as a trusted, independent, and objective voice. This role is deeply ingrained in our working culture and formalised structures, manifested through our Rules and Notations, as well as our direct relationships. Throughout shipping's history, class has been instrumental in facilitating every notable technological advance.

However, effective digital collaboration requires more than just the willingness to do so. What factors prevent us from collaborating better in shipping's digital and data ecosystem, how can we overcome these obstacles and what opportunities does it create? To help us answer these questions and gain a better understanding of what is at stake, we partnered with Thetius, who conducted interviews with key industry stakeholders.

The objective of this Thetius report is to explore how a fresh approach to collaboration can shape the exciting possibilities of a greener maritime future. The report presents the findings derived from those interviews, shedding light on the existing and potential solutions available to help us make digital collaboration a reality.

Laurent Hentges, Vice-President, Digital Solutions & Transformation, Bureau Veritas Marine & Offshore

INTRODUCTION

Maritime trade is built on the principle of reciprocal exchange. Throughout history, ships have been paid to move goods and raw materials from port to port within a competitive free market. But today, shipping companies are facing unprecedented challenges to business-as-usual. The level of response required to address the global energy transition and the impact of emerging technologies is far bigger than any single operator, ship type, maritime administration, or global power.

The latest figures from the International Energy Agency (IEA) show that the transport sector is responsible for about 22% of global CO_2 emissions from anthropogenic origins, with shipping responsible for 8-9% of the transport contribution.[1] [2] In the context of the fight against global warming, shipping is a significant emitter and pressure from the market and wider society is mounting.

It is now commonly accepted that the shipping industry must find ways to move freight more efficiently and reduce greenhouse gas emissions. Whether some industry players like it or not, fostering closer collaboration through data sharing and exchange among competing parties will be necessary to reach the mid and long-term emission reduction targets. But how can this be achieved in practice?

Digital technology and developments in data handling and exchange offer compelling opportunities to achieve these aims. But to succeed at scale, these solutions call for competing parties to recognise new common interests and shift industry mindsets to accept more data sharing and collaboration. As Benne Engelen, CIO at tanker operator Anthony Veder, told Thetius earlier this year: "Working with the same information at the same time, with all the stakeholders in the chain, really allows us to make better decisions and annihilate port waiting times. Obviously, digital technology can be of great value in doing that."[3]

This can be thought of as a "network optimisation problem". While individual action is vital, addressing this scale of business risk requires international, multilateral, and collaborative solutions. Remarking on the need for more collaboration in shipping, Sidsel Norvik, Director of the annual Nor-Shipping event, told Maritime CEO, "No one can rise to the transition challenges that we are up against in solitude. No single actor can address the evolving needs of cargo owners, and no one can juggle geopolitical shifts, energy concerns, regulatory frameworks, fuel options and decisions, attracting talent, and much more, without the right partners. But together, leveraging our individual strengths as collaborative partnerships, we can achieve truly ambitious objectives."[4]

Finding value in data sharing and collaboration requires maritime stakeholders to cross new digital frontiers. Achieving this while protecting free market enterprise requires creative data exchange solutions and equitable systems of collaboration. As the examples in this report will show, sharing data has the potential to yield transformative returns on the investment in time, technology, and capital resources. But

1 International Energy Agency (IEA) (March 2023) CO2 Emissions in 2022. Retrieved from https://www.iea.org/reports/co2-emissions-in-2022

2 International Energy Agency (IEA) (September 2022) Tracking Report – International Shipping. Retrieved from https://www.iea.org/reports/international-shipping

3 Thetius and Inmarsat (2022) The Network Effect. Available at https://thetius.com/free-report-the-network-effect/

4 Splash247.com (5 May 2023) Nor-Shipping: 'Collaboration is the true fuel of the future'. Retrieved from https://splash247.com/nor-shipping-collaboration-is-the-true-fuel-of-the-future/

to understand how, and appreciate why there are still hurdles to collaboration, it is first necessary to understand the difference. Sharing raw data alone will not manifest an improvement or bring about positive change. Collaboration requires there to be a common interest and the willingness to work together to extract some mutual value.

Shipping has a long heritage of collaboration under contracts. P&I clubs, slot sharing agreements and tanker pools are examples of shipping defining a mutual interest and developing a contractual framework to control collaboration fairly. In fact, around 95% of global containership capacity on East-West trades is controlled by operators working together through container shipping alliances.

But shipping must also contend with economic and technological fragmentation, as well as geographic and cultural diversity. In the maritime context, the concept of a 'common good' can be difficult to define. Shipping is, first and foremost, still a free market enterprise and the interests of its participants can vary considerably.

The industry must also balance new opportunities and new demands with good governance. Businesses are obligated not to erode their competitive position to the detriment of their shareholders, trade partners or employees. Through this lens, caution is understandable. Calls for the sector to drop the curtain and share large amounts of potentially valuable data will not be taken seriously without demonstrating clear benefits and addressing fair competition, misuse of data, and intellectual property concerns.

It is also vital to level the technological playing field. For example, while the COVID-19 pandemic resulted in a digital acceleration across maritime trade, one study published in 2022 found that just over 80% of sea ports still rely on manual legacy solutions such as whiteboards or spreadsheets to manage basic processes.[5] Similar disparities exist among ship operators too, where research and development activities for digital and data-driven solutions are beyond the reach of all but the most resource-rich carriers.

For example, while the COVID-19 pandemic resulted in a digital acceleration across maritime trade, one study published in 2022 found that just over 80% of sea ports still rely on manual legacy solutions such as whiteboards or spreadsheets to manage basic processes.

But industry participation is likely to require more data sharing and transparency across all levels of the industry. As Captain Pradeep Chawla, Managing Director QHSE and Training at Anglo Eastern Ship Management told Thetius, "I believe that in the not-too-distant future, perhaps less than three years, we will be looking at a more transparent shipping industry, where owners and charters will be able to look at the same data and avoid complicated speed claims and admission claims etc. The world is becoming more transparent and the data is available for all to see."

During Singapore Maritime Week 2023, President of Inmarsat Maritime, Ben Palmer, described the growing importance of data digitalisation like this: "Extracting and using more data is not just a maritime preoccupation, but it is rapidly becoming a dominant feature in this sector. Enhancing value from data is now critical to the profitability and sustainability of shipping companies the world over."[6] But as Peter Schellenberger, Founder and Director of maritime consultancy Novamaxis Pte Ltd, remarked; "It is often forgotten that 70% of the addressable fleet for decarbonisation and optimisation solutions are companies who own

5 Heikkilä, M.; Saarni, J.; Saurama, A. Innovation in Smart Ports: Future Directions of Digitalization in Container Ports. J. Mar. Sci. Eng. 2022, 10, 1925. https://doi.org/10.3390/jmse10121925

6 Inmarsat (25 April 2023) Shaping Connected Future Event – Singapore. Supported by Smart Maritime Network. More information is available at https://www2.inmarsat.com/SMW_Inmarsat_breakfast_event_2023

between 2 and 15 vessels. These companies need help and don't have access to global setups."[7]

Levelling-up starts with the continuing roll out of high-speed maritime connectivity. Very Small Aperture Terminal (VSAT) satellite technology is the current benchmark for high-speed maritime data exchange. According to Euroconsult, there were 37,000 VSAT-equipped vessels in operation in 2022, up 42% from 2018. This trend is set to continue as new build and retrofit programs supplant outdated slow-speed connections. Collectively, maritime satellite communications are predicted to compound at 7% per annum, resulting in 90,000 VSAT-equipped vessels by 2032. This will fuel accelerating demand for access to new digital products and services at sea.

Low Earth Orbit (LEO) satellite constellations such as Starlink or OneWeb will further underpin opportunities for more sophisticated maritime data-driven services. In 2022, Bureau Veritas announced a collaboration with maritime connectivity and smart networks service provider Marlink, to work on a series of next-generation data services for shipping.[8] Thetius asked Ghani Behloul, Chief Marketing Officer at Marlink, about the influence of connectivity and the impact that LEO services will have. He said, "Maritime connectivity is moving rapidly to a hybrid state. Geo-stationary VSAT services will continue to penetrate the market due to their reliability, wide coverage, predictability and guaranteed service level agreements. These are all key for business critical applications and running ship operations safely . However, low latency and very high-speed connectivity made possible with LEO, is a transformational development which will enable faster and/or larger data volume exchange" Mr Behloul concluded; "Central to supporting digitalisation and data collaboration in particular, LEO makes using cloud services at sea a very real prospect."

Digitalisation, data sharing and collaboration are vital to addressing decarbonisation and the high volume, high frequency freight demands of a growing global population. But how do these puzzle pieces fit together? How does "common good " manifest itself in a competitive free market environment? How can private companies be persuaded to give something of value – their data – to their customers and trade partners if they fear that it could compromise a competitive advantage? This report explores these questions and more by examining the benefits of sharing and collaboration, and highlighting a number of real-world examples. It addresses the key challenges to gaining confidence in data sharing, and breaks down the barriers to collaboration as a means to solving common problems. There is also a supplement which describes the fundamental technical and legal aspects of data, its use, ownership, and protection, and seeks to correct some of the most common misconceptions.

7 IBID (3)

8 Bureau Veritas (June 1, 2022) Marlink and Bureau Veritas in Partnership to Promote Digital Integration and Connectivity for Class Operations. Retrieved from https://marine-offshore.bureauveritas.com/newsroom/marlink-and-bureau-veritas-partnership-promote-digital-integration-and-connectivity-class

VISION AND VALUE – WHY DATA SHARING AND COLLABORATION MATTERS

Without real-world context, it is difficult to understand what data sharing and collaboration can achieve in shipping. Collaboration is an awkward concept in a competitive market. What could a company wish to share? For what purpose will that information be used and to whose benefit? Ultimately, what benefits will sharing data bring in return? In this section, we seek answers to these questions by looking at a selection of industry examples.

DATA INSIGHT AND SHIP PERFORMANCE ANALYTICS

The purpose for gathering data is to analyse it and learn something which could be used to make decisions. There are different types of data, multiple ways of analysing it and countless use cases for data insight – see A Brief Guide to Data Fundamentals – Is Your Data Your Data? Here, we will focus on operational and technical data and how it can support decision-making in maritime efficiency, resilience, and energy transition.

Thetius asked Benne Englen, CIO at Anthony Veder, about the current state of optimisation in the ocean supply chain and why shipping seems to suffer greater operational inefficiencies than other transport modes. He said, “Over the last 30 years, asset owners have placed a lot of attention on optimising individual assets in a supply chain. But that is not the same as having an optimised supply chain. What tends to happen is that inefficiencies get pushed towards the cheapest ton-mile assets in the chain, because that's where, at least from an economic perspective, they hurt the least. In our case, our vessels are the cheapest assets in the chain, so the inefficiency gets pushed to us, usually in the form of long waiting times at anchor before entering port.”

Now shipping is under intense pressure to improve carbon efficiency, operators are increasingly aware of the positive impact data analysis can have.

Arnaud Dianoux is the Founder and Managing Director of Opsealog, a data integration and analytics company which helps maritime businesses generate new insights and find opportunities for gaining efficiency. He told Thetius, "At Opsealog, we truly believe that we can decarbonise and optimise maritime operations for shipowners and charterers by using data."

Opsealog provides three core services to clients looking to liberate and use their data to find operational efficiency. The first is a digital data collection software called. This is used by hundreds of vessels worldwide and Arnaud Dianoux explains why it has proven popular: "Our digital logbook helps reduce the workload onboard and ensure the quality of data inputs from ships. Most of the world fleet is still working on paper. Ships that fall under IMO DCS, EU MRV and others have moved on to spreadsheets. But our studies have shown that these spreadsheets are often inaccurate and require a large amount of manual processing onshore to validate the data, send to the verifier, and subsequently upload it in the correct format to the relevant platform."

Assisting with data gathering for compliance is only part of the picture for Opsealog. As Mr. Dianoux explains, the company also helps operators gain operational insights. He said, "One of the biggest opportunities we have in the maritime sector is to use the data we already have. There are large amounts of interesting data not being used and dying on paper or in spreadsheets in email inboxes. Data is our fuel and our core business is transforming this data into action. We are confident that as long as accurate data is coming into the Opsealog platform, we will generate efficiencies."

Once data is gathered, analysed, and understood, Opsealog can assist in the decision-making process. As Mr. Dianoux points out, "There is a €2.4 trillion market opening up for maritime decarbonisation and one where everyone can benefit through collaboration. All stakeholders, like financial institutions, classification societies, shipowners, charterers, freight owners and forwarders, and digital developers like us, will all benefit from building the tools and infrastructure to measure and validate more accurate data, and build a realistic baseline from which to make reductions."

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Another maritime data and analytics company concerned with vessel performance is OrbitMI. Headquartered in New York City, with offices in Sweden, Norway, Greece, Serbia, and the United Kingdom, this software company creates what they call "intelligent connected workflows". OrbitMI essentially aims to derive more value from client data across pre-fixture, voyage and post-fixture processes. First launched in 2017, their Software-as-a-Service (SaaS) product provides ship operators with a suite of data-driven tools which complement existing systems to enhance data insight and analysis.

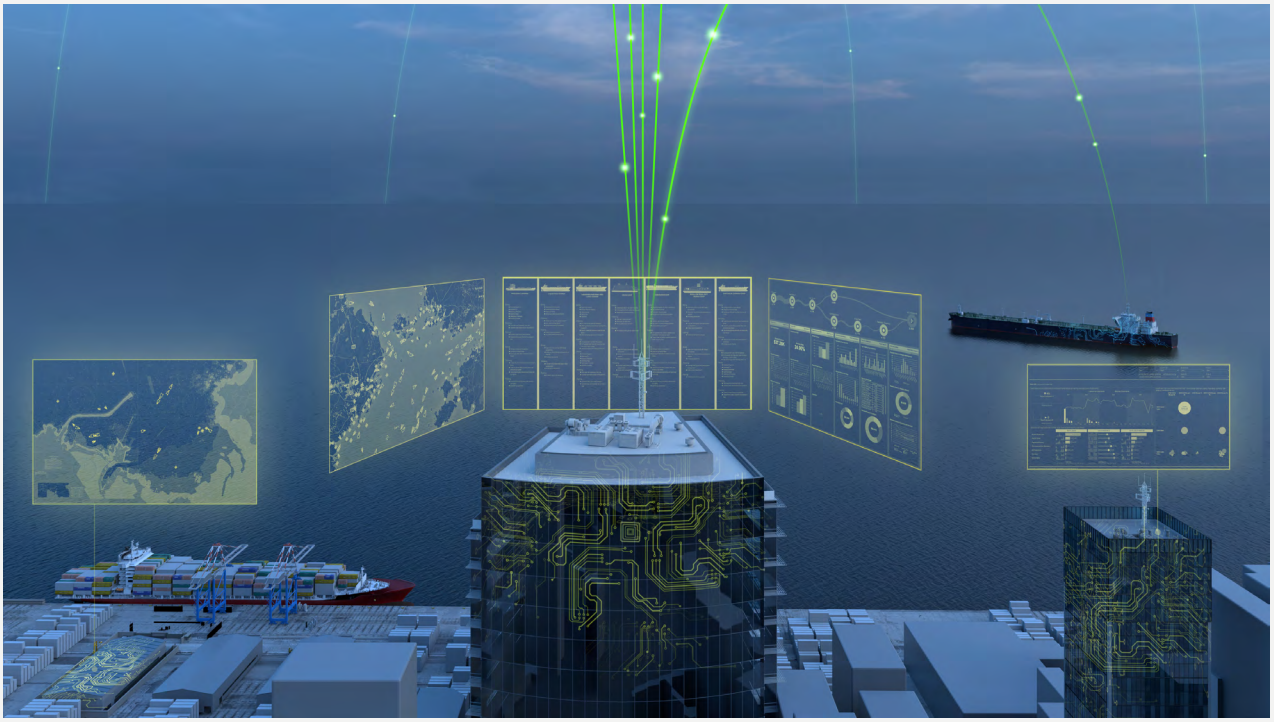
Orbit's Chief Marketing Office, David Levy, told Thetius, "We're trying to eliminate data silos and prevent the need to log in and out of multiple platforms and solutions. Instead, we deliver information in context, using interesting data visualisation tools. This allows any type of user to take action in the context of their existing workflows. The intelligent part is that we're taking data that may be sequestered in a voyage management system or other isolated location into OrbitMI and making actionable information out of it which can be used to make decisions."

Thetius asked Mr Levy about the current state of data collaboration between equipment manufacturers and their customers. He said, "I think ship operators and equipment manufacturers have had a kind of adversarial relationship which is healthy and productive, except when it comes to data sharing when things become more secretive and protectionist. One way of breaking through that is through controlled data sharing and collaboration. If businesses have nothing to hide from their customers and trade partners and are able to share things which bring about a mutual benefit, I think that is a powerful evolution for our industry."

One distinct aspect of OrbitMI's business model is that they don't seek to attract customers away from other vessel performance and voyage optimisation providers. Instead, the company seeks to add value to existing solutions. Mr Levy explained, "Our customers don't need to dispose of their existing investments in data management. We're not trying to rip and replace existing solutions. We will partner with any voyage management system or other software provider and make their solutions stickier and more compelling to the user."

David admits that this collaborative approach is unusual in the maritime sector: "When we announced our partnership with Nautilus Labs in October 2022, it sent ripples through parts of the market. Some people were surprised that we would be willing to work with a competitor like that. But we consider this an evolution, where tech companies which have complementary strengths and weaknesses look to collaborate in order that they can continue to focus on their core competencies, without feeling like they have to be all things to all people."

Thetius asked Nautilus Labs for their perspective and opinion on resistance to better voyage optimisation: "A lack of data-driven collaboration is endemic to the maritime industry. That's why it is so important we're partnering with companies like OrbitMI," said Matt Heider, CEO at Nautilus Labs. "The issue at the heart of this is the way legacy charter party agreements are built. They discourage information-sharing due to the penalty-



focused nature of performance clauses. Charter parties need to be changed so counterparties are encouraged to share data to improve commercial efficiency and decarbonisation efforts.''

DIGITAL SYNCHRONISATION OF AN ECOSYSTEM AND ADDRESSING THE CHALLENGE OF JUST-IN-TIME ARRIVAL

In a commercial capacity, shipping is experienced at trading under bi-lateral contractual arrangements with no requirement to regulate horizontally across competing vessels. Each voyage is set on its own terms, moving cargo from one port to another without reference to other traffic moving to or from the same port. Achieving a functioning system under these conditions requires contracts to set rules as they apply to a particular voyage or trading arrangement, with an agreed claiming mechanism to fall back on where disagreements arise, which they frequently do.

Naturally, this free-market model also requires a first come – first served port arrival system to govern the order in which ships are served in port. This has contributed in part to a paradigm of "sail fast then wait'' (SFTW), where ships find themselves contractually obliged and commercially incentivised to make best speed at sea to arrive at an anchorage and then wait for the next available berth. SFTW traces its origins back to the age of sail, where voyage arrivals would be impossible to predict and the ship would be out of contact throughout the voyage. Cargo owners required the assurance that captains would execute the voyage as quickly and directly as possible. Over time, this developed into a system of laytime and demurrage designed to protect cargo owners by ensuring voyages were executed promptly, while simultaneously protecting ship operators from delays experienced at the port of arrival.

Regulations concerning laytime and demurrage are now well established. However, now decarbonisation and energy efficiency are becoming critical factors in voyage planning, SFTW, supported by laytime and demurrage clauses in voyage charter parties, is presenting a significant challenge.

Two systems have long been proposed to eliminate SFTW: virtual arrivals and just-in-time (JIT) berthing. Both seek to better coordinate inbound vessel traffic in order to improve their energy efficiency and reduce GHG emissions. But there are significant obstacles to coordinating vessels in this way. Commonly, there is no formal relationship between vessels sailing towards a given port. Each has contractual obligations to their respective charterers and cargo owners, but no obligation – or contractual rights – to coordinate their arrival time with other vessels at sea.

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The virtual arrival concept was proposed by OCIMF and Intertanko in 2009. The idea is simple: an agreement is made between a ship owner and charterer to adjust a vessel's speed to match berth availability, allowing the ship operator to tender a "virtual notice of readiness" while still at sea. The parties then take a share of any fuel savings incurred.

However, virtual arrival has failed to achieve widespread adoption. There are two principal reasons for this. Firstly, virtual arrival is a bi-lateral agreement between a ship owner and a charterer and therefore it cannot serve the cargo owner in the same way as a traditional notice of readiness. Bills of lading are "executable", meaning that they carry a transfer of ownership which is commonly triggered by a notice of readiness. In

essence, the notice serves as confirmation that the cargo has reached its destination safely and will shortly be ready for onward transport. This transfers responsibility for the cargo to the buyer or buyer's freight forwarder. If the ship is still at sea when a virtual notice of readiness is tendered, neither of those implied conditions are met.

Virtual arrival contracts also have no control over the actions of other vessels proceeding to the same destination. The concept works well when the charterer owns the cargo and controls the terminal, but otherwise, virtual arrival is inconsistent with a system of first come – first served berthing, preventing it from offering a sector-wide solution to SFTW.

Natalia Walker is a project analyst for ship operators Carisbrooke Shipping. A large part of her role is helping the company find new efficiencies and developing insight through digitalisation and decarbonisation projects. She told Thetius, "Carisbrooke operates a fleet of 28 vessels split roughly in two fleets: a short-sea fleet with voyages between a day and 21 days; and a fleet of larger vessels trading globally under time charter contracts. Typically, our short-sea fleet can spend as much as 40% of their time alongside in port, so we are very keen to work with ports on ways to help each other reduce the carbon footprint and increase the efficiency of cargo operations."

Port call efficiency is vital for short sea operators. But, as Ms Walker explains, it is challenging to achieve: "From an optimisation point of view, we can run into problems with notices of readiness. For instance, the vessels may be expected to arrive at a port at a certain time and if we don't keep to that time slot, we could lose our place in the queue and the cargo could arrive later than expected. We are constantly trying to improve communications with our partners on port calls, making sure that we provide the right information at the right time to agents and authorities to help them run as smoothly as possible. The key is to continue to communicate frequently with the agents and the charterers."

Just-in-time berthing (JIT) has been explored over many years. This involves coordinating multiple actors within a port services community such as customs and excise, pilots, tugs, ship agents, stevedores, cargo handling equipment operators, and multimodal transport operators to calculate an optimal arrival time for an inbound vessel. Again, this allows vessels to reduce voyage speeds and save fuel. Because of the complexity of this calculation and its reliance on coordinating multiple independent actors, JIT is often constrained to the latter stages of a voyage, reducing its impact.

One maritime consortium-led project known as The Blue Visby Solution has been developing a way of eliminating SFTW while working within the contract regulated free-market dynamics of a first come-first served queuing system and in sympathy with the structure of voyage charter parties. The most compelling aspects of the Blue Visby approach are that it is systemic, globally adoptable, and operates horizontally across competing actors.

The Blue Visby Solution consists of optimisation technology, a contractual architecture, and a benefit sharing mechanism to encourage adoption. The system is capable of synchronising otherwise unconnected ships heading for a common destination using an algorithm which assigns an optimal speed reduction to each ship.

It does so while maintaining a first come-first served queuing ledger and includes a method of managing the distribution of benefits among the charter party, based on an artefact of maritime law known as "general average".

Haris Zografakis, Partner at Stephenson Harwood LLP, a leading member of the Blue Visby consortium, told Thetius, told Thetius, "In order to progress beyond 'sail fast, then wait', we need to recognise conflicting interests, or what economists term 'split incentives'. We have two options: One is to appeal to everybody's good nature and simply ask for collaboration. That is admirable, but I believe this is unlikely to find success. The alternative option is to give each stakeholder 'skin in the game'."

Mr Zografakis continued, "First, we need to devise a sharing mechanism where the shipowner, the charterer, and the cargo interests share the financial advantages of using the system. Fuel savings are one, but there are others. The second obstacle to overcome is that we have many ships steaming towards the same destination with no formal means of contact and certainly no contract between them."

How can these individual ships, with individual interests, be persuaded to use a system of cooperation and prioritisation? Blue Visby believes the answer is to create a framework of 'mutual association', similar to that used by protection and indemnity (P&I) clubs. Mr Zografakis explained, "A key feature of the Blue Visby Solution is the Blue Visby Mutual Association (BVMA), which will operate as a multilateral contract that binds participants together. The BVMA will set the rules, enforce the rules, and make sure that all parties are cooperating together as agreed. You could say there are some similarities with a pool of tankers, which is another example of collaborative arrangements for competitors who cooperate for one specific purpose".

As a maritime-led solution, Blue Visby focuses on optimising the seagoing part of the voyage. This has the advantage of eliminating the complexity of just-in-time berthing and the contractual issues associated with virtual arrival. Instead, ports are presented with a coherent flow of traffic, which has been timed to reduce congestion in anchorages. As Mr Zografakis explains, the opportunity for reducing carbon emissions is sizable: "Our extensive study, involving a large scale hindcast simulation of 13,000 merchant vessels across 250,000 voyages, has shown the potential for The Blue Visby Solution to reduce carbon emissions from global bulk shipping by 16%. That's equivalent to eliminating the carbon emissions of a typical mid-size European country."

What makes Blue Visby particularly attractive is its potential for immediate implementation. As Mr Zografakis remarks, "These arrangements are contractual in nature. They are possible without a regulator, a policy maker, governments, or the IMO. They work well because they reflect how maritime trade actually works."

The consortium, which includes representatives from shipping, government, classification societies, consulting, finance, and environmental organisations, has grown steadily since its launch in mid-2022 and the pilot program is expected to develop into prototypes by the end of this year.

PORT-CENTRIC DECARBONISATION AND ENERGY EFFICIENCY

A key goal of most synchronisation and optimisation strategies is to reduce cost – financial and environmental – and thus increase efficiency. The sustainability of maritime operations is tied to reducing GHG emissions while simultaneously maintaining the high pace of global freight logistics. It is doing the same amount of transport work while reducing emissions. New technology clearly plays a critical role in developing new efficiency, but in maritime trade, there are many opportunities to improve the efficiency of existing ship technologies.

The subject of considerable industry attention since their announcement in 2022, green corridor schemes are an embodiment of emission reduction strategies which target operational, rather than mechanical, or design, efficiencies. The schemes are simultaneously

regulatory sandbox environments, private sector-led trade agreements, and green incentives. While many ultimately seek to align shipping and port services to catalyse the development of alternative fuels, a large part of their design seeks to eliminate wasted effort and foster a collaborative ecosystem which identifies mutual-interest use cases for data exchange and produces value for all stakeholders in the scheme.

So far, this platform has catalysed a number of innovative applications developed for a variety of industry use cases by MarineTech companies.

Thetius spoke with Mr Koh ChinYong, Chief Information Officer at the Maritime and Port Authority of Singapore (MPA) about the impactful digitalPORT@SG™ project. Rolling out in phases, the project aims to revolutionise the way the port handles traffic and ultimately make best use of the latest available technologies.

Mr Koh explained how the concept of using technology to improve collaboration formed the precursor of Singapore's digitalPORT@SG™ project. He said, "Data is needed to support digitalisation and in 2019, MPA launched the Singapore Maritime Data Hub (SG-MDH), a platform which promotes data sharing and supports secure data exchanges between organisations. So far, this platform has catalysed a number of innovative applications developed for a variety of industry use cases by MarineTech companies."

Of course, collaboration requires an accompanying set of standards for each stakeholder to work to, and in 2020, MPA addressed the need to facilitate system-to-system interoperability within the global digital ecosystem. Koh explained; "We launched our digitalOCEANS initiative, which stands for Open / Common Exchange And Network Standardisation. The purpose is to foster standardisation and harmonisation of data, and develop common Application Programming Interface (API) Specifications in the maritime industry." He continued, "We launched our first set of API specifications for port clearance submission in November 2022, which was the result of working with several partners from the maritime and supply chain industry stakeholders."

The first phase of the digitalPORT project saw the introduction of Singapore's single window. As Mr Koh explained, "The objective is to enable a seamless port clearance process. So far, that has saved the industry an estimated 100,000 man hours annually in submission of regulatory reporting for declaration of arrival and departure of ships."

These initial steps have primed the Port of Singapore to accelerate their decarbonisation strategy too: "We have started phase 2 of the digitalPORT@SG™, where we will implement a Just-In-Time (JIT) Planning and Coordination platform in 2023. JIT aims to orchestrate the scheduling of resources required by ships, thereby facilitating optimal arrival

and departure timing for ships to and from the Port of Singapore. Using this platform, we hope to enable faster ship turnaround and reduce waiting times in our port. The improvements in operational efficiency will also help reduce greenhouse gas emissions from ships in our port."

True to the principles of increased collaboration and coordination in pursuit of common efficiency gains, MPA and Port of Singapore have been working with international partners too: "Singapore and China have piloted data exchanges of twenty-five types of ship certificates for the purpose of port clearance and Port State Control and this is all done via APIs. We have also started to collaborate with like-minded nations to promote digitalisation and decarbonisation. In August last year, we signed an MOU with the Port of Rotterdam to establish the world's longest green corridor to enable zero carbon shipping. Recently, we signed another MoU with Port of Los Angeles and Port of Long Beach, with the support of C40 Cities, to establish the green and digital corridor. We are working with other partners to establish further green corridors and there will be further MOU announcements in due course."

Thetius spoke to Saskia Mureau, Director Customer Digital at Port of Rotterdam, to see developments from the European perspective. Ms Mureau notes the relationship between data, digitalisation, and the energy transition: "The ports industry is entering the twin transition period of digitalisation and sustainability, which are rapidly beginning to merge. Ports are not using digitalisation just for efficiency and thus improving margins, but we're also using it very much to tackle climate-related challenges. Reports vary on the impact of digital technologies on port decarbonisation, but it's likely to contribute to around 15% of emission reductions."

Ms Mureau describes how the Port of Rotterdam is also focussing its attention outward in search of opportunities to identify mutual interests and collaborate on problem solving across the ecosystem. She said, "We are exploring new ways to collaborate with other ports and stakeholders. For example, we are working together with the Port of Singapore on our innovative Green & Digital Corridor Initiative. Work on our digital corridor initiatives has been focussed on three agenda items: just-in-time sailing, particularly along the Singapore-Rotterdam green corridor; paperless trade, where we are working closely with the Digital Container Shipping Association to support their electronic bill of lading ambitions; and the third is customs clearance, where we are investigating ways to harmonise and speed up customers administration at both ends."

Ms Mureau sees three critical areas for change to make progress on maritime digitalisation and decarbonisation: "The first is the document flow, the second is the physical flow (of ships and cargo), and the third is the flow of trade finance. In each case, it is vital that we develop and adopt products and services which help these areas progress and not cause additional or unnecessary burdens on people or other resources."

On sharing data and collaborating closer with customers and trade partners, Ms Mureau's advocacy was clear: "Data sharing is critical to decarbonising port visits. We have got to keep moving to a system where we share across trade partners more. We will cater for businesses who want to participate in mutually beneficial data sharing infrastructures." She continued, "The Port of Rotterdam is looking at all opportunities to share data. From more accurate orchestration of multi modal port traffic to providing accurate cargo data in real time, we see an opportunity for €400 million of benefits to users of the Port of Rotterdam alone. A single delay might seem insignificant, but each delay accumulates over the entire supply chain, adding up to a decarbonisation and efficiency opportunity of significant size and scope."

SHIP PERFORMANCE DATA MODELLING

Another major business case for large-scale data sharing is in modelling ship performance to determine optimal operating criteria. Pooling data from multiple ships can dramatically increase the accuracy of modelling algorithms and digital twins. Furthermore, this kind of data collaboration can, and usually is, carried out anonymously. In most cases, data received from vessels in service are completely anonymised, but each contributor will benefit

from increased accuracy in data models pertaining to their ship type or voyage routes.

NAPA Napa Shipping Solutions produces ship performance models based on data. The company can construct a ship-specific baseline performance model for any ship in the world by combining elemental models such as those for the specific propeller fitted to the vessel, the engine type and characteristics, and hull form, including dimensions, ship type, service speed, and engine power. Combining these parameters with generic and wave-added resistance curves, NAPA can build a ship performance model which can be used to test and develop multiple optimisation strategies.

Certain parameters are affected by real-world conditions, which alter the accuracy of some model components. A good example is biofouling on hull surfaces, propellers, and appendages. According to NAPA, this can increase real-world fuel consumption by up to 20% over model estimates. Consequently their models apply hindcast and nowcast data from sources such as noon reports and signal data from onboard sensors. According to NAPA, these types of data-driven models are also useful for revealing coefficients which aren't available in traditional naval architecture models, such as the impact of rotor sails and novel energy-saving devices.

Casimir Morobé is the Founder and CEO of ship performance modelling company Toqua. He started his company to improve the process of building on and correcting ship performance models from delivery throughout the lifespan of a vessel. He told Thetius, "There is a lot of potential in building models which use live data streams. Based on the traditional modelling approach using sea trial data, we find the average errors to be 10-20% adrift of operational data. Toqua's models reduce this to just a few percent. With our models, operators can model the performance of the ship for any draft, any speed, and any weather condition. Because our models are using real IoT data from the ship, they can model for operating conditions which aren't available in sea trial reports."

Toqua focuses on improving consumption estimates to help operators gain a better insight into efficiency gains throughout fleet operations. Morobé remarked that, "The speed-fuel consumption relationship lies at the heart of every decision taken in shipping; for example, how fast should we sail? When will we arrive? What quantity of emissions will we produce? What performance criteria can we promise in a charter party contract? All of these decisions start from a speed-fuel curve."

Toqua is working with a number of notable clients and Thetius asked about their impact to date: "A tangible example of the impact that our data-driven models can have is with our clients Euronav. We found that swapping out traditional performance models with our more advanced models within their existing routing solution, we were able to double the fuel savings. This was achieved without changing the routing algorithm, but just by giving the program a more accurate performance model. Being able to double fuel savings represents a major example of an accessible route to immediate decarbonisation, based on liberating operational data and, crucially, using it in an impactful way."

Similar to OrbitMI, Toqua is not seeking to dominate a broad spectrum of the market: "It is important to remember that every single maritime software solution at its core is based on these speed-fuel models. We don't try to compete with existing routing software providers, we are just focussed on developing the best models for their solutions based on sensor data."

This connective approach is vital to developing more collaboration across the industry. Morobé points out that the contractual nature of maritime trade can challenge the notion of data collaboration: "Contracts can limit data sharing because each party has their own interests, and this is a significant barrier to collaboration. In order to realise new efficiency gains, the maritime industry needs to share more data and agree on the performance of a vessel in a more accurate and uniform way."

Morobé also makes a distinction between data sharing and meaningful collaboration, highlighting how data shared out of context or without a common understanding of its meaning can end up creating another barrier to collaboration: "Just sharing raw data won't solve anything in itself. You can stream vast amounts of raw high frequency sensor data to a charterer, but the data will contain a lot of noise. Each party will try to interpret and understand that data differently and this could result in everyone taking a different approach to modelling and ending up with different results, still making it impossible to collaborate on ship performance."

Looking at requirements to develop data collaboration in the near term, Toqua sees the need to address three key concerns: data standards, human error, and siloing. Morobé concluded: "Humans can cope with non standard data in small quantities, such as a traditional noon report. But to harness the enormous potential of big data analytics, this work must be done by machine and machines need consistent standards to form rules around. It is our hope that these standards will soon be built into contracts to nominate the type of data, but also the units and nomenclature. Human data reporting remains a real problem to data quality and data-driven optimisation. For example, we see errors of up to 10% in between manual noon reports and raw sensor data. If you want to create highly accurate performance models, you need highly accurate data, and errors of 10% are simply way too much if you want to achieve accurate models that allow for fuel-saving optimisations. Finally, we need to break down data silos to broaden the playing field. If you develop a system in a closed off way, your solution will look like the best one because you're unable to see how it is performing against everybody else. Offering up data to all technology providers enables them to compete to get the most out of that data and build the best products around it. This will raise the quality of technological solutions available to the industry and benefit everyone overall."

CHALLENGES TO DATA SHARING AND COLLABORATION

There are several inhibitors to data sharing. Some are technical in nature and are better thought of as stubborn obstacles. Others are based on legitimate concern for good governance and stewardship in protecting the interests of a business and making sure that new practices don't stray outside the law. While it is outside of the scope of this report to provide legal guidance, it is worthwhile to summarise some of the key barriers to data sharing and collaboration in order to plot these against some of the solutions.

CHALLENGE 1: COMPETITION LAW AND ANTITRUST CONCERNS

The notion of openly sharing data with competitors is naturally unthinkable for many maritime businesses. But sharing data with trade partners and the wider supply chain on platforms which are also used by competitors is an increasing reality. In 2022, Houlder Navigator published a whitepaper containing the results of a survey of large and small shipping company executives across the container, tanker, bulk, cruise, and ferry sectors. The survey gathered opinions on the challenges and opportunities for digitalisation and the energy transition.

Houlder's report found that, "Collaboration will be critical to achieving rapid, fundamental change." But also pointed out that, "Many shipowners are keen to collaborate on decarbonisation projects with like-minded partners so long as they don't directly compete with them." Keeping access to data which could be used by competing businesses to gain some advantage will continue to be a priority. Houlder summarised the issue thus: "Ultimately, it is all about driving sustainability while safeguarding competitive advantage." When asked how much data one anonymous shipowner was willing to share, they replied, "We're happy to share some of it, but not all of it. You want to see what competitive advantage you can gain from some of these opportunities."[9]

But even where competing businesses are keen to exchange data to yield mutual benefits, there can be legal barriers to overcome. In the European Union for example, lawyers have pointed out that general antitrust legislation, in particular article 101 (1) of the Treaty of the Functioning of the European Union (TFEU) which prohibits anti-competitive agreements, may have implications for collaboration, even when the

9 Houlder (2022) Navigator Series: Clean technology and the decarbonisation challenge. Retrieved from https://www.houlderltd.com/insight/clean-technology-and-the-decarbonisation-challenge-a-houlder-navigator-whitepaper

goal is decarbonisation. It is likely that some of the issues competition law raises for data collaboration in European shipping will be addressed in forthcoming instruments such as the EU Data Act, but the commission's current approach is to provide guidance on the application of existing rules.[10] [11]

While EU level competition law will only apply where the undertaking might affect trade between member states, the guidelines do cover horizontal cooperation agreement types which are common in the maritime setting, including research and development agreements, commercialisation agreements, and standardisation agreements. The EU has published detailed guidance on how article 101 impacts what they refer to as "horizontal cooperation agreements" since 2011 and the latest version was released in March 2022. The latest iteration provides more clarity on how sustainability-driven collaboration can be navigated within the bounds of the existing law.

In essence, the guidelines suggest that article 101 assessments should be conducted in two stages. The first establishes whether an agreement has an "anti-competitive object" or "actual or potential restrictive effects on competition". Where anti-competitive objects or effects are identified, stage two determines the pro-competitive benefits produced. The EU then provides a framework for establishing the balance between the two and only if the pros outweigh the cons could the agreement proceed.

Of course, competition laws vary by jurisdiction and legal advice should always be sought by any company looking to enter into data sharing or collaboration agreements with any partner who could be considered an actual or potential competitor, or where entering in to such agreements with suppliers and trade partners might put competitors at an unfair disadvantage to the extent that competition and antitrust laws apply.

CHALLENGE 2: DATA SILOS

"Siloed data" is an increasingly familiar term in shipping. It refers to data which is stored and controlled by one company, department, or business unit in such a way that makes it inaccessible to other nodes in a system. As such, silos can be internal, where data might be available to a finance department but not to a commercial department, for example. Or external, where, for instance, berth productivity data might be available to the terminal operator, but not a ship operator.

Controlling access to data is a vital part of keeping data secure and protecting confidential and sensitive information. But silos can also restrict data access needlessly or to the detriment of others with a legitimate interest or use case. To move ahead with the technological evolution of the shipping industry at scale, liberating data and improving its liquidity is of vital importance. Moving data across environments and generating multiple copies of the same data has cost implications in time, money, and energy resources, not to mention the consequences of making the data more prone to error as a result of its syndication.

In 2022, IHS Markit and TradeWinds published a joint report on attitudes to data and digital transformation in shipping. In the report, Ivana Blažević, Vice President of Marketing and Supply at oil and gas company Equinor, told analysts, "Data management is a huge challenge for large companies, including ours. We process a lot of data. The first step involves getting data out of an on-premises siloed solution into a single platform." Getting data flowing is akin to turning on the fuel taps for digitalisation and transformation in shipping. Blazevic concludes, "the liberation, integration, and contextualisation

10 Thomson Reuters Practical Law (24 May 2022) Practice Note: Competition Law and Sustainability. Available at https://uk.practicallaw.thomsonreuters.com/w-035-6161?transitionType=Default&contextData=(sc.Default)&firstPage=true

11 EU legislative instruments can be viewed at https://eur-lex.europa.eu/

of data will be a key accelerator and critical differentiator in the industry going forward."[12]

There are market ready solutions which remove data silo problems and overcome access and exchange challenges. Switching to standardised exchange mechanisms such as a REST API and placing data in a single source location with access controls such as cloud platforms is becoming an increasingly attractive solution for maritime businesses. Where data is co-mingled in a cloud environment such as in a port community system, this enables powerful enhancements to the quality and sophistication of data products available to the contributors. It is a classic example of the total being greater than the sum of its parts.

CHALLENGE 3: CULTURE AND BEHAVIOUR RESISTANCE

The culture which exists at individual, board, and industry-wide levels can have a significant impact on the speed and direction of change. This report has already examined some of the legacies which exist in maritime and with them comes forces which favour a business as usual approach. A system of learning from mistakes and passing down traditional best practice from generation to generation builds wisdom, but may also limit innovation.

Change management is perhaps the most difficult thing a company will do, especially when a culture developed in a pre-digitised paradigm. In 2022, analysts from international consultancy giant PWC wrote that culture is the invisible enabler of change. The authors argue that highbrow rhetorical cliches from the board are unlikely to produce change successfully and explain how successful change management requires leaders to consider what change would really look like to an individual employee on a day-to-day basis. The article offers three lessons for a successful change program: (1) connect culture to strategy by firstly understanding in real terms what the company culture is and what needs to change to align with the proposed change; (2) translate change down to specific frontline team behaviours and highlight a restricted number of critical behaviours which need to change; and (3) create a plan, but expect to adapt it in response to incremental results. PWC concludes, "Based on our experience, culture is a key means of creating sustainable transformation, along with foundational elements like broad-based communication, employee engagement, and leadership alignment. The challenge is linking culture work to practical, business-relevant changes that directly affect the behaviours of frontline employees."[13]

This approach has direct relevance to digitalisation programs in shipping, especially when they concern maritime operations. A Thetius seafarer digitalisation survey from 2022 found that 40% of crew members who worked with digital technology at sea did not believe that it had been well designed for their needs. Considering how data and data sharing technology will be used by team members is critical to designing solutions which have high probabilities of success.[14]

Commenting on these types of cultural and behavioural barriers to digitalisation and data collaboration, Karin Staal, Founder and Director of Netherlands-based Staal Maritime, told Thetius that she created her business in part to promote more dialogue between seagoing and shore-based staff. She said, " What I see most often are new technologies, policies, procedures, and ideas being generated on shore, without consultation with seafarers."

12 IHS Markit and TradeWinds (2022) Data and Digital Transformation: Insights from Shipping Leaders. Retrieved from https://www.spglobal.com/marketintelligence/en/mi/Info/0222/edm-maritime-tradewinds-digital-transformation-whitepaper.html

13 PWC Strategy + Business (12 July 2022) Culture: Transformation's invisible enabler. Retrieved from https://www.strategy-business.com/article/Culture-Transformations-invisible-enabler

14 Thetius and Inmarsat (2022) Seafarers in the Digital Age: Prioritising The Human Element in Maritime Digital Transformation. Available at https://thetius.com/free-report-seafarers-in-the-digital-age/

Staal believes that digitalisation and data collaboration are vital parts of the systemic change needed if the maritime sector is to reach its goals, but properly aligning the human element is critical. She remarked, "It's people who are equipped with purpose and understanding, which will make the most of new technology and that takes more than a standing order or an SOP. It requires you to make them believers."

CHALLENGE 4: COST

The cost of gathering, storing, parsing, analysing, and sharing data can be considerably reduced if suitable market ready solutions are selected. However, cost is still considered by many to be a significant barrier to data-driven transformation in the maritime industry.

Government grants, which play a prominent role in sector-wide change programs, can act as a driver of collaboration in part because they often require consortium bids. However, while this is a positive force for greater collaboration, Houlder points out that this regime makes participation more difficult for smaller companies who don't have the technology or people resources needed to make collaboration happen.[15]

Data technologies can offer significant returns on investment, however. In November 2022, global technology giant Lenovo claimed that over the course of 2023, global companies will invest an average of $3m each on data technologies and initiatives and they anticipate a sizable 81% return on investment.[16] Similarly, maritime-focussed studies have shown that 71% of shipowners and managers stated that cost reduction was the primary driver of their digitalisation strategies. Nearly half of these respondents expected savings to exceed $1m per year, with 15% predicting savings in excess of $10m.[17]

15 IBID Houlder (2022)

16 Lenovo (November 2022) Data for Humanity: How can businesses balance profit with purpose? Retrieved from https://news.lenovo.com/wp-content/uploads/2022/12/Lenovo_Data-for-humanity.pdf

17 Lloyd's List and Inmarsat (2020) Digitalisation Uncovered: What's Next for Shipping? Retrieved from https://www.inmarsat.com/content/dam/inmarsat/corporate/documents/maritime/insights/Digitalisation_Uncovered_What_s_Next_for_Shipping.pdf

CONCLUSION

There is little doubt that the global shipping industry is committed to catching up on lost ground in the digitalisation and data integration of its functions, assets, and services. This report examines how data generation and exchange are growing rapidly in the sector and how policies, regulations and laws are accelerating those trends.

Data is now recognised for its importance and its value to shipping. But generating, transmitting, and storing data is meaningless if it isn't used in some way. The fact that the majority of maritime data remains unused is both a source of regret and perhaps the biggest untapped opportunity the industry has ever known.

Complex problem solving relies on converting data into insight and insight into action. But more than that, when faced with a multivariate, pan-sectoral challenge such as decarbonisation, sharing and collaborating on data becomes of paramount importance. Realising that the maritime industry is a vast interconnected ecosystem makes it obvious that solving problems in isolation among a limited number of actors cannot affect change across the entire network. While individual action from shipping companies and their trade partners is a welcomed step, these cannot bring about the depth and scale of advancement required to meet global challenges.

Reducing carbon emissions is arguably the most pressing example of common interest since the advent of the P&I club, or the creation of the Global Maritime Distress and Safety System (GMDSS). It is impossible to imagine a way for shipping to achieve meaningful carbon emissions reductions without pooling resources and having enough centralised data to render the macro view. As IMO Secretary General Kitack Lim told a Hamburg delegation in 2022, "I believe that the most fundamental change in shipping is going to come from a changing mindset. This means a shift to greater transparency, more sharing of data, better analysis of data and collaborative thinking. Only by working together collaboratively and cooperatively, can we make shipping greener and more resilient."

Data insight, analytics, data modelling, decarbonisation, energy efficiency, and synchronising the maritime ecosystem are just a handful of use cases where generating and sharing the right data with the right partners at the right time can lead to sector-wide progress. However, these efforts cannot be driven by the largest, richest, and most influential actors alone. In an industry where 80% of data isn't used, 80% of ports still rely on manual, analogue processes in their day-to-day tasks, and 70% of the addressable fleet are owned by companies operating fewer than 15 vessels, consolidating data and sharing insight throughout the ecosystem is key.

Breaking down barriers to data sharing and collaboration isn't easy. There are many challenges to address from practical, political, legal, and technological standpoints. Competition laws and antitrust concerns are likely to continue to test the boundaries between competition, collaboration, and consent throughout the transition. Cultural and behavioural legacy will also continue to apply a drag factor. Ultimately, all change comes at a cost: monetarily, culturally, and psychologically.

But, as this report shows, the time, technology, and trading environment is right to use digital data to evolve and grow. Shipping can choose to achieve its goals for decarbonisation and modernisation not as a result of political pressure, but as a pro-active, future-facing, resilient and responsible industrial sector.

By recognising the scale and depth of its common interests, shipping has an opportunity to use data sharing and collaboration to make rapid advancements in all areas from future fuels to training, retention, health and welfare of its workforce. Sharing and collaboration also distributes risk and leverages the many advantages and economies of scale. Collaboration is possible, practical, necessary, and mutually advantageous and that is a powerful and compelling combination.

SUPPLEMENT: A BRIEF GUIDE TO DATA FUNDAMENTALS – IS YOUR DATA YOUR DATA?

This supplement will not provide a legal treatise, but in order to round-off the discussion of data sharing and collaboration it is important to establish in general terms, some of the foundational concepts and definitions in data, its ownership, and protection in law. What follows is a brief guide to the main concepts.

DEFINING DATA

It might be convenient to think that the word "data" is interchangeable with "facts". While data can include facts, the two terms are not synonymous. Data typically refers to information which may or may not be factual. Data can include opinions, estimates, and other types of information that are not necessarily proven or verified.

Data can include observations of reality; figures, statistics, and other information which has the potential to be analysed to provide definition to a physical reality. But data does not constitute intelligence in isolation because data can be meaningless unless accompanied by a frame of reference. Data exists in various forms and in order to turn data into facts, it needs to be analysed against a frame of reference and validated through a verification system.

To determine which laws and regulations might apply to a piece of data, it is therefore necessary to understand its characteristics. Data can be financial, geospatial, biometric, environmental, personal, operational, or technical in nature, and how these are treated in law varies widely between jurisdictions and use cases.

Data is also classified by how it relates to business processes. The International Standards Organization (ISO) offers a data quality management standard – ISO 8000. This provides guidelines for the exchange, integration, and quality control of data used in business processes. Within it, ISO 8000 provides a useful distinction between "master data" and "transactional data" in a business context.

Master data is data which relates to core business information, such as product details, customer information, supplier records, and employee data. Master data serves as a foundation for business transactions and is relatively stable over time.

Transactional data captures the details of individual business activities or events. It includes information about specific transactions, such as sales orders, purchase orders, invoices, and financial transactions. Transactional data is time-sensitive, dynamic, and directly linked to business processes.

In data management practice, it is generally recognised that master data and transactional data have distinct characteristics and may require different approaches to their management. Businesses often implement separate processes for managing master data, such as data governance, data stewardship, and data quality assurance. Transactional data is typically handled through operational systems and processes that capture, process, and store the data as part of daily business activities.

Maritime data and data which could be shared within an ecosystem of partners for the purpose of making efficiency gains in ocean freight is generally *technical* and / or *operational* data. This is data relating to the performance, characteristics, and usage of technological systems or devices and as such, could be master data or transactional data. This can include data such as quantity measurements, parameters, system logs, device identifiers, IP addresses, browser types, and operating system details. Crucially, it is data which relates solely to things, rather than personal data, which can be used to identify individuals.

Data also exists at different stages within a transformation process. Technical data can be subdivided into three stages within this transformation process, each with their own characteristics and potential treatment in law. These subdivisions are as follows:

- **Raw Data** is data generated by digital means which has not been processed, analysed, or enriched in any way. It generally has no use without one of these three things being applied. For example, raw data could be a series of binary digits generated by the firmware of a sensor.
- **Pre-Processed Data** is derived from raw data, but it has been prepared in some way for processing, analysis, or enrichment. This could include filtering, aggregation, or labelling. For example, the raw binary sensor data referenced above will become pre-processed data once it has been segregated into a time series, grouping the data by date and time, for example.

- **Analysed / Processed / Derived Data** has been consumed or manipulated to produce intelligence of some form. This is data which is now able to provide meaningful value and constitute knowledge. To conclude our example, this would be the interpretation of the binary data generated by the sensor. For example, the sensor data might be codified into cylinder temperatures given in degrees celsius over a 7-day voyage. By taking meaningless raw data and processing and enriching it, that raw data was transformed into derived data, which provides intelligence about the operation of the engine.

Discussing 'maritime data' and 'data ownership' therefore requires a degree of nuance. This report has focussed on technical / operational data, but even at this level of precision, some maritime data ownership scenarios are more complicated than they first appear.

THE DATA VALUE CYCLE

Not only can data have multiple characteristics and transformation stages, but collecting, moving, and using data processes it through a system known as the data value cycle. This cycle can also influence data ownership and is a useful tool for understanding how many parties could be involved in managing and processing maritime data and, therefore, how many parties could legitimately claim rights over access and usage.

There are variations, but for our purposes, the data value cycle can be thought of as comprising the following stages:

Acquisition: This stage involves collecting or obtaining data from various sources, such as sensors, databases, or external providers. On ships, this could include temperatures, pressures, positions, statuses, conditions, motions, etc.

Storage: After acquiring data, it needs to be stored securely and organised in such a way that it can be recalled. This stage involves providing an appropriate storage medium, such as local storage devices, centralised servers, cloud infrastructures, data lakes, or archiving hardware. Best practice ensures that the data is properly backed up and protected from unauthorised access.

Processing: Once data is held in storage, it is likely to require processing to extract useful insights or information. Depending on requirements, several systems may need to access the data to conduct processes.

Analysis: After processing, the data can be analysed to extract decision-making information. This stage may involve using statistical methods, machine learning algorithms, or other analytical techniques to contextualise the information.

Contextualisation and sharing: The insights or information extracted from the data may need to be communicated to others. Visualisation tools such as graphs, charts, or dashboards can be used to represent the data in a meaningful and understandable way, but this stage may also involve machine to machine transmission through an application programming interface (API) for example.

Action: Finally, the insights or information obtained from the data can be used to make informed decisions or take action to achieve desired outcomes.

Most data value cycles are closed-loop processes. New data is constantly acquired, processed, and analysed to generate new insights and continually drive decision-making. Given that data exists in so many forms and positions in the data value cycle, the advent of data analytics in shipping raises a considerable challenge to the concept of data rights and ownership dealt with by contract law alone.

DATA AS A SERVICE (DAAS)

2022 data from IDC Research Inc. suggests that global data generation from all sources is growing at a compound annual growth rate (CAGR) of about 21%, reaching 221,000 exabytes by 2026. That is equivalent to filling the storage capacities of 442 billion 500GB laptop hard drives every 12 months.[18]

In the maritime sector, generated data includes information related to position, speed, heading, fuel consumption, weather conditions, cargo status, and other operational parameters and a significant amount of commercial data related to trade flows, supply chain logistics, and market trends. Many maritime businesses use this data to optimise operations, improve profitability, and stay competitive in the global marketplace.[19]

Back in 2018, research indicated that only around 1% of the data generated in the maritime industry was used for decision-making, leaving vast quantities of valuable data do expire on servers with no value extracted from it.[20]

The COVID-19 pandemic accelerated digitalisation across the maritime sector and placed an intense spotlight on the value of data. Inmarsat statistics on commercial shipping data exchanged over the company's satellite network showed that data consumption nearly tripled from 3.4 to 9.8 gigabytes between January 2020 and March 2021. Over a similar

18 IDC Custom Solutions (July 2022) High Data Growth and Modern Applications Drive New Storage Requirements in Digitally Transformed Enterprises. Retrieved from https://www.delltechnologies.com/asset/en-us/products/storage/industry-market/h19267-wp-idc-storage-reqs-digital-enterprise.pdf

19 International Association of Ports and Harbours (IAPH) and IMO (2018) Digital Transformation in Ports and Shipping: A Review and Assessment of the Opportunities and the Challenges. Retrieved from https://www.imo.org/en/MediaCentre/

20 DNV (2017) The Leading Maritime Capitals of the World. Retrieved from https://www.dnv.com/maritime/publications/maritime-capitals-2017-download.html

period, the proportion of shipping companies actively using data analytics to drive decision-making increased from 7% in 2017, to 26% in 2020.[21] Research from McKinsey & Company supported this analysis, estimating that data generation in the global shipping industry would grow at a compound annual growth rate (CAGR) of 30 – 40% up to 2030.[22]

Despite rapid increases in data generation, the EU maintains that currently 80% of industrial data still isn't used, and estimates that creating the conditions required to encourage this data to be shared will create an additional €270 billion in EU gross domestic product (GDP) alone by 2028.[23]

There are significant growth trends in both the amount of maritime data generated and the amount of data being used to inform decision-making, but there is still some way to go to bring the industry to an ideal state. A recent S&P Global Market Intelligence survey canvassed over 900 supply chain respondents from 85 countries. The results showed that while data played an important role in more than 9 out of 10 supply chain operations, on average, the industry still faced significant challenges in integrating, sharing, and accessing the data they needed.[24] This reflects both the importance of data to the supply chain and the need to share and exchange much more of it.

DATA OWNERSHIP

Data ownership is not the same as ownership of a physical asset. Misconceptions about what it means to own data are common. What does it mean to "own" information? If a person invests in a thermometer to measure the outside temperature, it would be unreasonable to suggest that they then own the fact that the ambient temperature is, say, 19°C outside. They own the instrument and as such, they have the right to control access to the readings from it. But the data – the information – the fact – that it is 19°C, belongs to anyone with a means to measure it for themselves. The same could be said for the position, course, or speed of a ship, or the amount of fuel it has on board, or the temperatures of its stack manifolds, etc.

There are significant growth trends in both the amount of maritime data generated and the amount of data being used to inform decision-making, but there is still some way to go to bring the industry to an ideal state.

It is reasonable to assume that common assumptions around proprietary data and data ownership have come from more developed areas of law which deal with personal data; for example, the EU General Data Protection Regulations, or the California Consumer Privacy Act (CCPA). Notably, neither of these regulations refers to a right to "own" data in the sense of proprietorship. Instead, the point of focus is on the right to control access, which is a fundamentally different concept. On top of that, data derived from sensors and machinery on ships is classified as 'technical data', which isn't defined or protected in the same way.

Understandably, there has been an acute degree of legal uncertainty around technical

21 Thetius and Inmarsat (2021) A Changed World: The State of Digital Transformation in a Post COVID-19 Maritime Industry. Available at https://www.inmarsat.com/en/insights/maritime/2021/state-of-digital-transformation-post-covid-maritime.html

22 Singh, K., Ellinger, J., Hellstrom, J., Kermarrec, J., & van den Hoogen, J. (2018). Digital transformation in shipping: A guide for business leaders. McKinsey & Company.

23 European Commission (23 February 2023) Data Act: Commission Proposes Measures for a fair and innovative data economy. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1113

24 S&P Global Market Intelligence (N.D.) Whitepaper: Supply Chain Industry Survey Results and Analysis. Retrieved from https://www.spglobal.com/marketintelligence/en/mi/Info/0922/supply-chain-industry-survey-results-and-analysis.html

data rights and ownership. As a result, best practice has traditionally tended to favour dealing with it through the law of contracts. In essence, a marine equipment manufacturer and ship owner enter into a contract which specifies data rights such as the data collection and processing rules, on a case-by-case, or contract-by-contract, basis.

Under this system, it has been common for OEMs or technology providers who are capable of analysing the data and providing data services to the product owner (i.e. the ship owner) to collect and analyse the data because there is an obvious mutual benefit. It is common for OEMs to collect data for the purposes of product development and performance monitoring through connected equipment or the Internet of Things (IoT).

What has been less clear is the ship owner's right to access data generated by the systems that they purchase. In the recent past, product owners have become less willing to automatically grant data access to manufacturers, perhaps due to a lack of trust, or because of an increased perception of value in the data generated on their ships. It is also true that many manufacturers have generated significant revenue streams from charging users to access data for the purposes of sharing it with other service and equipment providers. But shipowners are increasingly obliged to pool their data so that it can be used by several systems. The concept of maritime digitalisation is built around a multitude of specialist applications orchestrated to produce a single outcome and this frequently requires data to be shared across multiple domains.

A classic example of this can be found in voyage optimisation systems. Most of these products require data feeds from multiple sources, such as position, course, speed, inclinometer data, shaft power, propeller RPM, engine temperatures, meteorological data, and routing information. This data is produced by several systems, supplied by different manufacturers, and operating under individual service contracts, each with varying data rights. Liberating this data across a company's tech stack requires complex integration to ensure that data usage rights are not breached at any stage of the process.

PROTECTING TECHNICAL DATA

In response to a lack of unifying legal frameworks for sharing technical data, the EU recently proposed a new instrument called the EU Data Act.

While still in the process of adoption by the EU and not yet in force, the Act will attempt to standardise the rights, obligations, and processing of technical data across EU Jurisdictions. As the EU puts it, "The Data Act will ensure fairness in the digital environment, stimulate a competitive data market, open opportunities for data-driven innovation and make data more accessible for all. It will lead to new, innovative services and more competitive prices for aftermarket services and repairs of connected objects."[25]

A key result of the act would be to give shipowners more control of the data generated from and by the systems onboard their vessels. The act will also place a legal obligation on the technology provider or holder of the data to provide straightforward direct access to the data held and will not be entitled to profit from providing this access beyond reasonable administration charges. In addition, the manufacturer of the product will not be entitled to access or collect data without a specific contract in place with the shipowner which covers this usage.

Access by third parties is also a major development in the proposed act. Shipowners will be able to grant permission to third-party companies to request data from an equipment manufacturer or data holder. The data holder will be entitled to a fair compensation for this, but the EU is proposing a mechanism of control designed to protect small and medium-sized enterprises (SMEs) from exorbitant fees.

Many legal analysts believe that this framework would provide the right conditions to promote the free flow of data between systems and bring more certainty and regularity to the market, providing a potent catalyst to the digitalisation of the maritime industry. However, several challenges have already been set against the progress of the bill through the EU Parliament, including the treatment of trade secrets and commercially sensitive data.

Amendments made to the draft act in March 2023 made compromises which would allow data holders to refuse to share data under "exceptional circumstances", such as if disclosing the data would be highly likely to cause severe damage to their commercial interests, regardless of protections a receiver might put in place. The amendments define serious damage as, "damage with an adverse effect on the conduct of economic activity, when the data holder would face significant economic losses, which could, in particular, threaten its viability or pose a serious risk of bankruptcy."

In a maritime context, this could result in some proprietary data being withheld from shipowners and may, under some conditions, prevent the sharing of operational data from ships. Overall, within the EU jurisdiction, the act would enable:

- Measures to allow shipowners to gain access to data generated by connected devices on board their ships, much of which is currently harvested by manufacturers.
- Measures to prevent "contractual imbalances" in data sharing contracts due to unfair contract terms imposed by a party with a stronger bargaining position.
- Means for public sector bodies such as port state control to access and use data held by the private sector (shipowners, operators, charterers, OEMs etc.) that is necessary in exceptional circumstances such as a public emergency, or to implement a legal mandate if such data is not otherwise available.
- New rules to allow users to switch between different cloud data-processing service providers, including safeguards to prevent unlawful data transfers.

Since the 24th March, the EU Commission has agreed a unified negotiating position, and the act is expected to progress through accession throughout 2023. However, until the EU data act enters into force, the protection of operational and technical data largely remains under the purview of contract law.

25 European Commission (23 February 2023) Data Act Factsheet: The path to the digital decade. Retrieved from https://ec.europa.eu/newsroom/dae/redirection/document/83517

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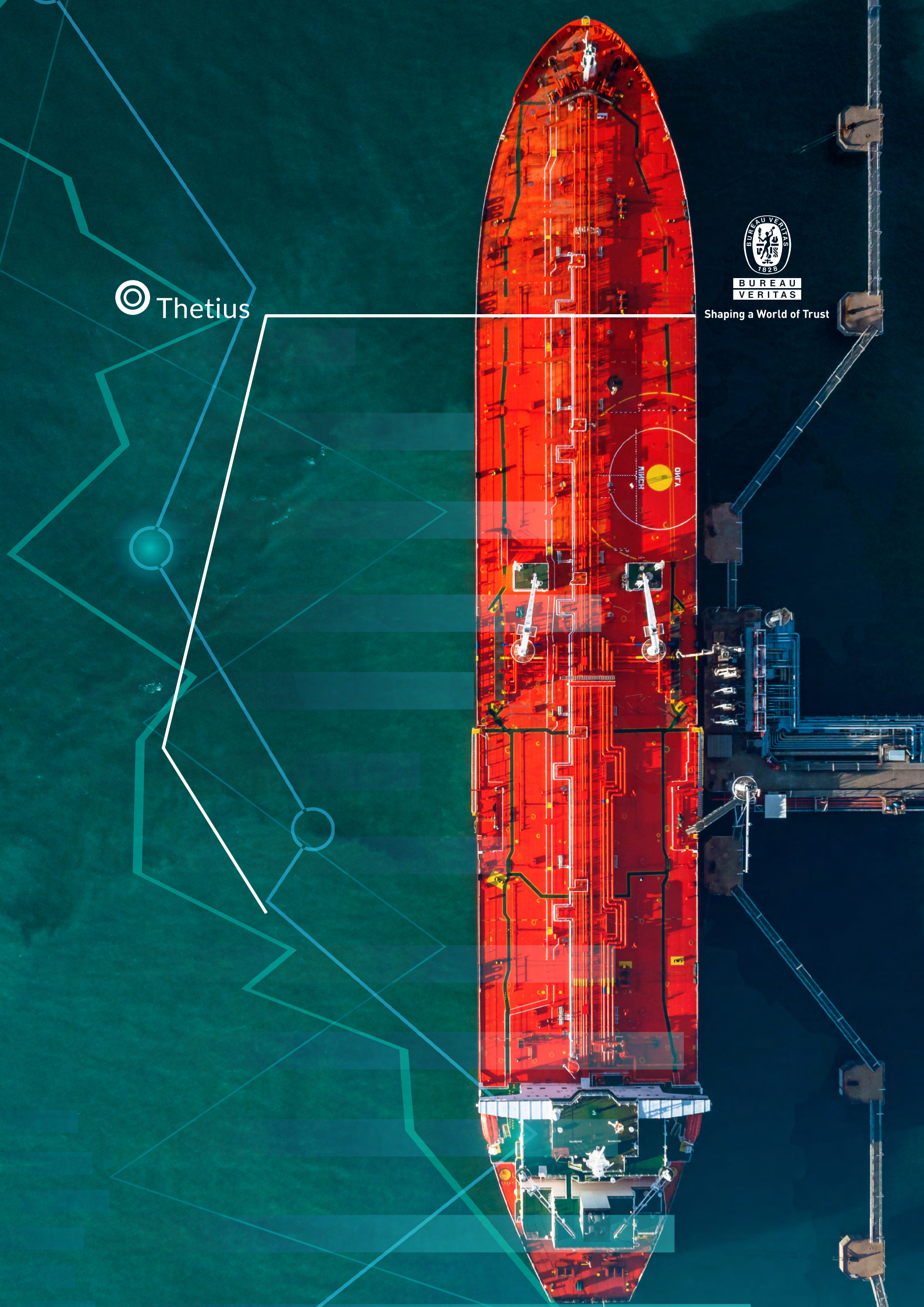
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