How Digitalization Can Unlock Green Shipping Corridors from Feasibility Study to Implementation.

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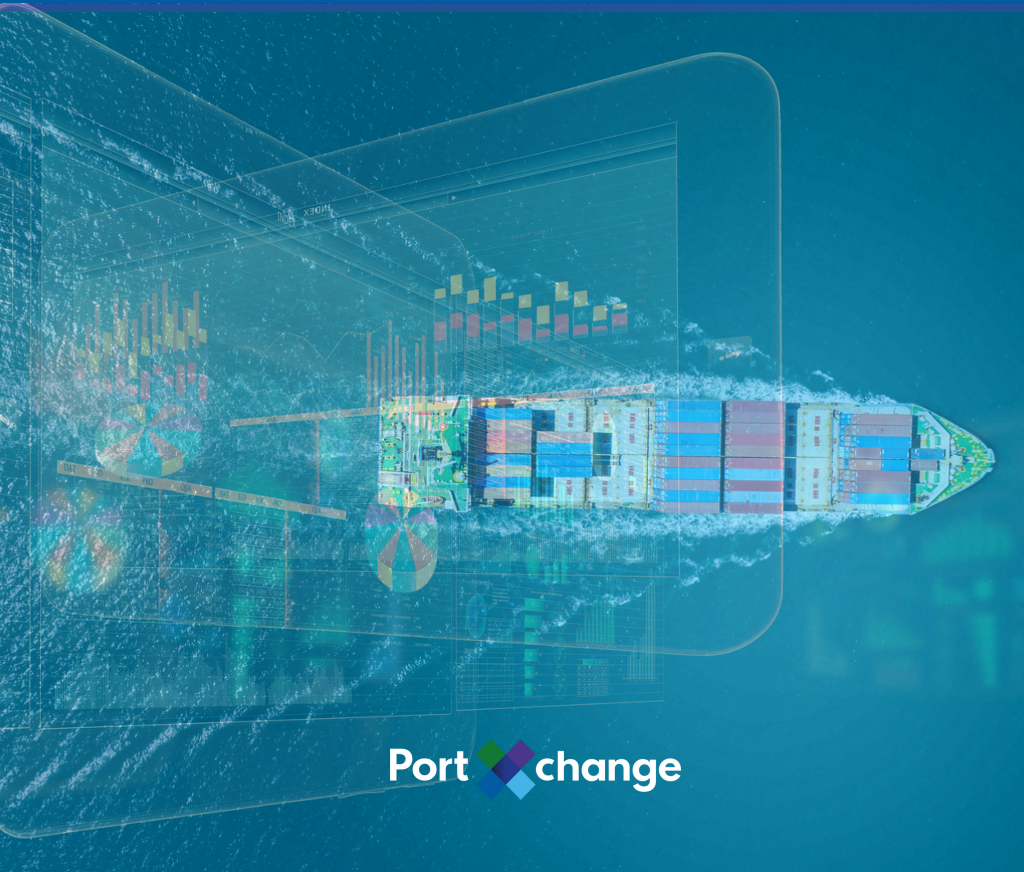

Port change

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INTRODUCTION

This white paper by PortXchange explores the strategic implementation of green corridors, examining the opportunities and challenges involved, and provides actionable insights for stakeholders committed to achieving a sustainable maritime industry.

We present a strategic five-step approach that creates a value proposition for green shipping corridors. This approach incorporates the critical additional benefits of digital solutions to accelerate decarbonization and create tangible results for faster implementation. This approach is designed to streamline the process of establishing successful green corridors, effectively bridging the gap between intention and realization. It enables maritime and port authorities worldwide to enhance operational efficiency, reduce their carbon footprints, and Scope 3 emissions.

Executive Summary

Why do we need green shipping corridors?

To achieve full decarbonization of the shipping sector by 2050, zero-emission fuels and vessels must be deployed at scale over the next decade.

The green corridors concept emerged from COP26 (2021) in the Clydebank Declaration, which was endorsed by 22 countries. This declaration included a commitment to establish at least six green shipping corridors by the middle of this decade.

The same year, the Global Maritime Forum's "Getting to Zero Coalition" report highlighted the potential of green shipping corridors along specific trade routes using major port hubs to pave the way towards zero emissions. The report emphasized that green corridors could create favorable conditions for decarbonization by enabling policymakers to establish a supportive ecosystem through targeted regulatory measures, financial incentives and safety regulations.

Creating these green shipping corridors allows the maritime industry to test, calibrate and assess risks within localized or specific trade route ecosystems, providing valuable insights that can be scaled to other regions or sectors.

While some green shipping corridors have made progress towards feasibility assessments, few have released detailed plans or metrics for realizing these corridors. This indicates either slow movement or the magnitude of the task at hand, partly due to challenges such as uncertainty around fuel pathways, the complexity of bringing all stakeholders together to develop a strategy and implementation plan and high investment costs.

FORWARD

Green corridors run the risk of being deprioritized or abandoned if they continue without tangible results. Adding digital solutions might be a simple yet effective way to address this issue and help bring forward their implementation.

Another component that needs serious addressing is the low barrier to entry due to the absence of stringent criteria which allow anyone to declare a shipping corridor as green. Although this openness increases volume of new corridors to be created, it also leaves room for some stakeholders to design corridors without firm commitments, diminishing their impact and rendering them ineffective in meeting the necessary criteria for significant maritime decarbonization. From conversations we have had with various ports, it is evident that despite the oversight and management from the Global Maritime Forum, quite a few corridors have still been created from a marketing point of view.

To counteract greenwashing within the green corridor movement, transparency is crucial. This involves standardized digital reporting on the progress of green corridors and educating stakeholders. Additionally, sharing data and challenges will foster an environment where all participants collaborate to address the issues and make collective progress.

The Global Maritime Forum's Annual Progress Report on Green Shipping Corridors states, "If green corridors are to hit their targets and fulfill their function, 2024 must be a breakthrough year in which front-running initiatives begin to execute their plans and others are primed to follow quickly. Success hinges on accelerated effort within the corridors, the swift introduction of fit-for-purpose measures by the governments, and the willingness of the broader shipping ecosystem to support the first adopters/frontrunners."

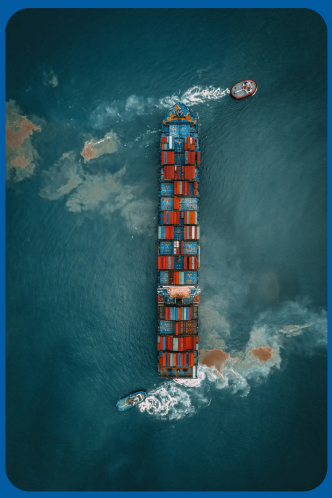
According to the DNV database, 57 green shipping corridor initiatives have been recorded as of February 2024. This number doubled from 22 in 2022 to 44 in 2023, the year the IMO adopted its revised greenhouse gas strategy.

As an industry, we must ask ourselves: are we truly committed to Green Shipping Corridors? Is there an element of greenwashing? Will they lose momentum due to the time required for implementation and the number of stakeholders that need to be engaged?
To avoid this challenge, it is imperative to integrate digital solutions, transforming most green corridors into green and digital corridors.

The criteria for which corridors should be prioritized for this transformation are:

- Short Distance, Direct Connection: Corridors with shorter distances and direct connections are more manageable and can serve as pilot projects for larger-scale implementation. They allow for quicker adaptation of new technologies and practices, which can then be scaled up.
- Container/Passenger Traffic Dominated: Corridors dominated by container and passenger traffic should also be prioritized because these sectors have high visibility and significant environmental impact. Enhancing their sustainability will not only reduce emissions but also set a standard for other types of shipping.

These criteria ensure that the efforts to implement digitized green corridors are focused on areas with the highest potential for immediate impact and feasibility. For detailed implementation strategies, please refer to Chapter 4.



To decarbonize the shipping industry, we should not wait for a consensus on the right fuel type(s) or the availability of necessary infrastructure. We should act now, working together as terminals, shipping lines, and ports to align on utilizing digitalization to reduce emissions.

Teaser Chapter 6

CHAPTER ONE

Green Shipping Corridors

The critical operational components in a green corridor include

Ports —port call optimization, fuel bunkering for ships, truck-to-ship, onshore power/cold ironing alongside the ports' vehicles and cranes.
Ships — zero emission fuels (well-to-wake emissions analysis), voyage optimization, JIT arrivals, vessel dynamics, speed optimization, weather routings, data gathering and analysis, optimized utilization, vessel design.

Establishing a green corridor will involve coordination across multiple players, including governments, local authorities, industry, ports, and shipping lines.

Green Corridors Leadership and Goals

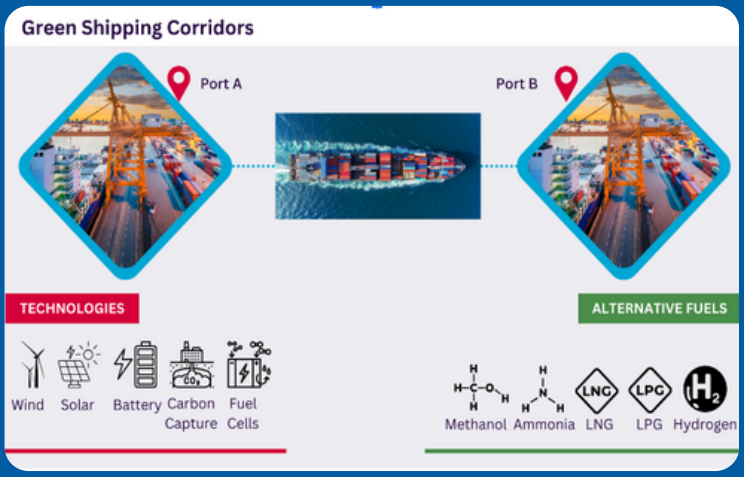
The leadership and goals of each green shipping corridor project can differ, reflecting specific regional needs and strategic targets. However, all such projects share a common purpose: to advance multiple aspects of maritime sustainability. These corridors serve as dynamic environments for the development and scaling of innovative solutions across various dimensions, including:

- **Fuel Production and Infrastructure:** Expanding green fuel production capabilities and infrastructure to support widespread adoption.
- **Technology Advancement:** Enhancing the maturity of green technologies and striving for cost reductions to make them more accessible and competitive.
- **Regulatory Frameworks:** Speeding up the creation of safety regulations and standards that govern the use of new fuels and technologies in maritime contexts.

1. **Policy Development:** Formulating supportive policies that encourage adopting green shipping practices and technologies.
2. **Market Demand:** Increasing the demand for green shipping services through market incentives and green contracts which can drive broader industry shifts towards sustainability.

Green shipping corridors not only aim to reduce carbon emissions but also focus on the digital transformation of maritime transport. These corridors are pivotal in testing and proving the viability of new technologies and fuels, setting the stage for their broader application in the global shipping industry.

This holistic approach ensures that green shipping corridors are at the forefront of promoting environmental sustainability and technological innovation in maritime logistics.



CHAPTER TWO

Benefits of Green Corridors

Green shipping corridors are integrative by nature. They are bringing together multiple stakeholders, from government authorities to corporations and providing numerous benefits to countries and companies through decarbonization. By involving everyone, green shipping corridors show how to create a positive socio-economic and environmental change.

The primary goal and foremost benefit of these corridors is to reduce greenhouse gas (GHG) emissions and other pollutants. This significantly improves air quality, marine life and ecosystem protection, promoting healthier oceans and mitigating climate impact. Consequently, they offer health benefits to local communities and create green economy opportunities for the participating countries.

Green corridors represent a practical and strategic approach to achieving significant environmental, economic, and social benefits, paving the way for a more sustainable maritime industry.
In pursuit of GHG emissions reduction, green shipping corridors foster the transition to low- and zero-emission fuels and leverage the development and deployment of new technologies and digital solutions, enhancing innovation and competitiveness.

For instance, the Singapore-Rotterdam Green & Digital Shipping Corridor foresees a 20% to 30% reduction in emissions from international shipping by 2030 through a combination of operational and digital efficiencies.

Finally, as we navigate the transition away from fossil fuels, it is crucial to reflect on and address the existing injustices embedded in today's global economy, such as unequal access to energy, food, and water, economic disparities between the Global South and Global North, and social inequities. By applying a just and equitable transition lens to green corridors, stakeholders can shape a transition that not only mitigates negative impacts but also ensures that the benefits are inclusively shared across communities and nations (UNFCCC, 2023). With that, green shipping corridors can even facilitate governmental and international support through subsidies, grants, and favorable regulatory conditions.

Rotterdam-Singapore Green & Digital Shipping Corridor adopted a "building block" approach to decarbonize the trade lane

The Singapore-Rotterdam Green and Digital Shipping Corridor brings more than 20 partners together from across the shipping industry's value chain in an effort led by two of the biggest bunkering hubs in the world. The corridor is established on one of the busiest trade routes in the world and features participation from all major container lines active on that route.
The initiative has adopted a "building-block" approach, identifying zero and near-zero fuel pathways and building an enabling ecosystem for deployment. This includes developing and harmonizing emerging methanol and ammonia bunkering standards in the Ports of Rotterdam and Singapore, exploring reduced port dues for zero and near-zero-emission vessels and undertaking joint pilots and demonstrations. One example is the bunkering of the green methanol-powered vessel Laura Maersk in both ports.

The US perspective on the Green shipping corridors

The US is actively spearheading the development and promotion of green shipping corridors as a core part of its strategy to lower greenhouse gas emissions in maritime transport. It involves 13 out of 44, or 30% of the green corridors committed globally. These corridors are designated to demonstrate the viability of low- and zero-emission fuels and technologies across specific maritime routes, thereby supporting global climate objectives.

A significant thrust of the US approach is its focus on international partnerships. For instance, the US and Norway have played pivotal roles in launching and advancing the Green Shipping Challenge at COP27 and COP28. This initiative is a global effort aimed at aligning the shipping industry with the Paris Agreement's objective to cap global temperature increases at 1.5°C.

During COP28, notable progress was made with the announcement of over 60 new measures to fast-track shipping decarbonization. These measures include forming partnerships to create green shipping corridors along major trade routes, significant investments in alternative fuels such as green ethanol, ammonia, and hydrogen, and the introduction of innovative low-emission vessels.

The United States, which is leading the Green Shipping Challenge alongside Norway, has collaborated with several other countries, such as the U.K., Canada, South Korea, and Panama, to bolster green shipping corridor projects.

Production At Port	At Sea	Policy Context
Production of zero-emission fuels; demonstration and development of zero-emission bunkering and recharging capabilities; development of renewable energy infrastructure	Demonstration and deployment of low- or zero-emission vessels; launch/advancement of green shipping corridors.	Participation in initiatives such as the Clydebank Declaration, Declaration on Zero-Emission Shipping by 2050, First Movers Coalition shipping component, or Zero Emission Shipping Mission; national actions or action plans to reduce emissions from domestic shipping/vessels. Just Transition of the Workforce in the Context of Maritime Decarbonization.

The First Trans-Pacific Green Shipping Corridor is a remarkable project involving key stakeholders like the Ports of Los Angeles, Long Beach, and Shanghai, some of the world's largest carriers, and prominent cargo owners.

Within the US territory, the Federal government unveiled the $7 billion investment in hydrogen hubs, funded by the Bipartisan Infrastructure Law. The goal is to contribute to the decarbonization of multiple sectors of the economy, including heavy-duty transportation.

These multifaceted efforts underscore the US commitment to reshaping maritime transport into a more sustainable industry through extensive collaboration, investment, and innovation in green technologies.

Every green shipping corridor is expected to be unique, as the geographical locations, behavior of the stakeholders, fuel availability, economy, and trade patterns will be different. They represent a system of systems, and each system interacts with the others in unique ways. However, despite their peculiarities and unique characteristics, green shipping corridors can provide numerous benefits to all stakeholders involved: governments, regulators and civil society.

CHAPTER THREE

Challenges and Solutions in Implementing Green Corridors

Implementing green shipping corridors presents several challenges. Developing and scaling green technologies and ensuring a consistent and reliable supply of alternative fuels require significant investment in infrastructure, research and development. However, the adoption of carbon-neutral fuels is currently being hampered by the price premium of green transport. As governments highly subsidize fossil fuel-based transport, carbon-neutral fuels are costly, and there is a lack of availability, infrastructure and specific safety standards.

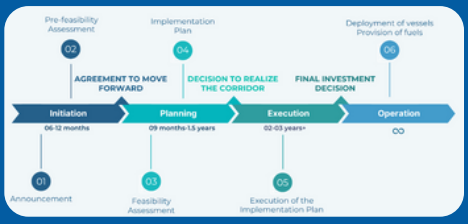
Such initiatives are vital for steering the maritime industry toward complete decarbonization.

Given the high investments necessary to develop green shipping corridors, the economic benefits may not be immediately apparent, making it challenging to secure funding and to balance the distribution of costs and benefits among stakeholders, including shipowners, port authorities, and governments.

Aligning policies and regulations across different jurisdictions to support green corridors requires extensive coordination and cooperation. However, the uncertainty around future regulations and policies is deterring investment in green technologies. Several ports involved in green corridors have indicated to be mostly concerned with 'administrative burden' around getting permits and regulations in place to facilitate investments in new infrastructure. These regulatory change trajectories may take years and really hamper the deployment of the infrastructure required to facilitate more sustainable cargo transport within the corridor.

Ensuring sufficient market demand for green shipping services is critical for the success of the green corridors. Still, they must remain competitive with traditional shipping routes to attract users and stakeholders.

The practical implementation of green shipping corridors requires collaboration and engagement among a wide range of stakeholders, including governments, shipping companies, port authorities, and environmental organizations. This is why most green shipping corridors are still in the feasibility study phase.



From Intention to Implementation

Transitioning from the intention to implement green shipping corridors involves multiple stages and crucial milestones. The initial step involves bringing together all relevant stakeholders from the value chain to set realistic timelines, define clear targets, and map out expected achievements.

To ensure smooth progress, these stakeholders need to minimize risks of delays, maintain momentum, and identify mechanisms to address financial challenges, such as procurement policies, green financing options, government incentives, and regional support tools.

Having supportive government policies is crucial. It's worth noting that governments are showing strong support for these corridors with evidence showing that 18 are already directly involved in green corridor projects, but that the reality of change management is becoming an apparent delay factor.

Creating a fully decarbonized green shipping corridor is a long-term process that requires robust plans to help participants meet their emission reduction goals. Engaging with community stakeholders, particularly those in near-port areas with environmental justice concerns, is vital to ensure that strategies are inclusive and community-focused.

Ports, carriers, and other value chain participants must actively demonstrate their commitment and accountability. Local, state, and federal governments can facilitate this by convening stakeholders, enforcing regulations, and formulating supportive policies.

Regular and transparent information sharing about the development of green corridors is crucial. This includes publishing baseline emissions and energy inventories and providing updates on progress towards environmental targets. As data on corridor operations becomes available, it should be reported using consistent and verifiable methods to ensure improvements are measurable and comparable across different corridors and technologies. This open data sharing aids decision-making and encourages other entities to adopt similar green initiatives.

Transparency extends to disclosing the roles of all participants in the corridor initiative, including ports, terminal operators, vessel owners, charter companies, and logistics firms engaged in these critical environmental efforts.

CHAPTER FOUR

Digitization - the key enabler

Digitalization: A Catalyst for Streamlining Green Shipping Corridors

Digitalization will be vital to any genuinely efficient and smart green corridor. Digital-enabled optimization will unlock additional energy and efficiency-saving potential. Enhancing digital integration and communication between ships, shore offices and ports will provide critical benefits in a green corridor. These include standardization, improved port call planning, Just-in-Time port calls, streamlined scheduling, efficient logistics and enhanced information transparency. Leveraging digital capabilities, including AI, will also boost performance, saving energy and cost.

Digitalization will also enhance operational efficiency, improve navigational accuracy, and support the effective management of maritime logistics. It can also enhance standardization and data sharing required to enable port call optimization. It also serves as the first step in operationalizing zero and low-carbon fuels on the trade lane.

This technological integration helps to optimize route planning, fuel consumption, and cargo handling, thereby reducing emissions and increasing the sustainability of shipping practices.

Several studies have demonstrated the potential of Just-in-Time sailing and Port Call Optimisation, showing reductions in bunker fuel consumption and emissions ranging from 4% to 40%.

Moreover, digital tools enable real-time monitoring and management of environmental impact, ensuring that green shipping corridors not only adhere to but also set new standards for ecological responsibility in maritime transport.

Digital green corridors will also be essential in preparing the industry for the rise of autonomous operations within shipping.

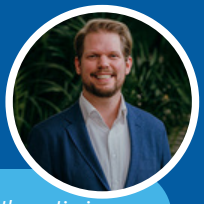
CHAPTER FIVE

Case Study: PortXchange's Approach

PortXchange is steering the maritime industry towards global sustainability, empowering port authorities to lead the way to net-zero emissions. Our commitment to social responsibility and ethical business practices across the value chain enhances transparency, accountability, credibility, efficiency and resilience for ports and their stakeholders. Implementing our solutions that track and monitor emissions in and around ports and facilitate Just-in-Time arrivals, shipping lines, terminals and port authorities will reap economic and environmental benefits.

Rooted in our belief that collaboration, digitization, and sustainability are key to the shipping industry's future, PortXchange is committed to aiding ports, shipping companies, and other maritime stakeholders in effectively setting up green shipping corridors.

Our collaboration with the Port of Rotterdam has enabled the establishment of the Singapore-Rotterdam Green and Digital Corridor, which is accelerating digitalization and decarbonization with new global value-chain partners. This successful Green Corridor case has moved from intention (feasibility studies) to implementation.



Digitalization can significantly optimize port operations and reduce emissions by connecting operational planning and enabling just-in-time sailing. This is an easy solution; it's a low-hanging fruit that can be implemented today. Although not every ship will arrive precisely on time, many inefficiencies—such as the prevalent "sail fast, then wait" behaviour—can be entirely avoided.

Data sharing among ports, shipping lines, and operators is crucial. When these entities collaborate in a structured manner and share data, inefficiencies can be mitigated. Vessels can be informed of future port delays, allowing them to optimize speed, reduce waiting times and lower emissions.

Gaining better insights into emissions from ships in transit and at berth and understanding the connection to hinterland transportation will help ports make informed decisions about decarbonization investments.

Sjoerd de Jager, Managing Director, PortXchange

CHAPTER FIVE

Singapore and Rotterdam have successfully trialled the exchange of port-to-port data. They can now exchange vessel arrival and departure times to facilitate port planning and optimize ships' port call voyages between Singapore and Rotterdam. To date, the GDSC initiative has brought together 26 global value-chain partners across shipping lines, fuel suppliers, port authorities and operators, industry coalitions, banks, and leading institutes of higher learning and knowledge partners.

The progress made since the establishment of the Singapore-Rotterdam Green and Digital Shipping Corridor in August 2022 demonstrates that public-private collaboration across global value chains can be achieved. This collaboration will allow Singapore and Rotterdam to pilot innovative solutions on one of the world's busiest shipping routes and accelerate the decarbonization and digitalization of the shipping industry.

Teo Eng Dih, Chief Executive of the Maritime and Port Authority of Singapore (MPA)

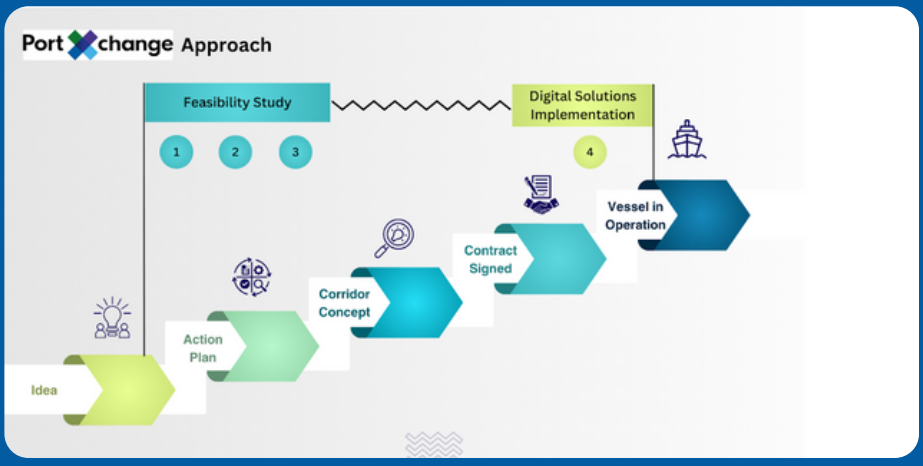
The Singapore-Rotterdam Corridor is a very valuable collaboration in accelerating the twin transition: the integration of digital innovation in energy transition efforts. Not only are we seeing the first results in standardization and data sharing for Port Call Optimization but also the first steps in moving towards operationalization of zero and low carbon fuels on this trade lane.

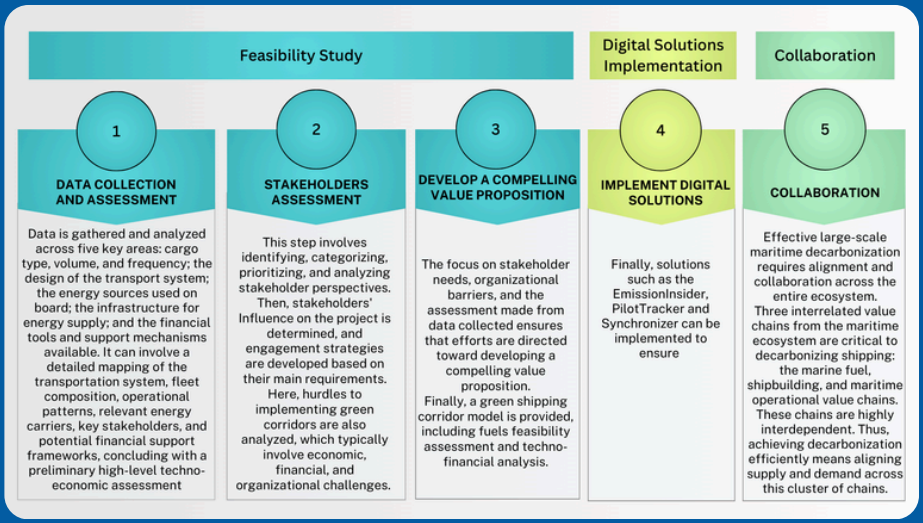
Boudewijn Siemons, Chief Executive Officer of Port of Rotterdam

CHAPTER FIVE

PortXchange's strategic five-step approach

To continue our efforts to decarbonize the maritime industry, we have devised a strategic five-step approach based on our robust experience from established green corridors in Rotterdam and over five years of delivering science-based digital solutions. This methodology is designed to optimize the process for implementing successful green corridors, enabling maritime entities worldwide to enhance operational efficiency and reduce their carbon footprints.





CHAPTER SIX

The Future Is Now

Looking Ahead

Green shipping corridors are pivotal in promoting the early adoption of zero-emission fuels and technologies, setting the maritime sector on a reliable path to achieve zero emissions by 2050. These are essential for meeting the International Maritime Organization's (IMO) emission targets. By concentrating efforts on specific routes and fostering close collaboration among key stakeholders, green shipping corridors effectively address and overcome challenges associated with introducing new fuels and technologies, making the transition manageable and scalable.

However, green corridors must also embrace digitalization to accelerate this transition, effectively monitor progress, and achieve tangible collaboration. The shift to new fuels is lengthy, costly, and bureaucratic, creating a significant risk that stakeholder engagement may wane due to slow progress. This is especially true as stakeholders depend on infrastructure developments and investments. Digital solutions can enhance transparency, streamline processes, and maintain momentum, ensuring continuous engagement and progress toward decarbonization goals.

While the maritime industry must seek better vessel hull design, energy-saving technologies, engine improvements, more efficient alternative fuel sources and shore power solutions, we cannot afford to overlook the immediate potential of digitalization for emission reduction. The magnitude of CO2 reduction through digitalization may vary depending on the port, carrier, and vessel size, but our findings demonstrate a significant and replicable effect. This is where PortXchange can provide valuable assistance as partners or consultants, helping to maximize the benefits of digitalization.

To decarbonize the shipping industry, we should not wait for a consensus on the right fuel type(s) or the availability of necessary infrastructure. We should act now, working together as terminals, shipping lines, and ports to align on utilizing digitalization to reduce emissions.

PortXchange collaborates to support the fragmented sector of ports, terminals, and shipping lines in aligning and adopting technology that is already available, tested, and proven to be effective. The cost of saving a ton of CO2 with digitalization is a fraction of the cost associated with saving a ton of CO2 through new vessels and new fuels.

The way forward

Call to action

To accelerate the transition toward a sustainable future, it is crucial that all green corridors integrate digital solutions alongside their environmental efforts. By embracing both green and digital transformation, we can achieve faster, more impactful results. Digital technologies enhance operational efficiency, optimize resource use, and provide real-time data that drives smarter decision-making. This holistic approach not only accelerates decarbonization but also ensures long-term resilience in the face of changing demands and environmental challenges.

We call upon our partners in ports and shipping lines to include digitalization in their project scope. Digital solutions are a proven approach that deliver immediate benefits, from reducing emissions to optimizing supply chains. By embedding technology into green initiatives from the start, we can accelerate the journey toward decarbonization and ensure that the transition to sustainability is not only effective but also future-proof. Let's make our green corridors both green and digital, driving meaningful change from day one.

We need to start making a change now. We as an industry need to take more responsibility and take the steps necessary to decarbonize the sector; we need to stop ignoring the red flags and change how we work to move to a more sustainable future. By focusing on and monitoring our emissions data and making more sustainable decisions regarding fuel types, we as an industry can overcome the ongoing concerns around decarbonizing and make the sector more sustainable and effective.

Sjoerd de Jager, Managing Director, PortXchange

CLOSING THOUGHTS

About PortXchange

EmissionInsider

Synchronizer

EmissionInsider tracks and analyzes a port's carbon footprint, identifying pollutant sources and hotspots. The solution empowers users to assess multiple "what-if" scenarios based on the port's specific data, determining a potential decarbonization plan's impact on improving air quality before implementation.

It helps to build a path toward a zero-emission port by making data-driven decisions on which decarbonization initiatives to prioritize, allowing ports to achieve targets faster and provide data f**or corrective actions on existing plans.**

Our Synchronizer platform has been tested for over five years in different ports: Rotterdam, Algeciras, Port of Houston and Port of Corpus Christi to prove that when multiple parties use the Synchronizer platform, transparency increases, resulting in improved operations. For these tests, port master data, terminal data, AI predictions, port authority, and nautical service operational data were integrated into the Synchronizer platform.

Contact us for a FREE demo:
E-mail: support@port-xchange.com
Website: port-xchange.com/contact

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