iaph
international association
of ports and harbors

WORLD PORTS TRACKER

SUSTAINABILITY & MARKET TRENDS

2025

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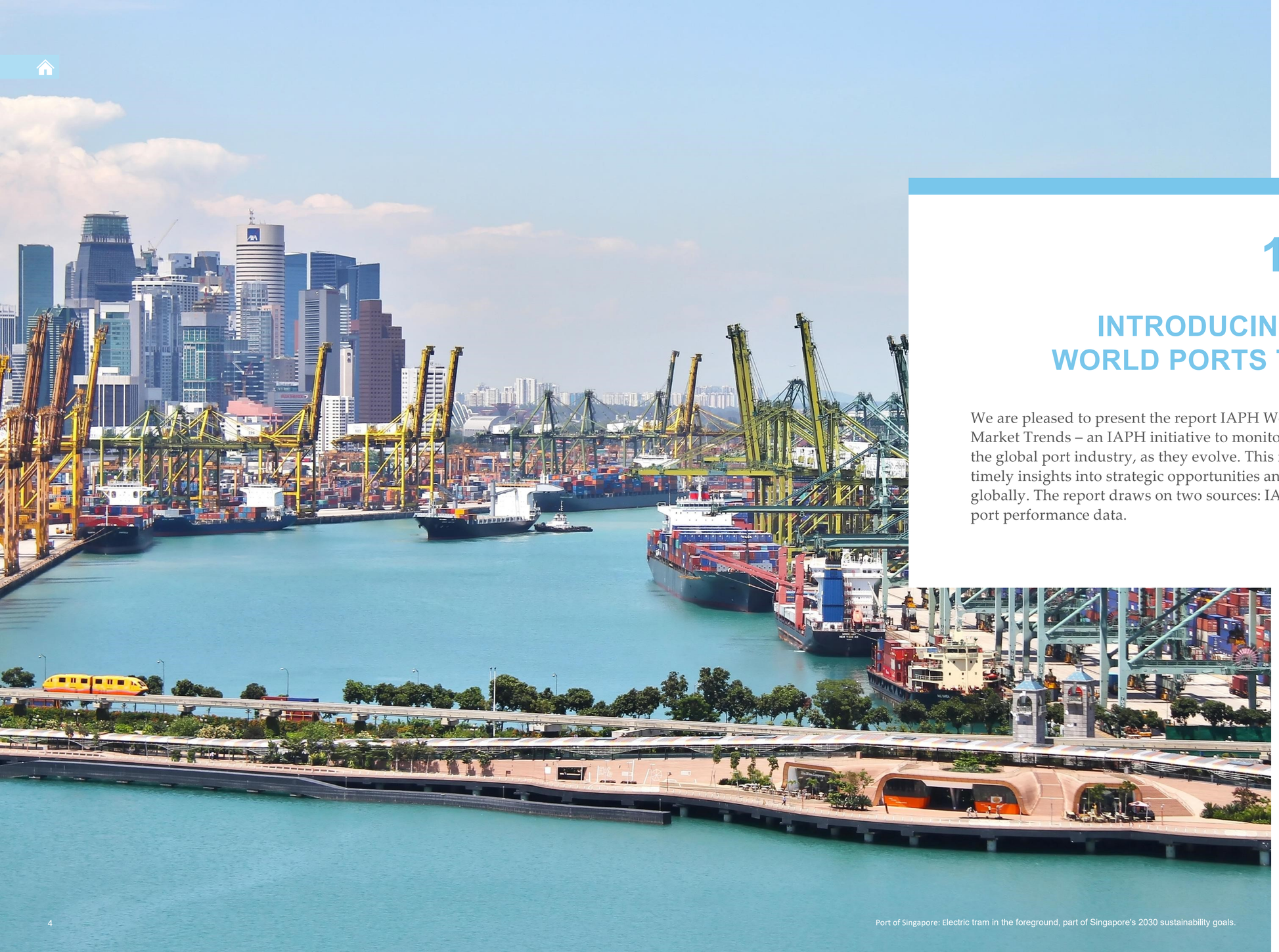
CONTENTS



Port of Singapore: Electric tram in the foreground, part of Singapore's 2030 sustainability goals.

1

INTRODUCING THE IAPH WORLD PORTS TRACKER 2025

We are pleased to present the report IAPH World Ports Tracker 2025: Sustainability and Market Trends – an IAPH initiative to monitor and evaluate critical developments shaping the global port industry, as they evolve. This report is designed to provide ports with timely insights into strategic opportunities and challenges that emerge regionally and globally. The report draws on two sources: IAPH survey results and external container port performance data.

The IAPH survey is conducted annually among regular IAPH members. This report presents analysis of data collected in March and early April 2025. The survey includes questions exploring trends in eight port-related themes:

- Digitalization
- Climate and Energy
- Infrastructure
- Market outlook
- Community building
- Health, Safety and Security
- Environmental care
- Strategic decisions

The first six themes align with the areas of interest of the World Ports Sustainability Program (WPSP), with the respective questions asking about the port's status on sustainability. The survey questions under 'market outlook' and 'strategic decisions' reflect port managers' short-term expectations for the next 12 months in these fields. All survey information is treated confidentially, and only aggregated data are published. No reference is made to individual ports.

A total of 81 valid answers were received from IAPH members. The survey results are primarily based on inputs from seaports belonging to the more active half of the IAPH membership regarding outreach and active participation in IAPH committee work. These port authorities typically are frontrunners in the inception and implementation of green and smart port solutions. The results need to be read and interpreted accordingly.

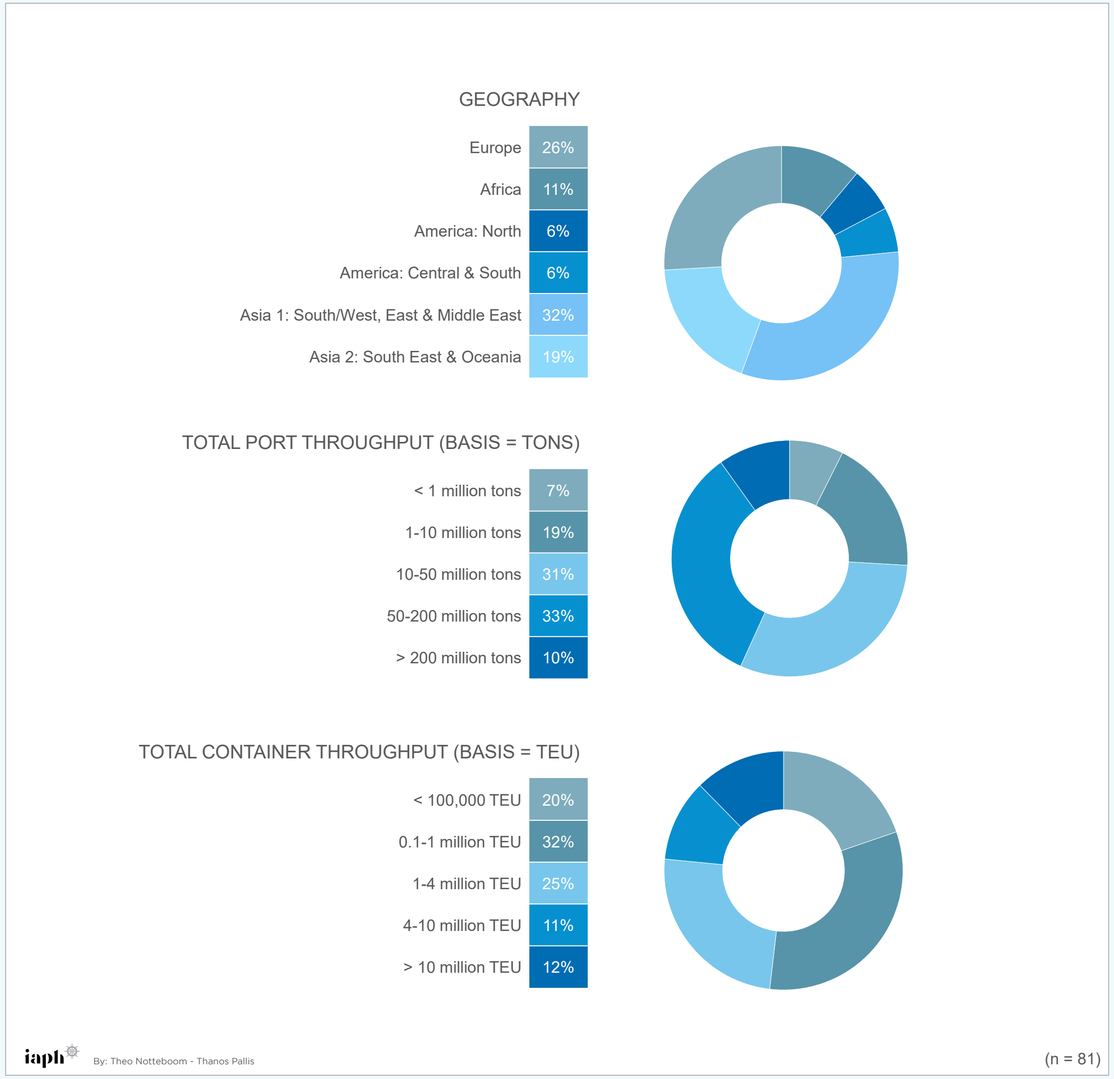
Furthermore, the valid answers are not evenly spread across the different continents. South/West/East Asia and the Middle East (Asia 1), Europe, and Southeast Asia and Oceania (Asia 2) are the leading regions by a distance, with 26, 21 and 15 responding ports, respectively (Figure 1). Fewer answers were received from American and African ports, an observation which partly reflects the current geographical balance in the IAPH membership.

When considering port size in terms of cargo volume, 31% of the responding ports handle between 10 and 50 million tons, and 33% handle between 50 and 200 million tons. One in ten ports handle more than 200 million tons (all cargo considered), while 7% handle less than 1 million tons annually. A fifth of the surveyed ports handle a total container throughput of less than 100,000 TEU. Conversely, 12% of ports record an annual container traffic of more than 10 million TEU.

The non-survey part of the report analyses quarterly container port statistics based on UNCTAD/MDS Transmodal data on the liner shipping connectivity index (LSCI) and the S&P Global Port Performance Program data. The latter statistics focus on four container port metrics: the number of vessel calls, the evolution of vessel size, the evolution of call size (number of TEUs handled per call), and port moves per hour, aggregated per region. This data covers the period from Q1 of 2019 to Q4 of 2024, thereby including the last pre-pandemic year as well as the COVID-19 years of 2020 and 2021. The data analysis is based on an index-based evolution (Q1 2019 = 100) in nine port regions.

Figure 1

Replies to the Survey according to geography, total port throughput (basis = tons) and total container throughput (basis = TEU), in % of the total number of respondents



2

DIGITALIZATION IN PORTS

2.1 The adoption of emerging technologies in ports

Digitalization in ports has the potential to significantly improve efficiency, safety, and sustainability in the shipping and logistics industries. Ports around the world are increasingly adopting digital technologies. Figure 2 provides an overview of the share of responding ports that adopted emerging technologies.

Ports have adopted several **digital technologies**.

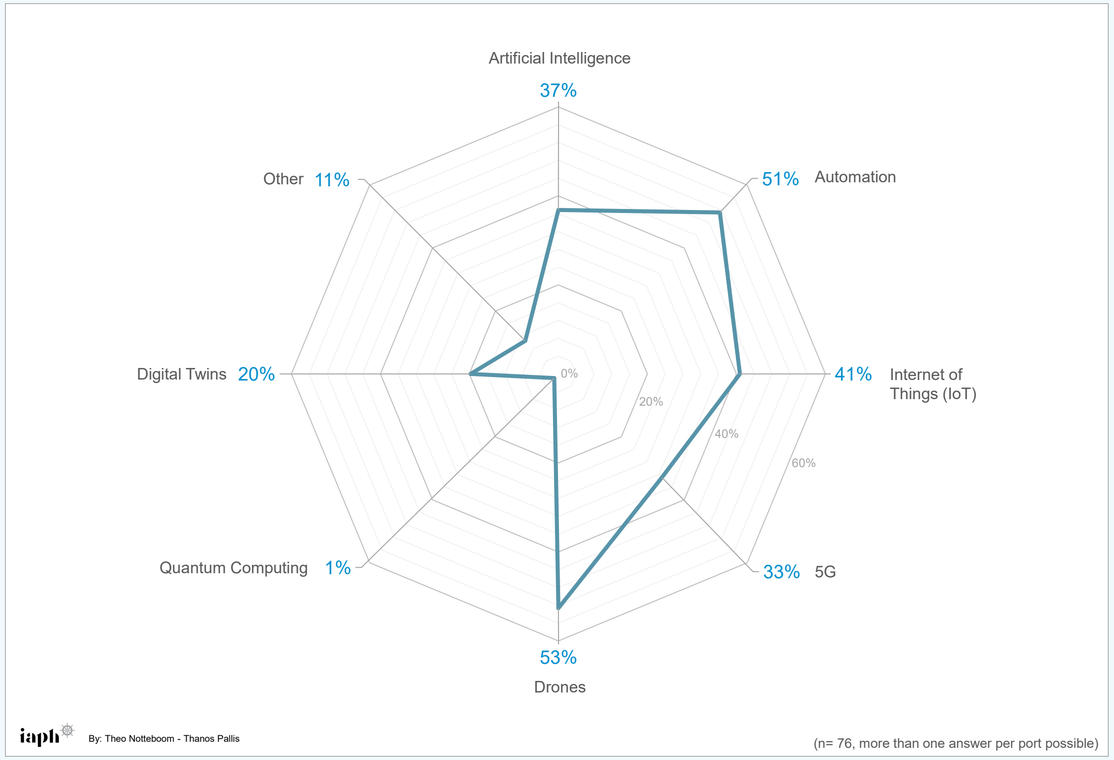
> 53% of ports actively use drones in the port area.

Drones are one of them, with 53% of ports indicating that they actively use drones in the port area. Drones are mostly used for aerial inspections of port infrastructure and superstructure, improving safety and efficiency. Drones can also be used for real-time tracking of cargo and containers, improving visibility and operational efficiency.

More than half of the ports indicate the application of **automation and robotics**. For example, fully and semi-automated container terminals are increasingly used for loading and unloading containers. These terminals deploy advanced equipment such as automated stacking cranes (ASCs), Automated Guided Vehicles (AGVs), or occasionally, remotely operated ship-to-shore cranes. In the digital sphere, Robotic Process Automation (RPA) technologies are being used to automate administrative tasks, such as document processing and compliance checks, which improves the efficiency of back-office operations.

Some 41% of ports have adopted the **Internet of Things (IoT)** in some form. This can include the use of smart sensors and devices for real-time monitoring of various port assets and vehicles. Sensors can collect data on location, temperature, humidity, and more, helping with predictive maintenance, asset tracking, and supply chain management. IoT also helps ports monitor the status of equipment, ensuring they are operational and reducing downtime through predictive maintenance.

Figure 2
The adoption of emerging technologies (share of responding ports)



Artificial Intelligence (AI) and Machine Learning have already made their way in 37% of the responding ports.

Artificial Intelligence (AI) and Machine Learning have already made their way into 37% of responding ports. This includes a broad array of possible application fields, such as cargo and traffic optimization, AI-powered operations, and AI-enabled administrative processes.

One-third of ports have implemented **5G technology**. 5G networks offer ultra-low latency and higher bandwidth, enabling more reliable and faster communication between IoT devices, systems, and port management platforms. With 5G, remote operation of port equipment becomes feasible.

One-fifth of ports have adopted **Digital Twin technology**. Digital twin technology creates a virtual replica of a physical port process (such as the nautical chain or a terminal), allowing operators to simulate and analyze real-time data. This can help optimize operations and improve resource allocation. Port actors can use digital twins to test different operational scenarios before implementing changes in the physical port, which aids in planning.

Quantum computing is still in its early stages, and its application in ports is not widespread (only 1% of responding ports). However, there is growing interest in exploring how this emerging technology could transform port operations, logistics, and supply chains in the future. Quantum computing holds promise for tackling problems in ports and logistics that are currently difficult or inefficient for classical computers. There is active research into how it could be applied to optimize complex logistics and supply chain problems. Some ports and port-related organizations are collaborating with academic institutions, tech companies, and governments to explore the potential benefits of quantum computing, mostly in a proof-of-concept setting. It will likely be a decade or more before quantum computing becomes practical for ports.

About 11% of responding ports indicate they have implemented **other emerging technologies** such as Virtual Reality (VR) and Augmented Reality (AR) and blockchain technology.

2.2 Implementation status of major maritime and port-related digital solutions

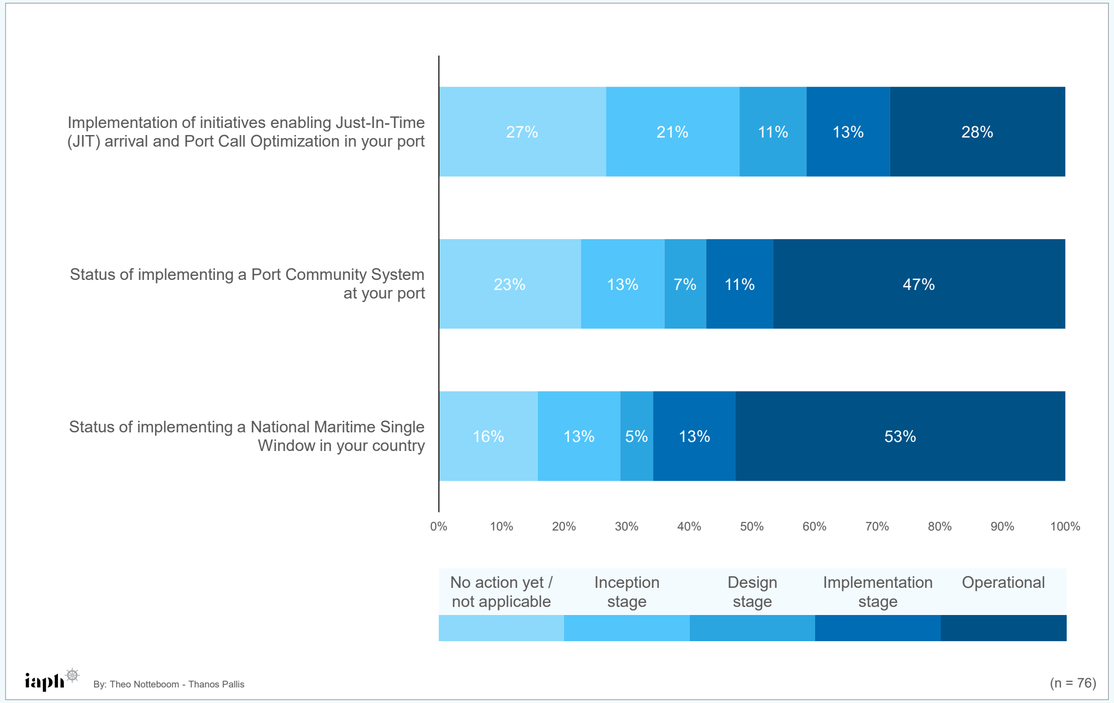
Port call optimization refers to the process of improving the scheduling and coordination of ships calling at ports to maximize efficiency, minimize delays, reduce costs, and enhance the overall flow of goods. About 28% of the ports have already implemented solutions in this area (Figure 3). A quarter of the respondents are designing or implementing such solutions. Nearly half of the ports have not yet taken any action in this field or have not moved beyond the stage of inception.

The implementation status of **Port Community Systems (PCSs)** shows a different picture. **PCSs** are operational in nearly half of the responding ports, with another 18% moving towards their implementation. A PCS is a digital platform that facilitates the exchange of information between different stakeholders in a port environment. It acts as a centralized hub that connects shipping lines, port authorities, customs, freight forwarders, transport operators, and other entities involved in maritime trade.

> **Port Community Systems** are operational in nearly half of the responding ports, with another 18% moving towards their implementation.

The **National Maritime Single Window** (NMSW) is legally mandated under the IMO Facilitation (FAL) Convention, with additional regional and national frameworks and regulations. Amendments to the FAL Convention mandate the electronic reporting of ship arrival, stay, and departure information through a single-entry point, i.e., the NMSW. From 1 January 2024, all IMO member states must have an operational NMSW. Different regional organizations have specific regulations requiring the implementation of NMSWs, such as Regulation (EU) 2019/1239 (EMSWe Regulation) for the EU. Not surprisingly, 53% of the ports are in countries that have already implemented NMSW, with many more currently implementing the necessary provisions.

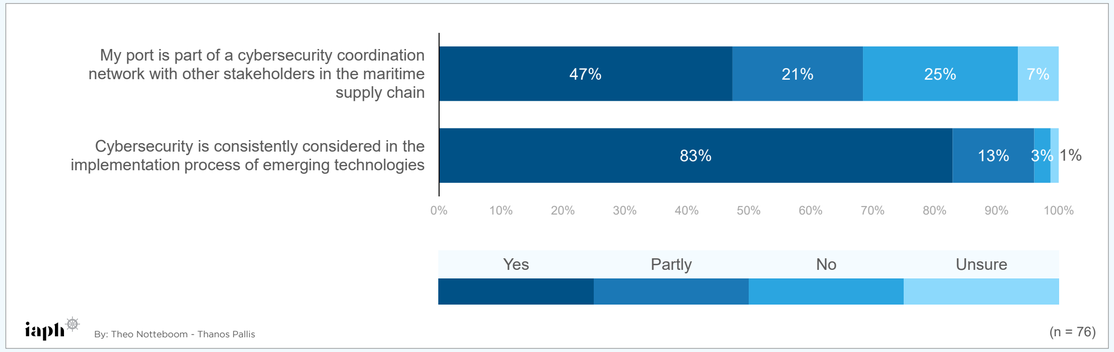
Figure 3
Implementation status of major maritime and port-related digital solutions



2.3 Dealing with cybersecurity challenges

One question in the survey focused on how port authorities are dealing with the many challenges posed by cyber threats. The results show that an impressive 83% of the ports indicate that cybersecurity is consistently considered in the implementation process of emerging technologies (Figure 4). Almost half of the responding ports are part of a cybersecurity coordination network with other stakeholders in the maritime supply chain.

Figure 4
Arrangements to deal with cybersecurity



2.4 Structures and mechanisms for the promotion of port innovation

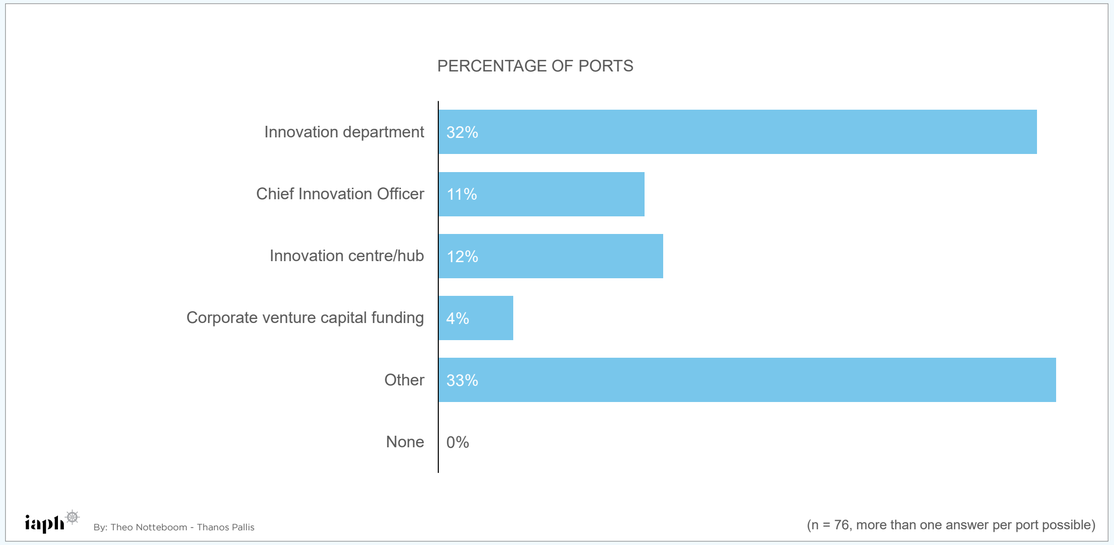
Port innovation is essential for enhancing port efficiency, sustainability, and competitiveness. Various structures and mechanisms support the adoption and advancement of innovative solutions in ports. These include institutional frameworks, financial incentives, public-private partnerships, and technological initiatives. The survey focused on the institutional settings in the port that promote innovation (Figure 5).

> One-third of ports have set up a separate innovation department within the organization, and chief innovation officers are found in 11% of the port authorities surveyed.

One-third of the surveyed ports have established a dedicated innovation department, while 11% report having a Chief Innovation Officer within their authority. Other initiatives include the development of an innovation hub or centre (such as incubators) and access to corporate venture capital funding.

The 'other' category includes a heterogeneous set of actions and solutions. Several ports have developed dedicated programs to foster innovation in the port. Quite a few ports mention the existence of Public-Private Partnerships (PPP) collaborations with private sector expertise to implement cutting-edge technologies, enhance efficiency and implement innovative solutions. In some ports, dedicated government departments and cells are essential in facilitating port innovation. Additionally, global networking platforms for port innovation can also be found.

Figure 5
Structures and mechanisms used for the promotion of innovation in ports



3

CLIMATE AND ENERGY

3.1 The use of renewable energy sources in ports

A second theme of the survey is climate and energy issues in ports. When it comes to the share of renewable energy sources in total electricity consumption in the port area, more than half of the respondents position themselves in the 0-25% group (Figure 6). At the other extreme, 14% of the ports report a share above 76%. The share of zero carbon fuels in the total fuel consumption mix of port area operations is below a modest share of 5% in six out of ten world ports (Figure 7). A notable rate of "unsure" responses in both questions (28% and 35% respectively) indicates that world port authorities do not always have access to energy-related data for the whole port area.

> Renewable electricity produced onsite in port areas relies heavily on solar power – four out of five ports report solar energy production in the respective areas.

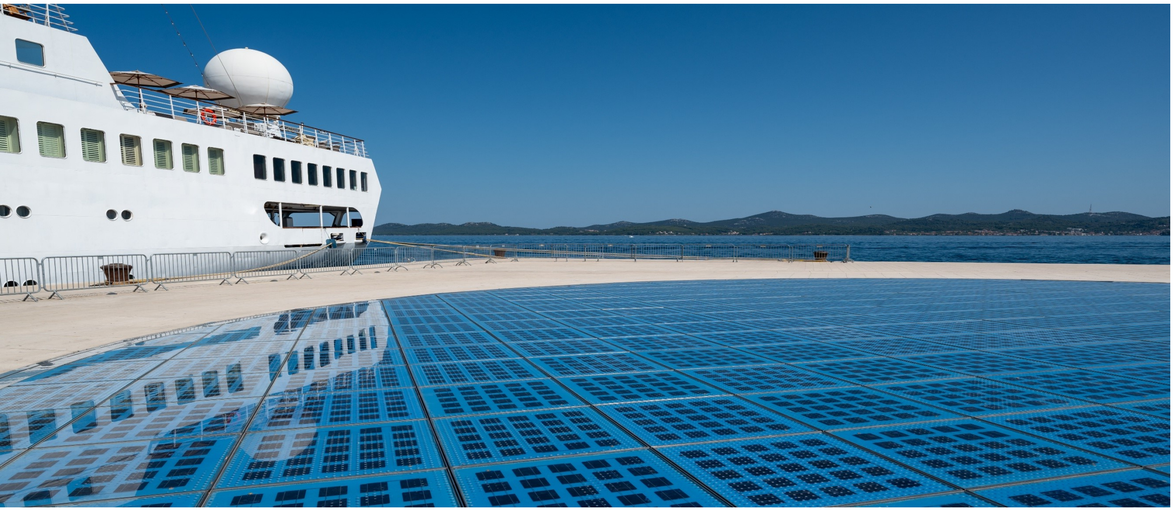


Figure 6
Share of renewable sources in total electricity consumption in port area

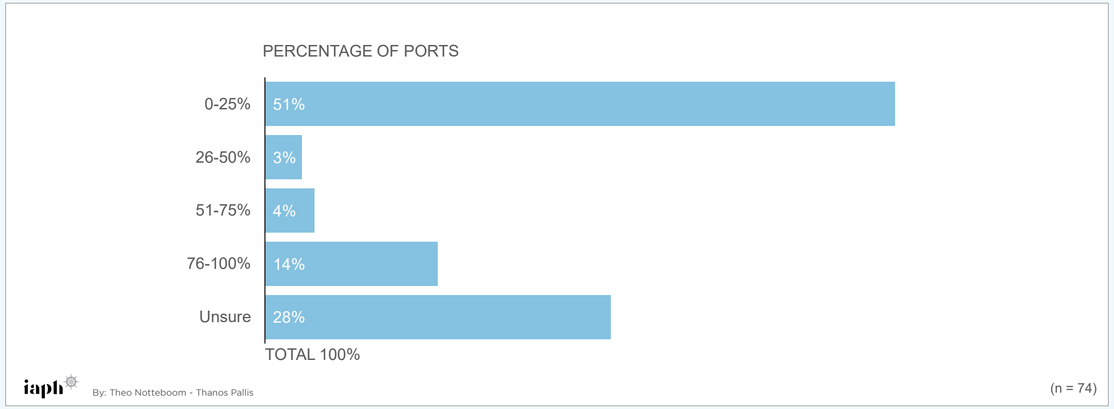
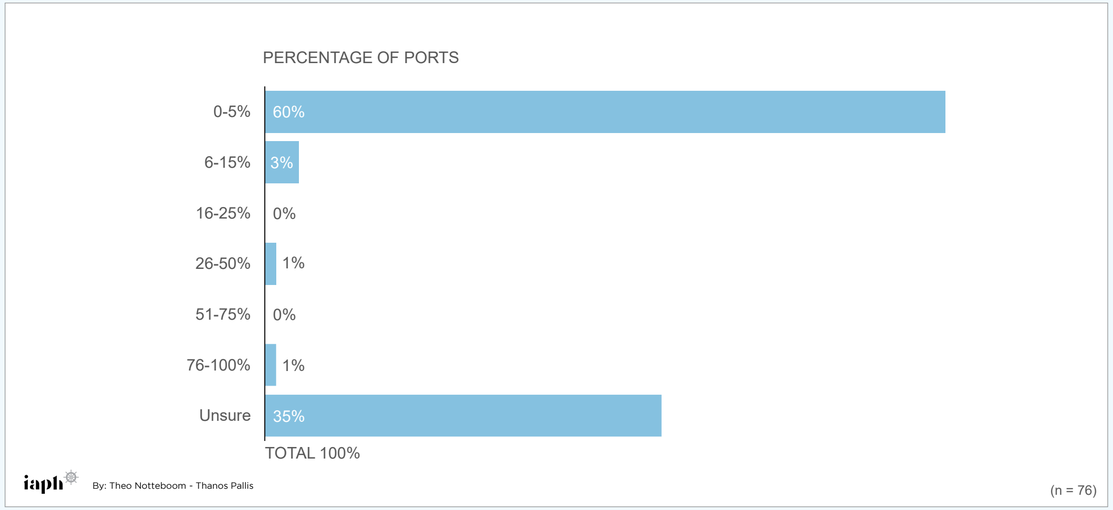


Figure 7
Share of zero carbon fuels in the total fuel consumption mix of port area operations



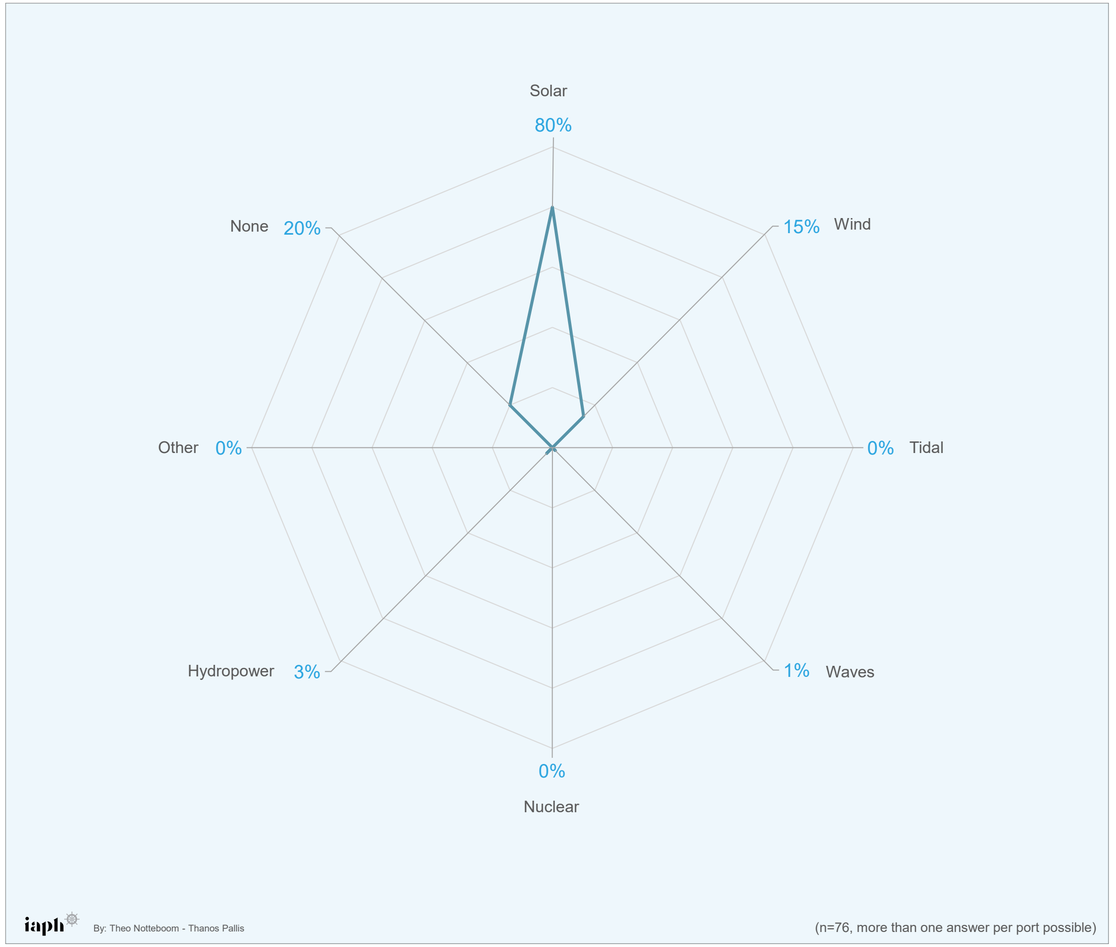
Renewable electricity produced onsite in ports areas relies heavily on solar power. Four out of five ports report **solar energy production** in the port area (Figure 8). Next to traditional photovoltaic panel parks on flat roofs or on vacant onshore or offshore port sites, alternative solar energy solutions based on Concentrated Solar Power (CSP) or Concentrated Solar Thermal energy (CST) are slowly starting to get adopted in ports. These technologies use mirror-based configurations to produce heat by solar irradiation concentrated on a small area. Some ports are exploring other solar energy configurations, such as floating solar parks or vertical solar parks.

Windmills can be found in 15% of the harbor areas considered. Onshore wind turbines in port areas are mostly found on breakwaters and at cargo terminal sites. Ports have a key role to play in offshore wind energy. Green energy production at offshore wind farms has seen a spectacular rise in past decades and will see strong increases in many parts of the world in the future. Given the rise of the offshore wind industry, quite a few ports have positioned themselves as major logistics hubs in the supply chains related to the production, assembly, installation, and maintenance of offshore wind turbines.

Hydropower and **wave energy** solutions are sporadically found across the world's port scene. Waves are generated by wind patterns and can provide a consistent and predictable source of renewable energy. Coastal seaports, in principle, offer opportunities for wave energy generation due to their proximity to the ocean. Port infrastructure, such as breakwaters and piers, can be equipped with wave energy devices, such as oscillating water columns to capture energy from waves.

The Netherlands, Offshore Wind Farm: 56% of the Netherland's electricity was generated by clean sources in 2024, surpassing fossil fuels.

Figure 8
Renewable electricity produced on site in the port area



3.2 Low- and zero-carbon fuels

As the shipping industry moves toward decarbonization, low-carbon fuels play a crucial role in reducing greenhouse gas (GHG) emissions. These fuels serve as alternatives to traditional fossil fuels like Heavy Fuel Oil (HFO) and Marine Diesel Oil (MDO), helping the sector comply with International Maritime Organization (IMO) regulations, including the IMO targets for reducing carbon emissions.

Several questions in the survey focus on a port's status when it comes to a selection of widely considered low- and zero-carbon fuels: **Liquefied Natural Gas (LNG)**, methanol, biofuels, compressed hydrogen, liquid hydrogen and ammonia. **Methanol** has 10-15% lower CO_2 emissions when fossil-based but near-zero when produced from biomass (bio-methanol) or renewable sources (e-methanol). As methanol is less energy-dense than diesel, it requires specialized fuel handling. **Biofuels** such as biodiesel and hydrotreated vegetable oil (HVO) result in a 50–90% lower CO_2 emissions depending on feedstock, but its supply is limited partly due to competition with food production for raw materials. **Ammonia** (NH_3) has zero CO_2 emissions if produced using renewable energy, but it is highly toxic and requires new engine technology. **Hydrogen** (H_2) also generates no CO_2 emissions when produced from renewable sources (green hydrogen). Hybrid and dual-fuel solutions (e.g., LNG-methanol, ammonia-diesel) are adopted to bridge the transition to full decarbonization. It is expected that no single fuel will dominate the future of shipping. Instead, a mix of LNG, methanol, biofuels, ammonia, and hydrogen will be key to achieving net-zero emissions by 2050. The pace of adoption of these fuels will strongly depend on the fuel availability and infrastructure in ports, and on policy initiatives.

> LNG (operational in 33% of ports) and biofuels (operational in 24% of ports) show the most significant progress to date, whereas ammonia and hydrogen remain in the early stages of adoption.

Figure 9 reveals that rules and procedures for the safe bunkering of low- and zero-carbon marine fuels are not widely implemented, as these go hand in hand with respective bunkering requests in ports. LNG (operational in 33% of ports) and biofuels (24%) show the best progress, while ammonia and hydrogen still have a long way to go.

It is promising that a fair share of the respondents is in the inception or design stage in the field of such rules and procedures. Since 2012, the IAPH Clean Marine Fuels (CMF) working group has brought together experts from frontrunner ports to develop such supporting tools and methodologies.

Many ports must prepare for importing and/or exporting low- and zero-carbon fuels as commodities (Figure 10). In this area, most progress has been made in dealing with LNG and biofuels, with methanol not far behind. Far fewer ports are ready to import or export ammonia and hydrogen. The IAPH Port Readiness Level (PRL) working group and the high-level Clean Energy Marine Hubs (CEM Hubs) initiative are expected to accelerate these developments through dedicated tools and methodologies, together with the respective market developments.

Figure 9
Implementation of rules and procedures for the safe bunkering of low- and zero-carbon marine fuels

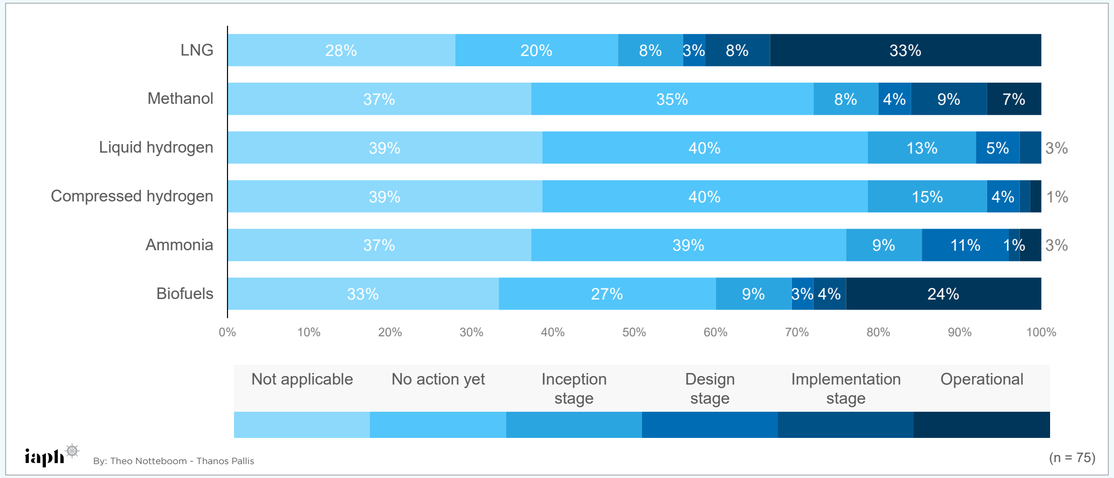
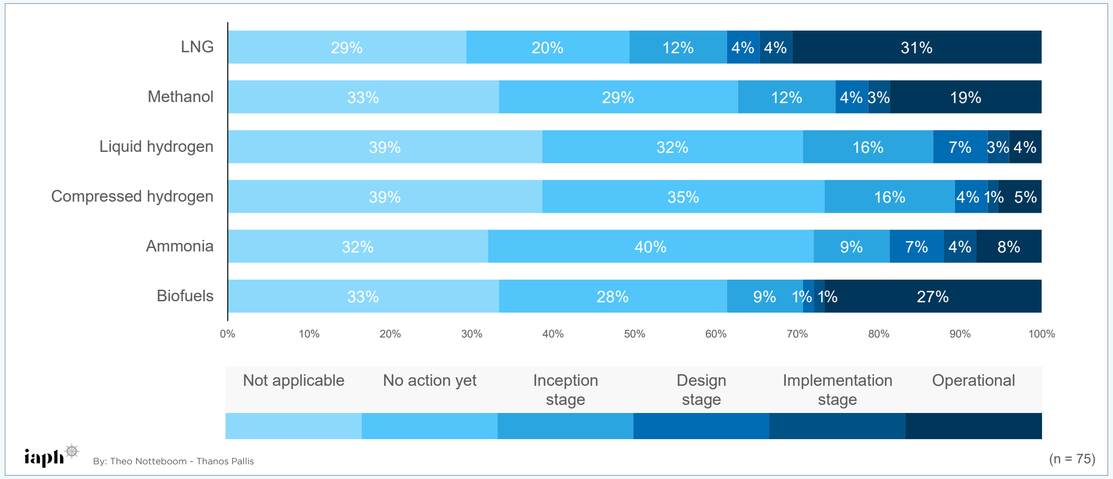


Figure 10
Implementation process of preparing the port for importing and/or exporting low- and zero-carbon fuels as commodities



3.3 Incentives and tools used by the port authority

Ports can implement voluntary programs to incentivize ship operators to green their ships. Green ship operators, in return, receive a benefit, such as a discount on port dues. A widely used scheme is the IAPH Environmental Ship Index (ESI). The index was created by major ports in cooperation with IAPH in 2011 and has been fully integrated into the IAPH's governance structure since 2020. The ESI portal enables ports and other interested parties to incentivise ships to use cleaner engines and fuels, with preferential treatment offered through discounts on port dues, bonuses, or other benefits commensurate with a specified level of cleanliness. By 2026, ESI's revised and expanded offering will consider a range of potential emissions, introduce a new GHG methodology, and reward innovation and the application of zero-emission techniques onboard vessels. The new ESI will also address global concerns about the environmental impact of vessels on marine life. Today, the total number of ESI incentive providers (ports and national administrations) in the world is 76l, with 6,021 ships registered in total.

Figure 11 reveals that 19% of responding ports have adopted the ESI scheme to provide incentives to best-performing vessels. One out of ten ports has implemented incentives based on another index, while 13% promote green shipping through local regulations. Still, 59% of respondents do not offer incentives to greener vessels.

Several tools and methodologies are available, allowing ports to facilitate the decarbonisation of ships. The **Clean Marine Fuels Safety Toolkit** is an initiative developed by IAPH through its Clean Marine Fuels (CMF) working group. This toolkit provides standardised resources to ensure the safe and efficient bunkering of vessels with alternative marine fuels, such as liquefied natural gas (LNG), methanol, hydrogen, and ammonia. About 28% of respondents use this toolkit (Figure 12). **The Port Readiness Level (PRL) Self-Assessment Checklist** is a structured tool also developed by IAPH as part of its Clean Marine Fuels (CMF) initiative. It helps ports evaluate their preparedness to handle and support the bunkering (fueling) of ships using alternative clean marine fuels. The checklist allows ports to self-evaluate their current capabilities and identify gaps or needs for improvement to safely and efficiently support vessels using alternative fuels. It serves as a diagnostic and planning tool for infrastructure, policy, safety, and operational readiness. Close to one-third of surveyed port authorities indicate that they are actively using this tool.

Figure 11
Incentives provided by the port to best-performing vessels

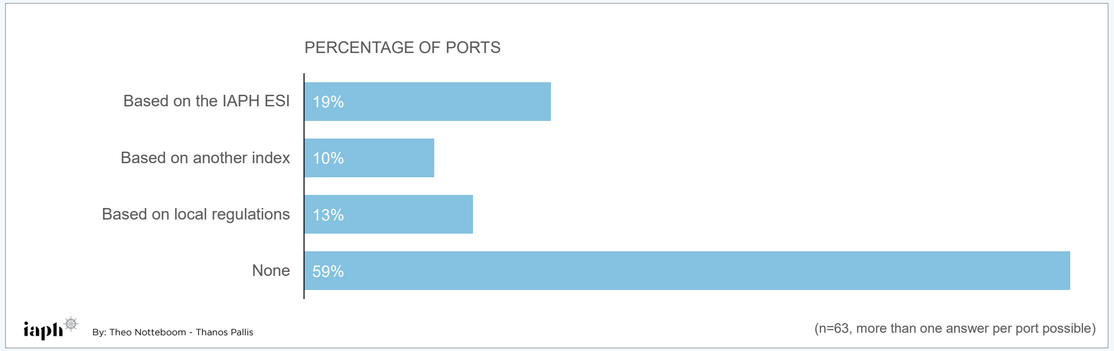
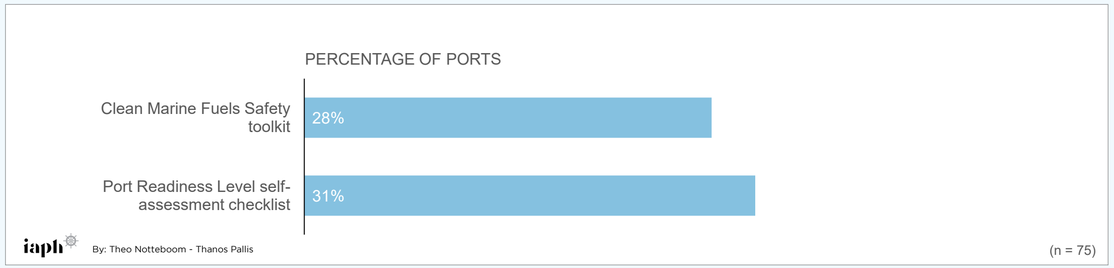


Figure 12
Use of IAPH tools and methodologies



When it comes to **CO_2 measurement and reporting**, the Greenhouse Gas Protocol (GHG Protocol) is an international standard that aims to provide enterprises, public authorities and other organizations with a consistent and reliable way to measure, manage and reduce their carbon footprint. The GHG Protocol divides emissions into three scopes that are released across an organization's entire value chain. Scope 1 emissions concern greenhouse gases that a port or logistics company emits from sources it owns or controls directly. Scope 2 emissions are released by off-site and upstream energy providers when a company makes a purchase. Scope 3 includes indirect emissions needed to keep the organisation's business running. They arise across the value chain, both upstream and downstream. Scope 3 emissions are the most complex.

About 29% of ports do not regularly measure their carbon footprint (Figure 13). Half of the ports extend their carbon footprint calculations to include partially or fully Scope 3 emissions, while only 9% limit their calculation to Scope 1 emissions.

> 58% of world ports are 'going the extra mile' by publicly declaring targets to achieve carbon neutrality before 2050.

It is widely acknowledged that all sectors of the economy need to decarbonise by 2050 to remain on track for the 1.5-degree temperature rise pathway. This imperative is echoed in the IMO Greenhouse Gas (GHG) Strategy, which targets the decarbonisation of international shipping by, or around, the same year. Encouragingly, 58% of ports worldwide appear to be taking proactive steps, publicly announcing their commitments to reach carbon neutrality ahead of the 2050 deadline.

3.4 Green corridors

Green maritime corridors are specific shipping routes where vessels operate using zero-emission or low-emission fuels, supported by clean energy infrastructure at ports. These corridors are established through international cooperation between ports, shipping companies, and governments to accelerate the decarbonization of the maritime sector. Ports along the corridor typically aim to provide onshore power (OPS) and bunkering facilities for sustainable fuels. Uniform standards across countries are needed for smooth implementation. About 9% of surveyed ports indicate their involvement in an active green corridor initiative (Figure 14). Another 18% of ports are currently implementing such initiatives.

Figure 13
Calculation and reporting of carbon footprint

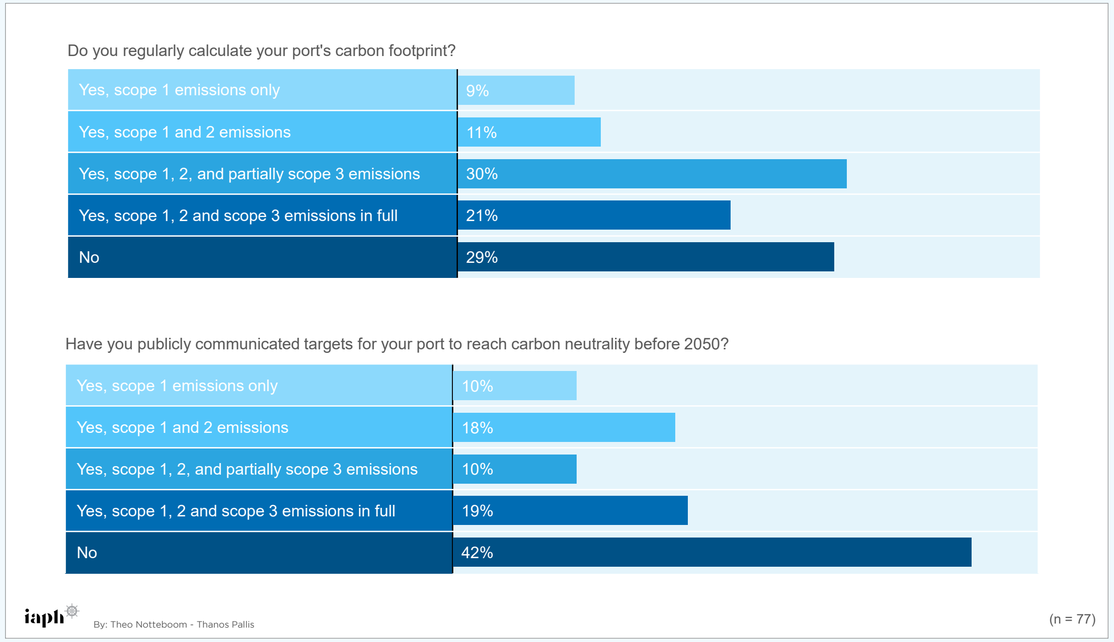
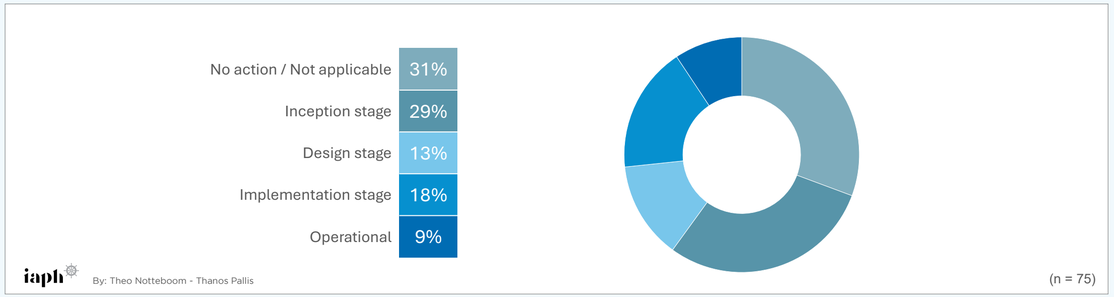


Figure 14
Port involvement in green corridors



4

INFRASTRUCTURE TO FACILITATE SUSTAINABILITY

4.1 Onshore Power Supply (OPS)

Onshore Power Supply (OPS) - also known as shore power, cold ironing, or alternative maritime power (AMP) - is a technology that allows ships to plug into the local electrical grid while berthed instead of running their onboard auxiliary engines. This enables ships to cut down on emissions like CO_2, NO_x, SO_x and particulate matter, and to comply with increasingly strict environmental regulations. Installing the OPS infrastructure (substations, cables, connection arms, grid upgrades) is expensive. Moreover, ports must have sufficient grid capacity to handle the surge in demand, especially when multiple ships are plugged in. Grid electricity should come from renewable sources, otherwise OPS represents a shift rather than a reduction in emissions. Although international standards like ISO/IEC/IEEE 80005 exist, not all ships or ports adhere to them. The implementation of OPS projects requires collaboration among port authorities, terminal operators, utility companies, and shipowners.

A quarter of the respondents indicate they have already implemented OPS for harbour craft and port auxiliary vessels. Another 7% are currently implementing such possibilities (Figure 15). Progress is also made for other ship types, in particular, container ships, cruise ships and ferries, with 17%, 10% and 10% of ports, respectively, reporting that OPS is already operational to some degree for such vessel types. The advances towards OPS implementation are the lowest for bulk carriers and tankers. The IAPH Onshore Power Supply working group provides a forum for the exchange of practices among frontrunner ports and it continuously looks at addressing remaining challenges for the broader rollout of OPS.

4.2 Carbon Capture and Storage (CCS)

While Carbon Capture and Storage (CCS) has not yet seen widespread adoption, 6% of the surveyed ports report having some form of CCS in operation, with an additional 3% at the implementation stage.

Carbon Capture and Storage (CCS) in seaports refers to the process of capturing carbon dioxide (CO_2) emissions generated by port-related industries or vessels/vehicles and then transporting and storing that CO_2 to prevent it from entering the atmosphere. Although CCS has not yet been widely adopted, 6% of the surveyed ports indicate having some form of CCS in operation, with another 3% reaching the implementation stage (Figure 16). This emerging strategy helps ports and the heavy industries around them to decarbonize and reach climate targets, especially where emissions are hard to eliminate. Future utilisation of the captured CO_2 – for example in the production of synthetic fuels – is expected to offer further circular economic opportunities.

Figure 15
Implementation status of high voltage OPS for the commercial vessel types

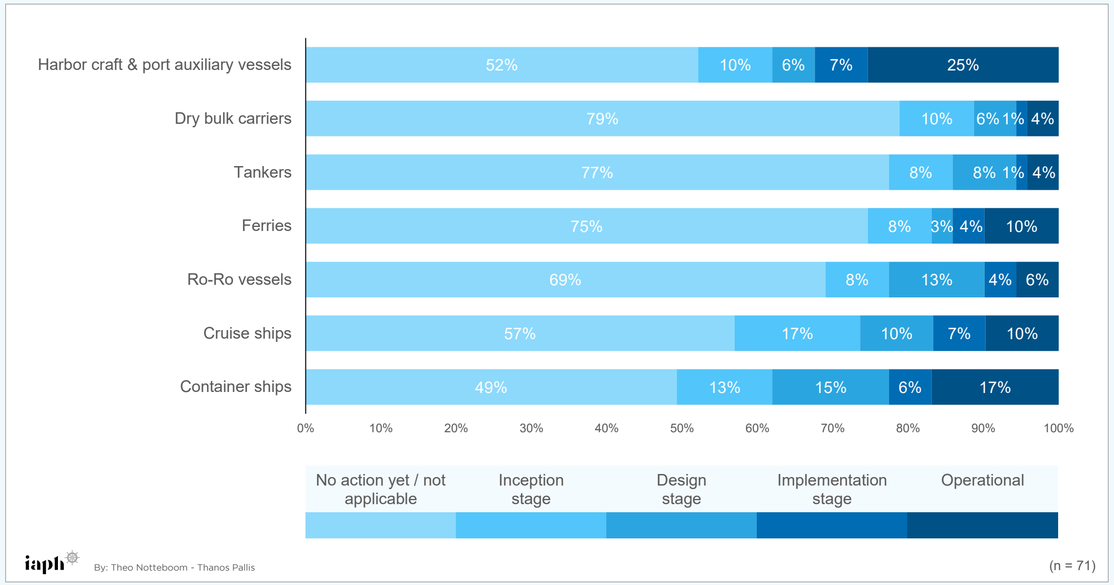
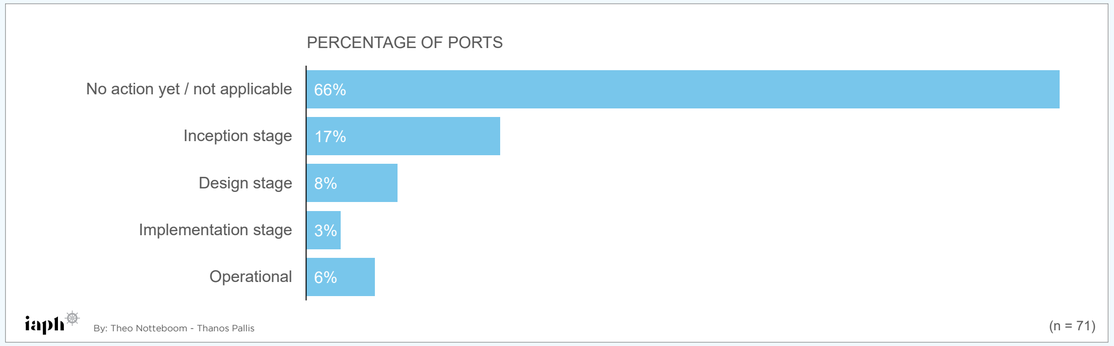


Figure 16
Implementation status of carbon capture and storage infrastructure in the port



4.3 Circular economy

The **circular economy** emphasizes reducing waste and promoting resource efficiency through recycling, reusing, and remanufacturing. Ports are challenged to adopt circular economy principles – like reducing waste, reusing resources, and recycling materials – as part of port operations and logistics. Instead of the traditional linear model of take-make-dispose, ports embracing circularity aim to create closed-loop systems that are more sustainable, cost-effective, and resilient. Most progress has been made so far in the field of dredged material reuse, with 44% of the responding ports having implemented solutions in this area and another 8% moving into the implementation stage (Figure 17).

> Most progress towards circularity has been made in dredged material reuse, which will soon be present in more than half of ports: 44% have already implemented solutions, and an additional 8% are in the process of such implementation.

Instead of dumping, sediment from dredging is repurposed for land reclamation or building materials. Almost one-third of world ports have operations in place **for water reuse** and the **beneficial use of waste streams**, with several more ports moving in that direction. Circular initiatives around **heat reuse** and **industrial symbiosis** are less common, probably because they require the right local industrial ecosystem to flourish. Industrial symbiosis is a form of collaboration where different businesses and industries located within or around a port exchange materials, energy, water, and by-products to improve efficiency and reduce waste. Instead of each company working in isolation, they form an active ecosystem.

4.4 Hinterland modal split

The hinterland modal split of a port refers to the distribution or share of different transportation modes (such as road, rail, and inland waterways, but occasionally, also shortsea shipping and pipelines) used to move goods between the port and its hinterland. Ports are increasingly focused on reducing the environmental impact of transport within the hinterland by promoting intermodal and synchromodal solutions, and by incentivizing the use of greener transport modes. The survey results in Figure 18 show that the combined share of rail and inland waterways in the hinterland modal split for containerized cargoes is below 25% for about 61% of the surveyed ports. At the other extreme, this combined modal share exceeds 50% in one-tenth of the ports.

Figure 17
Implementation status of circular economy in the port

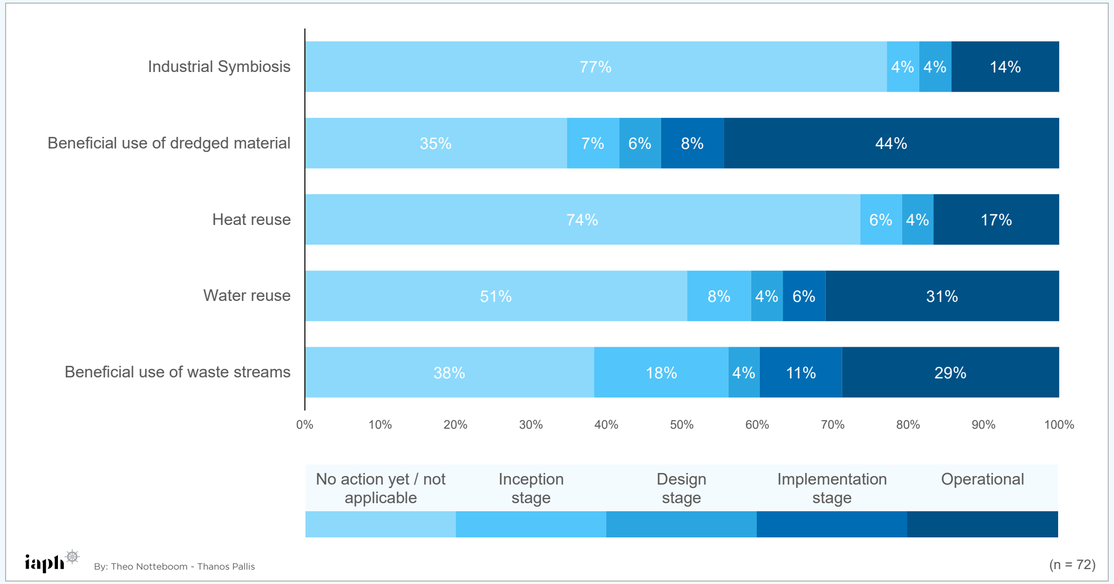
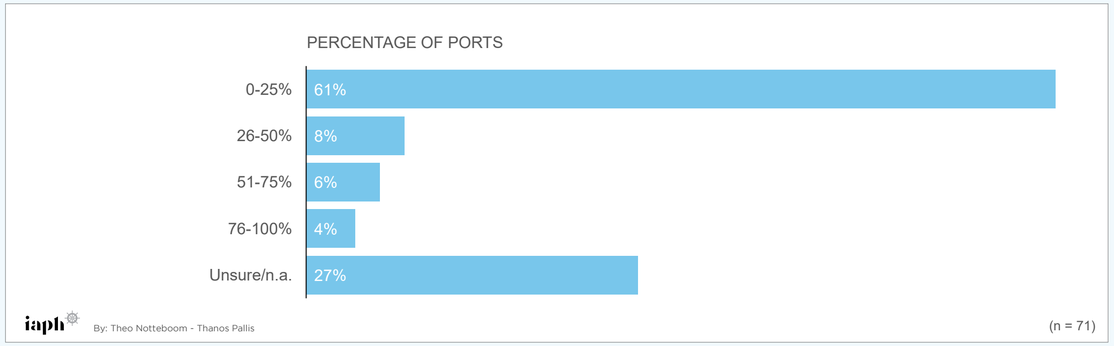


Figure 18
Percentage of containers transported to and from the port by rail or inland waterways



5

ENVIRONMENTAL CARE

Port of Oakland, California, San Francisco Bay.

5.1 Environmental monitoring

Seaports are dynamic environments with a wide range of activities that can impact the environment. Monitoring environmental aspects is essential for effective environmental management and sustainability. The survey results provide insight into key environmental aspects that are monitored in seaports (Figure 19).

Four out of five ports monitor water quality.

Four out of five ports monitor water quality. Water quality issues can arise from a multitude of factors, such as water runoff from port pavements (if contaminated with oil, heavy metals, or sediments), ballast and bilge water discharges from vessels, spills, and dredging impacts.

Almost the same percentage of ports monitor **air quality**. Next to emissions from ships, terminals, industrial premises, and land transport modes, air quality is also influenced by other factors such as dust from cargo (e.g., coal, grain, clinker) during loading/unloading or odours from certain bulk cargos, waste storage or industrial activities.

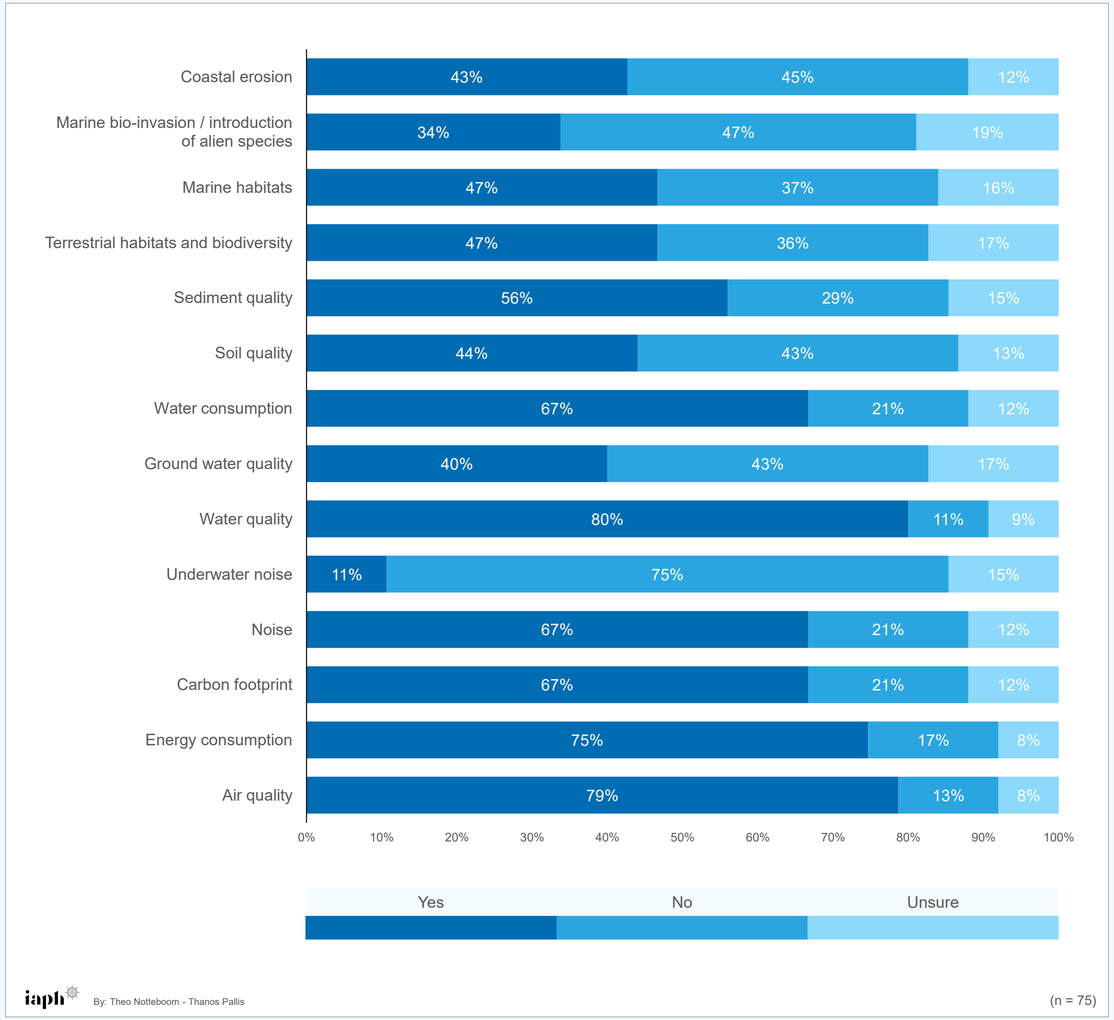
Two-thirds of respondents indicate that they monitor water consumption. The same percentage applies to noise and carbon footprint.

Underwater noise pollution is the least widely monitored (only 11% of ports). This type of pollution can come from multiple sources, such as ship engines and auxiliary generators, and construction or dredging operations. The measurement of groundwater quality and marine bio-invasion is more common, although not very widely practised.

5.2 Port certification under an environmental management system

Port certification under an Environmental Management System (EMS) is an increasingly vital part of sustainable maritime and logistics operations. Certifying a port under an EMS framework – such as ISO 14001 – signals a structured commitment to managing and reducing environmental impact. Certification provides a standardized method for ports to assess, monitor, and improve their environmental performance. An EMS-certified port demonstrates a commitment to continuous improvement, which can enhance its public image and stakeholder trust, especially in an era of Environmental, Social, and Governance (ESG) scrutiny.

Figure 19
Does regular environmental monitoring take place in your port for the following parameters?



Common frameworks and certifications include:

- **ISO 14001** is the most widely recognized EMS standard. It emphasizes continuous improvement through the "Plan-Do-Check-Act" cycle. Figure 20 demonstrates that 44% of the port authorities have acquired this form of certification.
- **EcoPorts Port Environmental Review System (PERS)** is the only port-sector-specific environmental management standard. PERS incorporates the primary general requirements of recognized environmental management standards (e.g., ISO 14001), while also considering the specificities of ports. One in five responding ports has obtained PERS certification.
- **EMAS** (Eco-Management and Audit Scheme) is a specific EU-developed scheme that goes beyond ISO 14001, emphasizing public transparency more strongly. Approximately 8% of ports are EMAS-certified.

Importantly, a substantial 37% of ports indicate that they have no port certification under an environmental management system.

5.3 Ecological restoration initiatives

63% of respondents have proactively invested in ecological restoration as part of the port's broader environmental policies and responsibilities.

Ecological restoration initiatives in seaports are projects and strategies to reverse or mitigate environmental damage caused by port development and/or other operations. These initiatives seek to restore natural habitats, improve biodiversity, and integrate ecological functions into the working landscape of ports. Some common and impactful ecological restoration initiatives found in seaports around the world include coastal wetland restoration (e.g., mangroves); artificial reefs and habitat structures; bird habitat creation (e.g., bird nesting areas and mudflats); green buffer zones and ecological corridors; and fish passage and spawning habitats.

An elevated 63% of respondents indicate they have proactively invested in ecological restoration as part of the port's broader environmental policies and responsibilities. About 44% of the surveyed ports reported that they have invested in ecological restoration initiatives as part of new development projects (Figure 21).

Figure 20
Port certification under an environmental management system

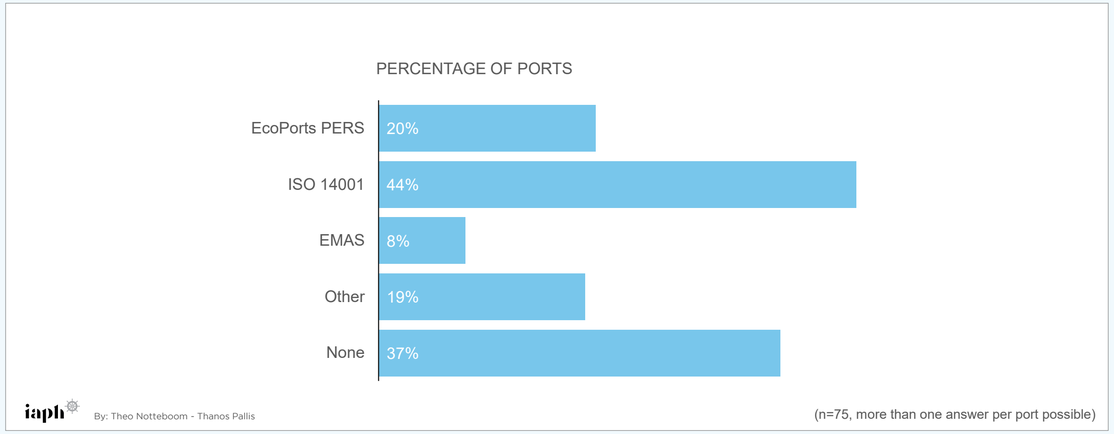
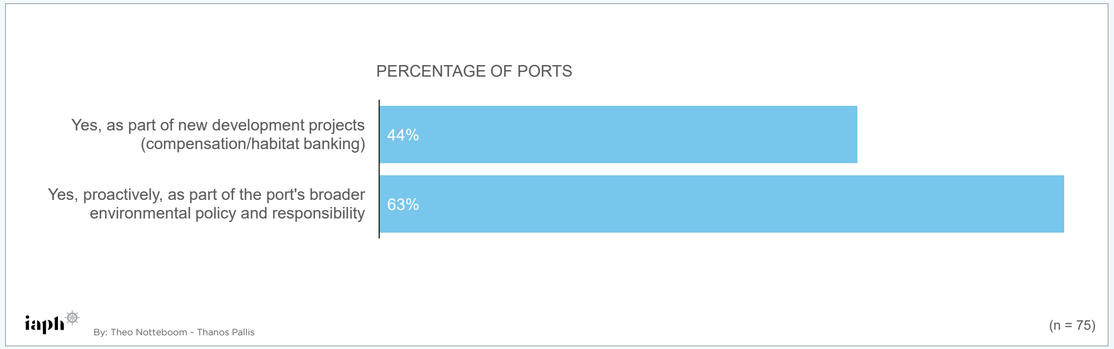


Figure 21
Has your port been investing in ecological restoration initiatives under the following circumstances?



6

COMMUNITY BUILDING

A mural part of the *Generation 17* initiative, this work adopts SDG Goal 5 - Gender Equality.

6.1 Community-building initiatives

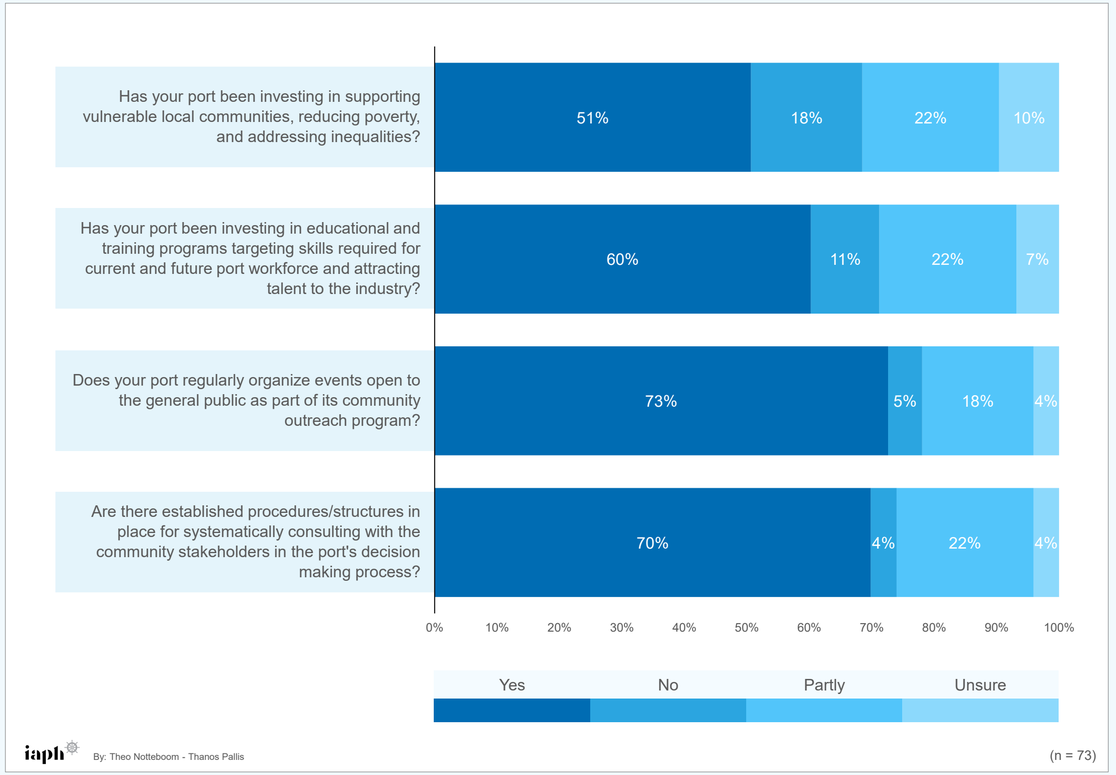
Community-building initiatives in seaports aim to strengthen relationships between ports and the communities that surround them. Since ports are often located near densely populated urban or coastal areas, it is crucial to maintain trust, minimize negative impacts, and create shared value. These initiatives help ports become not just economic engines but also socially responsible and inclusive spaces and attractive workplaces.

The survey results reveal that almost three out of four ports regularly organize events open to the public (such as open port days) as part of their community outreach program (Figure 22). Moreover, seven out of ten ports have established procedures and structures enhancing systematic consultation with community stakeholders as part of decision-making processes.

> Seven out of ten ports have established procedures and structures to facilitate systematic consultation with community stakeholders as an integral part of their decision-making processes.

Sixty per cent of respondents have invested in educational and training programs targeting skills required for the current and future port workforce and attracting talent to the industry. Just over half of the port authorities have invested in supporting vulnerable local communities, reducing poverty, and addressing inequalities. In addition, for all the above cases, between 18% and 22% of surveyed ports indicate they have partly engaged in such activities. Thus, very few port authorities are not investing resources in community-building initiatives.

Figure 22
Status of community building initiatives



6.2 Communication on sustainability initiatives

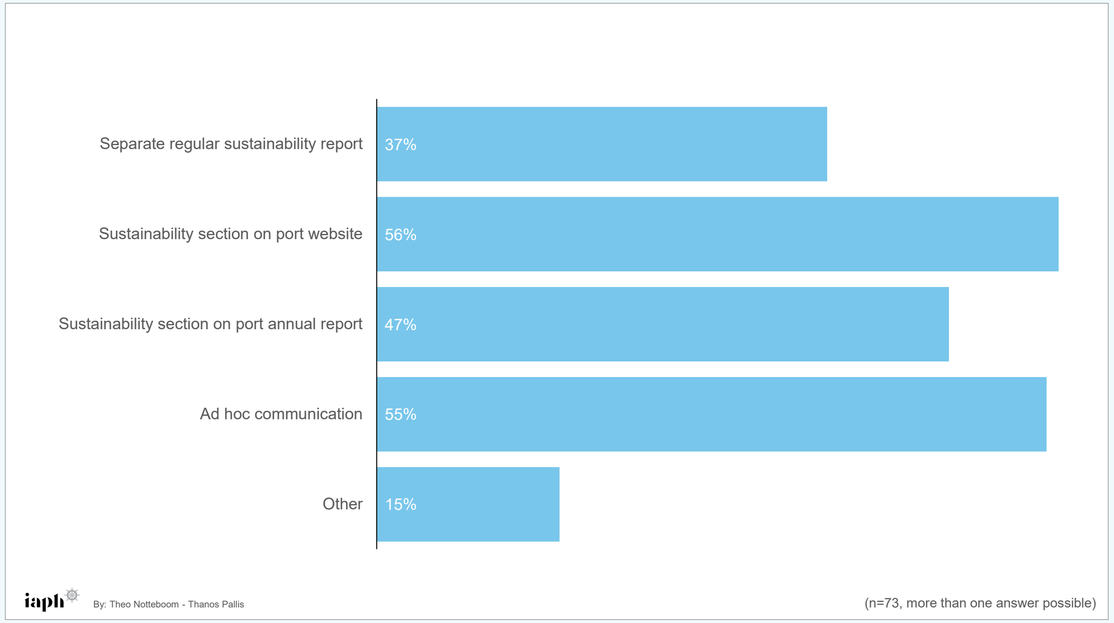
Port authorities can communicate their sustainability initiatives in various ways to engage stakeholders, raise awareness, and ensure that their efforts are transparent, impactful, and well understood. Effective communication is crucial for gaining public support, attracting green investments, and meeting regulatory or certification requirements. The survey zoomed in on the various paths that port authorities can use to communicate sustainability initiatives (Figure 23).

> 37% of the responding port authorities publish a separate sustainability report on a regular basis, mostly on an annual or bi-annual basis.

Sustainability reports are comprehensive reports documenting the port's sustainability efforts, achievements, goals, and future plans. They help to provide transparency and accountability to stakeholders such as governments, businesses, and local communities. Ports increasingly follow global guidelines and standards for sustainability reporting (e.g., the Global Reporting Initiative – GRI). About 37% of the responding port authorities publish a separate sustainability report regularly, mainly annually or biannually.

Approximately 56% of the port authorities have a **dedicated section on their official website** or a separate digital platform that shows sustainability initiatives. In this way, they provide stakeholders with easy access to up-to-date information. The information available ranges from real-time data on environmental performance, information about green certifications, and sustainability dashboards, to press releases and news about ongoing projects. Almost half of the port authorities opt for a **dedicated sustainability section in their annual reports**. **Ad hoc forms of communication** on sustainability initiatives are another common practice.

Figure 23
Means used to communicate on sustainability efforts



6.3 Women at the work floor

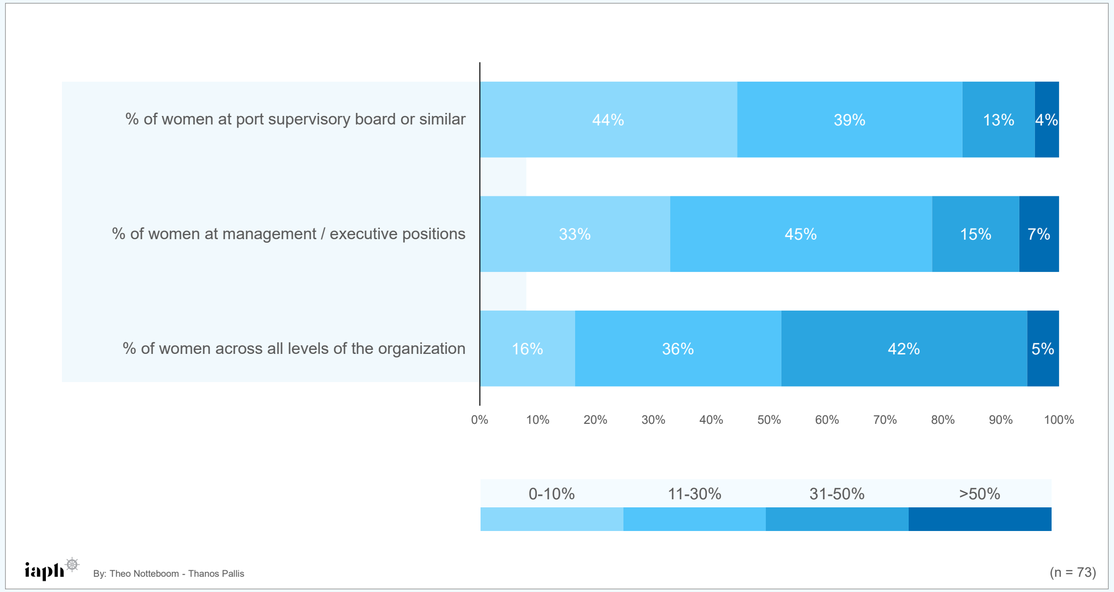
Knowing and communicating on the share of women working in ports is relevant in the context of sustainability, diversity, equity, and inclusion, as well as the development of a competitive and resilient port industry. Understanding the representation of women in ports helps port authorities identify gender disparities and implement initiatives to promote gender equality. It ensures that opportunities for employment, training, and leadership are accessible to all, regardless of gender.

> The survey results reveal a significant disparity in the representation of women in port supervisory boards compared to their overall presence within port authorities.

Ports that show a commitment to gender equality are likely to have a stronger public image and attract more business from clients who value sustainability and diversity. By actively involving women in port work, ports can tap into a broader talent pool, helping to address labor shortages and promote skills development. Tracking and improving the share of women in ports can also help port authorities stay in line with existing regulations in this area.

Yet, the survey results (Figure 24) show that the share of women in port supervisory boards or similar bodies is quite low compared to the situation across all levels of the port authority. Approximately 17% of ports report that women make up more than 31% of supervisory boards, while this figure amounts to 47% when considering all levels of the organization. However, in 44% of cases, women's share in supervisory boards or similar is below 10%. This share reaches 16% when considering all levels of the port authority. In very few cases, women are overrepresented (i.e., over 50%) in their organizations.

Figure 24
Share of women working at different levels of the port authority organization



6.4 UN SDGs integration in port governance

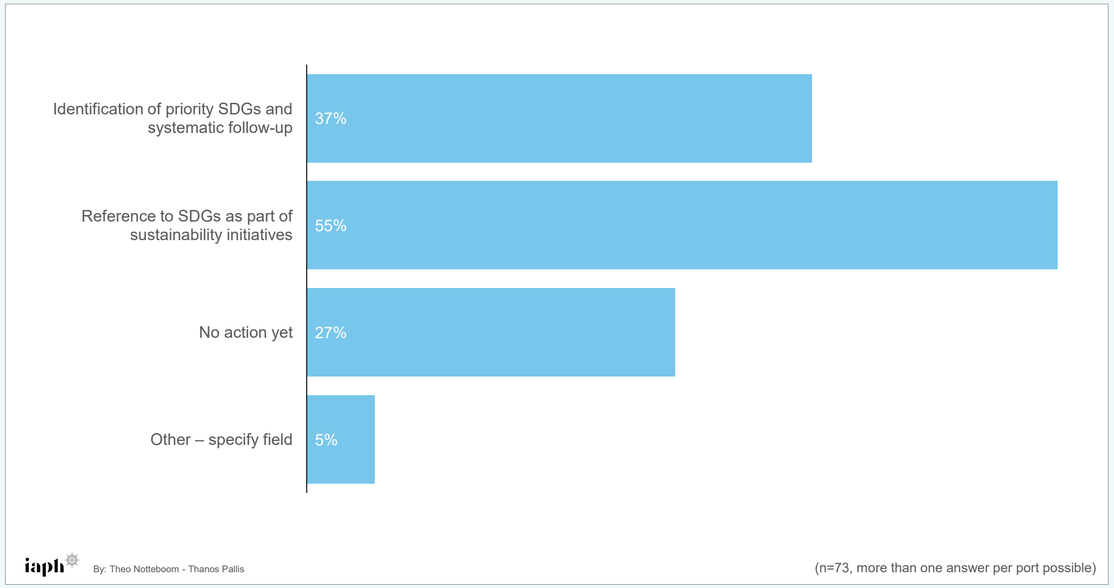
The integration of **the United Nations Sustainable Development Goals** (UN SDGs) in port governance is an increasingly important focus for port authorities worldwide, as the global maritime and logistics industry strives to become more sustainable, resilient, and inclusive. Ports, as major hubs of global trade and logistics, have a significant environmental, social, and economic impact, which means their governance structures and operations are challenged to align with the 17 SDGs to ensure long-term sustainability.

55% of ports have integrated a reference to the UN Sustainable Development Goals (SDGs) in their governance practices.

The adoption of the UN SDGs in port governance can take various forms. About 55% of the surveyed port authorities refer to the UN SDGs as part of sustainability initiatives, while 37% identified and systematically follow up on priority SDGs (Figure 25). More than a quarter of port authorities report no specific action in this field. The World Ports Sustainability Program (WPSP) was initiated by IAPH in 2018 with its main aim to assist ports in integrating the UN SDGs in port governance. Through its projects database, the annual IAPH Sustainability Awards, and the Port Endeavour port training game, WPSP continuously delivers along this pathway.


Osaka, Kansai, Japan : The United Nations (UN) Pavilion themed *"United for a Better Future"* at Expo 2025.

Figure 25
UN SDGs integration in port governance



7

HEALTH, SAFETY AND SECURITY

7.1 Risk factors for the port

Seaports face a variety of risk factors that can impact their operations, growth, and sustainability. These risks can stem from environmental, economic, operational, geopolitical, and technological challenges. Understanding and managing these risks is crucial for port authorities to ensure resilience, safeguard investments, and continue effectively facilitating global trade. One of the survey's questions focuses on how port authorities evaluate potential risk factors (Figure 26).

> Cybersecurity threats lead as the most important risk factor perceived by port authorities: 62% of responding ports consider cyberattacks a high risk, and an additional 30% consider them a moderate threat.

Cybersecurity threats rank as the most critical risk factor (by a distance) perceived by port authorities. No less than 62% of the respondents consider cyberattacks a high risk, with another 30% pointing to a moderate threat. With the increasing use of digital technologies, automation, and Internet of Things (IoT), ports are vulnerable to cyberattacks and data breaches that can disrupt operations, steal sensitive information, or cause significant financial loss.

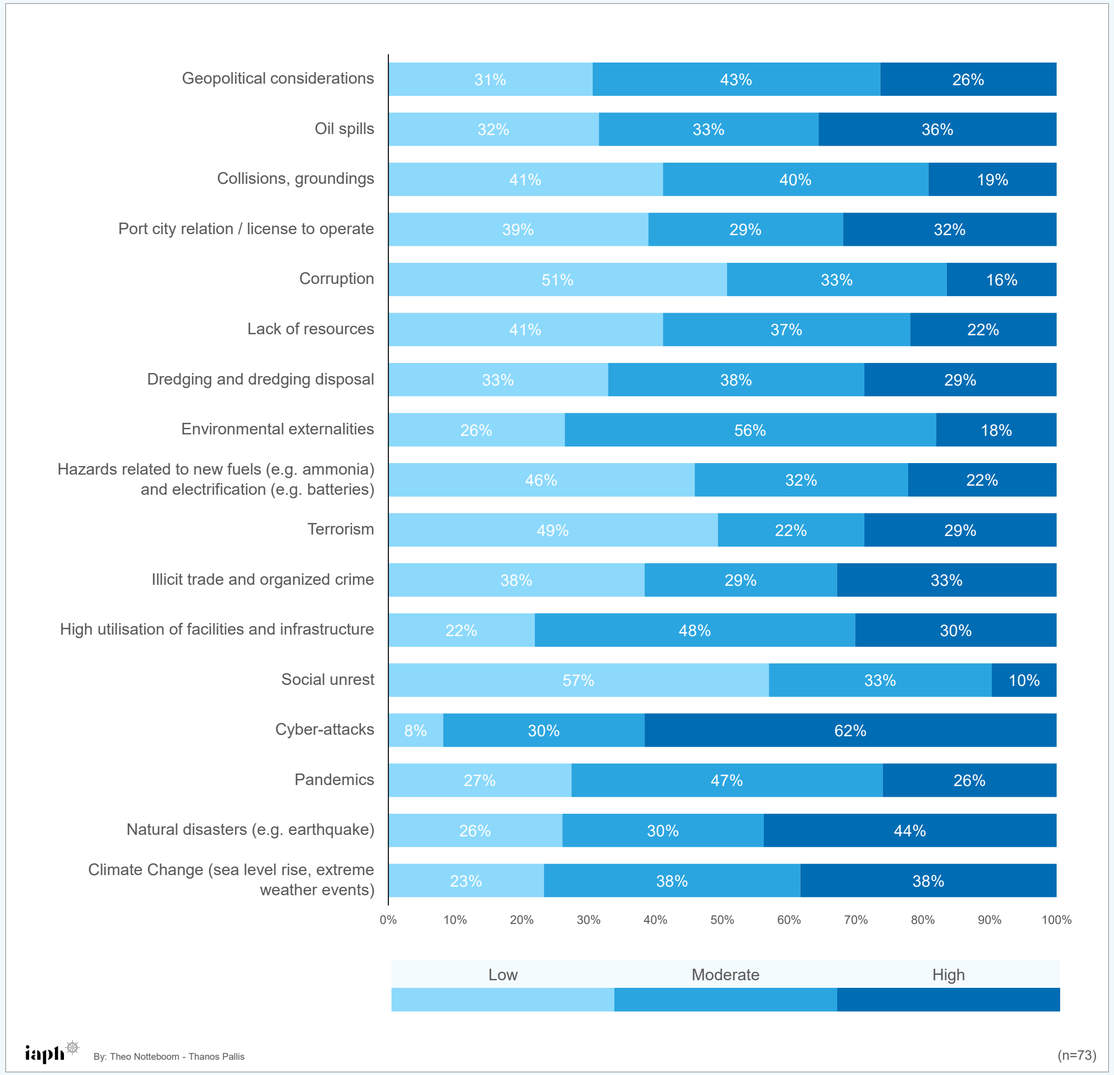
Natural disasters and **climate change** are considered a high-risk factor by 44% and 38% of ports, respectively. Earthquakes, tsunamis, and other natural disasters pose severe risks to port infrastructure. Ports located in earthquake-prone regions, like Japan, must be especially resilient to such events. Rising sea levels, more frequent and intense storms, and changing weather patterns are increasing the risk of flooding, infrastructure damage, and disruptions to port operations. Ports are vulnerable to storm surges, hurricanes, and flooding, which can halt operations and damage infrastructure. **Oil spills** and **illicit trade and organized crime** complete the top 5 of the most important risk factors considered by port authorities when considering the 'high risk' share.

When combining the 'moderate risk' and 'high risk' percentages, the high utilization of facilities and infrastructure comes second after cyber-attacks (78% compared to 92%), closely followed by climate change (77%), environmental externalities (74%), and natural disasters (74%).

Despite the tense geopolitical situation in the world, **geopolitical considerations** are considered a high risk by only a quarter of the respondents. Geopolitical impacts differ strongly by port. For example, ports located in politically unstable regions face risks from civil unrest, changes in government, or policy shifts that could affect port operations or access to key trade routes. Ports may be differently impacted by sanctions, trade restrictions, or changes in international trade agreements, which can affect the flow of goods through certain regions or ports.

Only one out of ten port authorities consider **social unrest** a high-risk factor. This is the lowest share of all listed risk factors. Labor issues, such as strikes, can severely disrupt port operations, leading to delays in cargo handling, increased costs, and potential damage to reputation. However, the potential exposure to social unrest can vary greatly between regions and even between ports of the same region.

Figure 26
Evaluation of risk factors for the port area



7.2 Initiatives in the field of health, safety and security

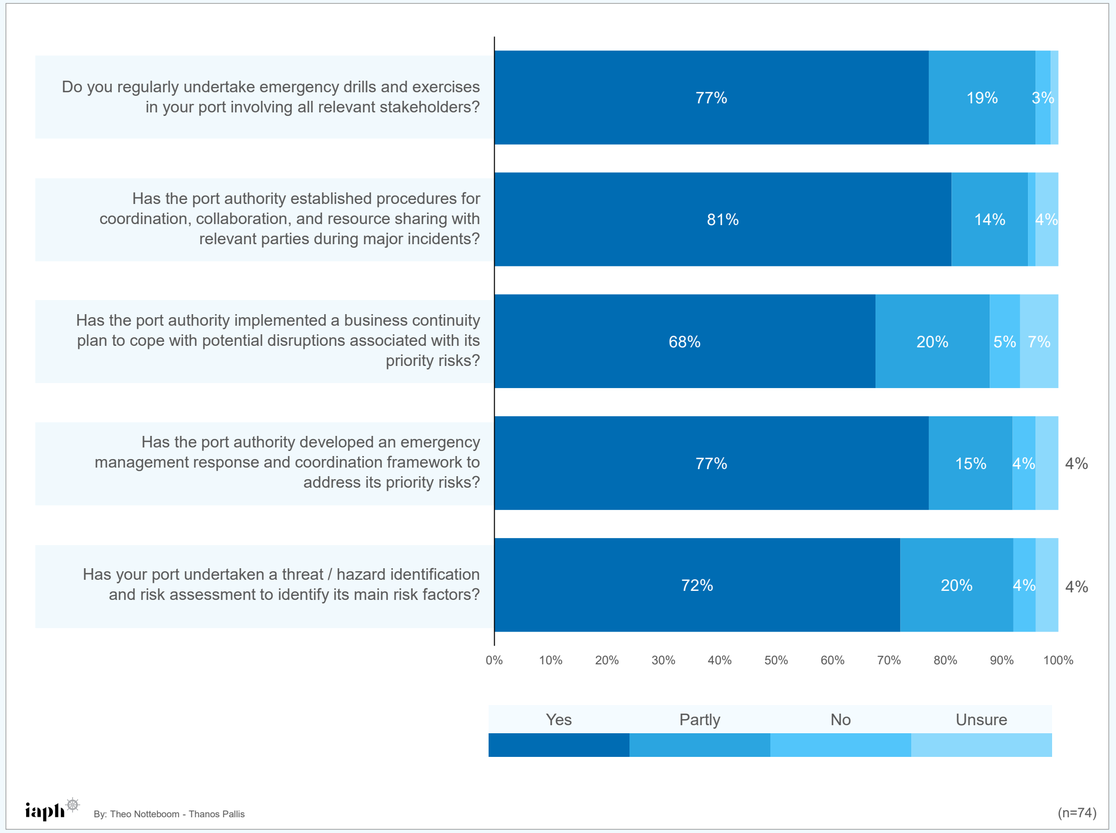
The survey results reveal that health, safety, and security are top priorities for port authorities (Figure 27). To ensure smooth operations, protect workers, and safeguard the port's infrastructure, various initiatives are implemented in these areas.

Over three-quarters of the ports regularly undertake **emergency drills and exercises** involving all relevant stakeholders. The same percentage of port authorities have developed an **emergency management response and coordination framework** to address their priority risks. More than 81% of surveyed port authorities have established procedures for coordinating, collaborating, and sharing resources with relevant parties during major incidents.

> Over 81% of surveyed port authorities have implemented procedures for coordinating, collaborating, and sharing resources with relevant stakeholders during major incidents.

About 72% of the respondents have undertaken a **threat or hazard identification** and risk assessment to identify main risk factors, and 68% implemented a **business continuity plan** to cope with potential disruptions. In addition, between 14% and 20% of responding ports indicate they have partly developed actions in the listed areas.

Figure 27
Status of initiatives in the area of health, safety and security



8

TRENDS IN CONTAINER PORTS

In 2024, container ports worldwide witnessed significant changes in the trade patterns they support. These changes are reflected in the index-based analysis of port performance by region, using data from the S&P Global Port Performance Program. This part of the report compares container vessel call trends, vessel size, call size (i.e. (un)loaded TEUs per call), and productivity between Q4 2023 and Q4 2024 while also providing a longer-term comparison with Q4 2019 (Figures 28 and 29).

Port of Shanghai: Overlooking the container terminal.

In most world regions, the number of container calls decreased, as did the frequency of calls by containerships that are larger than 8,500 TEU capacity. At the same time, the size of calls increased in all world regions.

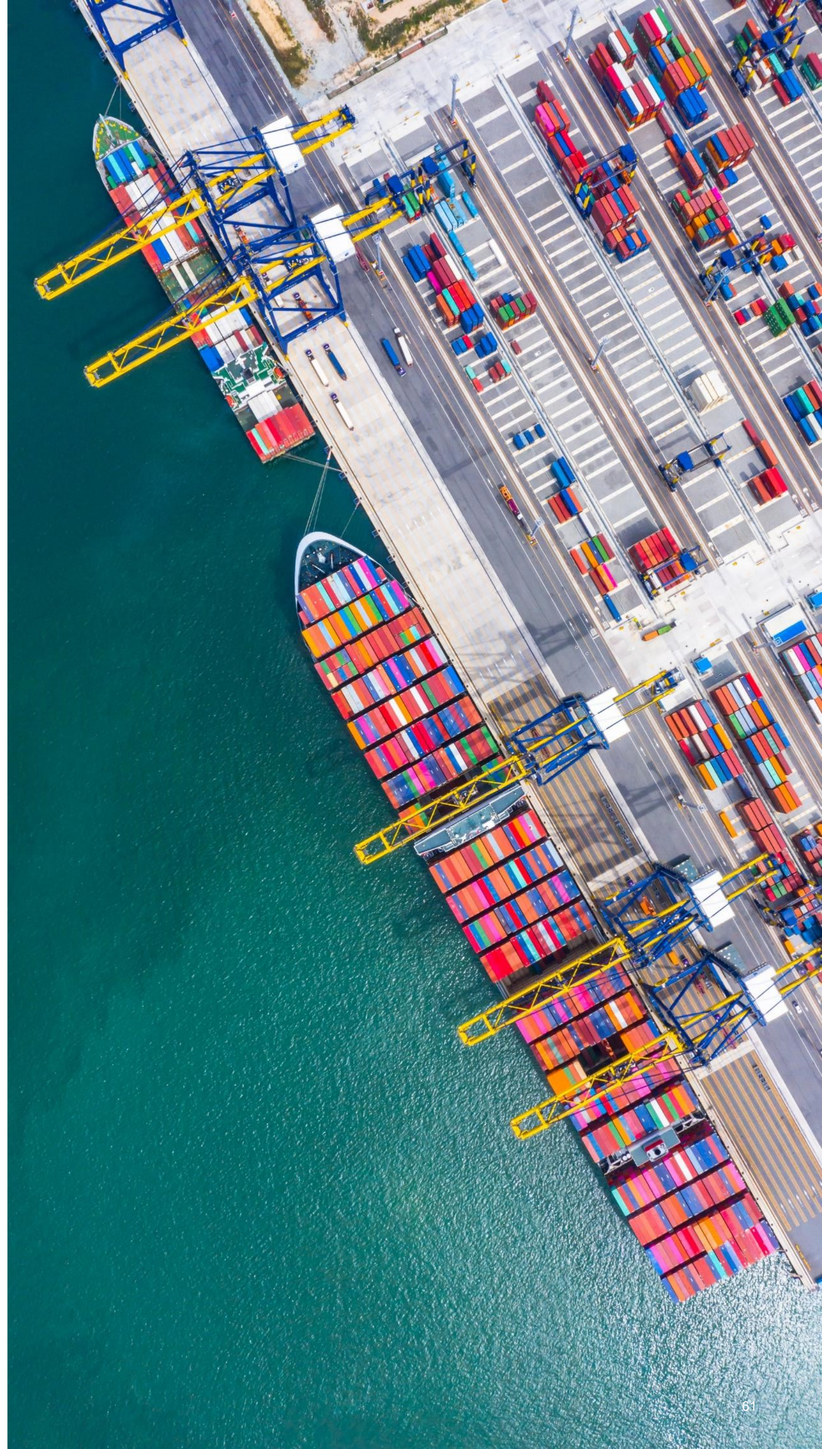
8.1 Number of vessel calls

The index-based **evolution of vessel calls** reveals a significant year-on-year decline in container ship arrivals in five out of nine global regions. The most substantial decreases – each at 11% – were recorded in Latin America & the Caribbean, the Mediterranean Sea, and the Middle East & Asia. North America and Northern Europe also saw notable declines, with vessel calls dropping by 7% and 5%, respectively. In contrast, ports in Africa (+3%), Northeast Asia (+4%), and Oceania (+10%) saw increases in container ship arrivals compared to the previous year.

From a longer-term perspective, vessel calls remain below Q4 2019 levels in all regions except Africa. North America saw the steepest decline, with vessel arrivals dropping by more than 20%, followed closely by Northern Europe at -18%. The other six regions experienced declines ranging from 8% (Latin America) to 13% (Oceania). Africa stands out as the only region to exceed the 2019 levels, with vessel calls 7% higher, maintaining this growth trend since 2019.

Liner shipping companies reduced **the frequency of calls of their largest vessels** in Q4 2024 compared to the same quarter in the previous year (Q4 2023). In seven regions, the year-on-year share of vessel calls by container ships with a capacity of more than 8,500 TEU declined. The most notable decreases were observed in the Middle East and India, where the share dropped from 33.5% to 21.5% (a decline of 36%), and the Mediterranean, where it fell from 16% to 13.6% (-15%). Southeast Asia also experienced a double-digit decline, with the share falling by 11% to 16.6%. In Northeast Asia, the share decreased by 8%, reaching 34.5%. Other regions saw more moderate declines: in North Europe, the share lowered to 25.3% of the total, in Latin America and the Caribbean to 27.5% North America to 32.4%. In Oceania (7.9%), the change was marginal, indicating relative stability in vessel size deployment. Conversely, Africa recorded a slight increase in the share of large vessel calls, rising from 5.9% to 6.1%. This growth is linked to the Red Sea crisis, which led to the rerouting of several westbound mothership services via the Cape of Good Hope.

Over the longer term, from Q1 2019 to Q4 2024, trends in the deployment of large container vessels present a mixed picture across global regions. The most significant increase occurred in Oceania, where the share of 8,500+ TEU capacity containership calls as a percentage of all calls rose by 7.2%. In North America and Northeast Asia this percentage recorded a 3.5% increase, while Latin America and the Caribbean saw a more modest rise of 2.2%. In contrast, the most substantial decline was observed in the Middle East and India, where the share of large vessel calls dropped by 8.7%. Africa also experienced a decrease (-1.4%), as did container ports in Northern Europe (-2.3%) and the Mediterranean (-0.8%). Southeast Asia recorded only a marginal decline of -0.2%.



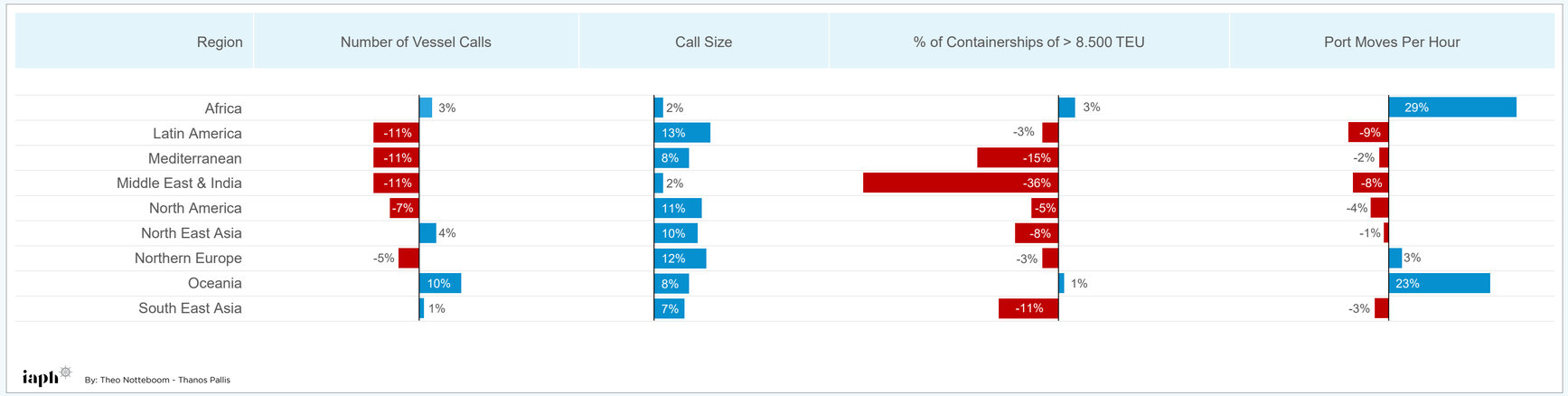
8.2 Size of vessel calls

An increase in the **size of vessel calls** accompanied the previously mentioned trends in the number and capacity of containership calls. In all world regions, the number of containers loaded or unloaded per call in Q4 2024 was higher than in Q4 2023. The increase reached double-digit percentages in Latin America (+13%), Northern Europe (+12%), North America (+11%), Northeast Asia (+10%), and the Mediterranean Sea (+10%). It was also notable in Oceania (+8%), and Southeast Asia (+7%), while Africa saw a more modest increase of +2%.

The increase in TEU handled per containership call becomes even more significant when viewed in the context of its evolution since 2019. This sustained growth has placed considerable pressure on existing operational models.

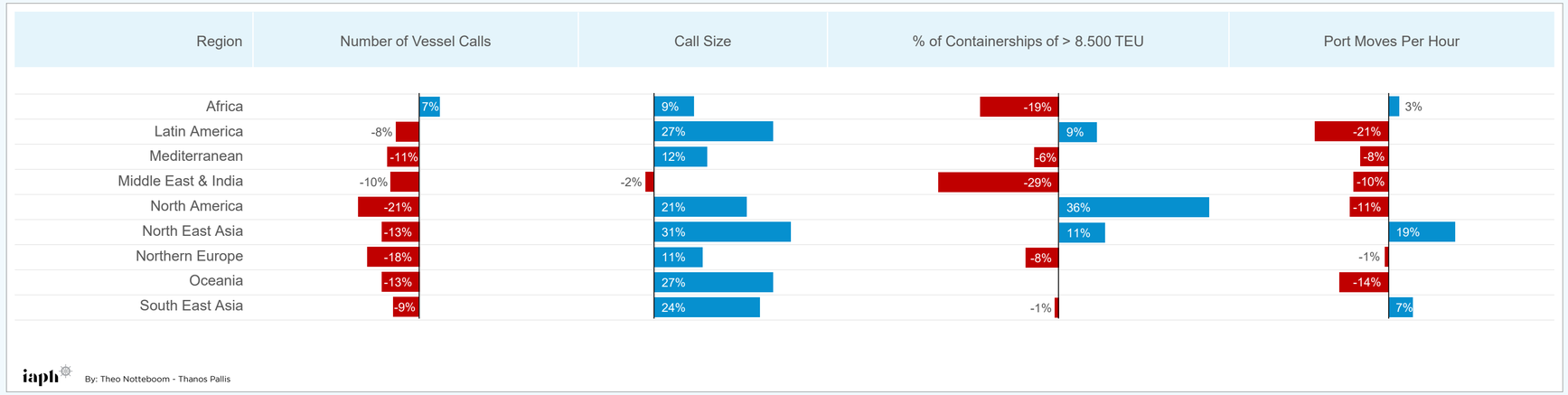
Ports in the Middle East and the Indian subcontinent are the only ones where this change has been relatively insignificant, showing a slight decline of 2%. In Q4 2024, ports in Northeast Asia handled 31% more cargo per call than in Q4 2019. Latin American and Oceanian ports recorded a 27% increase, Southeast Asia 24%, and North America 21%. In Europe, the growth ranged from 12% in Northern Europe to 11% in Mediterranean ports. African ports experienced a 9% increase.

Figure 28
Trends in container ports: Index-based year-on-year evolution (Q4 2024 vs Q4 2023)



Data Source: S&P Global

Figure 29
Long-term trends in container ports: Index-based evolution (Q4 2024 vs Q4 2019)



* Oceania: The presence of containerships of > 8.500 TEU capacity calling in 2019 was marginal.

Data Source: S&P Global

8.3 Container moves per hour

Container port productivity is a multi-dimensional construct, with operational efficiency standing among its critical components. Container moves per hour are among the most indicative indicators of such efficiency; although it does not provide a thorough performance assessment, monitoring it offers a useful insight into the evolution and challenges of port operations.

> With the size of calls increased in all world regions, in Q4 2024 the number of container moves per hour was lower, with the exceptions being Africa, North Europe and Oceania.

The combination of bigger call sizes, lower number of calls, and lower percentage of calls has contributed to a lower number of container moves per hour in ports in Latin America, the Mediterranean, Middle East and India, North America, Northeast Asia and Southeast Asia.

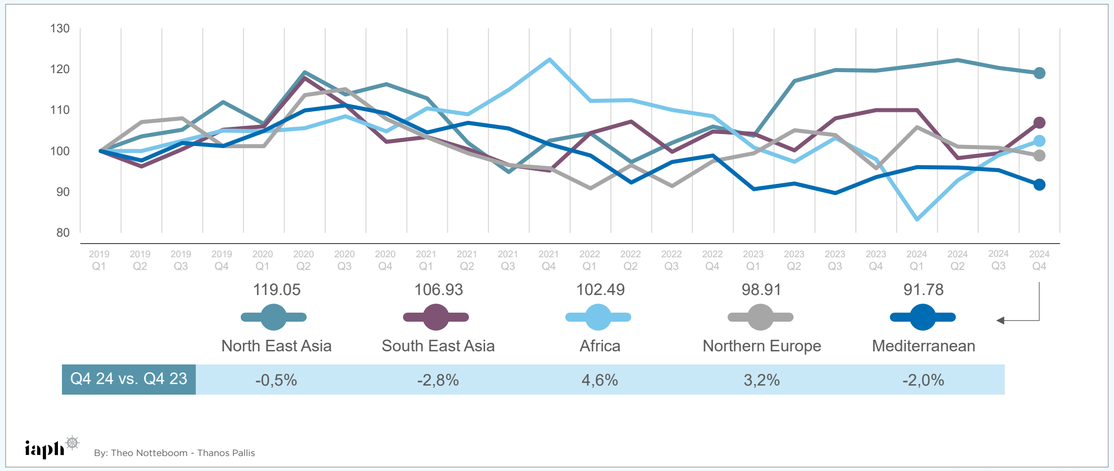
The regional data on **port moves per hour** demonstrate that these six world port regions had to accept a decline in Q4 2024 compared to the same quarter in 2023. Port productivity levels saw strong year-on-year growth in Africa (+29%) and Oceania (+23%), two regions that recovered from equally large productivity declines the previous year (i.e. in 2023 compared to 2022).

When looking at trends since 2019, container port productivity increased only in Northeast Asia (+19% more moves per hour) and Southeast Asia (+7%), with Africa showing a modest improvement of +3%. In all other regions, ports have struggled to adapt to the structural changes in maritime container trade, resulting in productivity declines.

In Northern Europe, the decline was marginal (-1%), while container moves per hour in Mediterranean ports were 8% lower in Q4 2024 than at the beginning of 2019. Latin America and the Caribbean (-21%) and Oceania (-14%) experienced the most significant drops in productivity. Ports in North America and the Middle East and Indian subcontinent also saw notable declines of 11% and 10%, respectively.

Figure 30

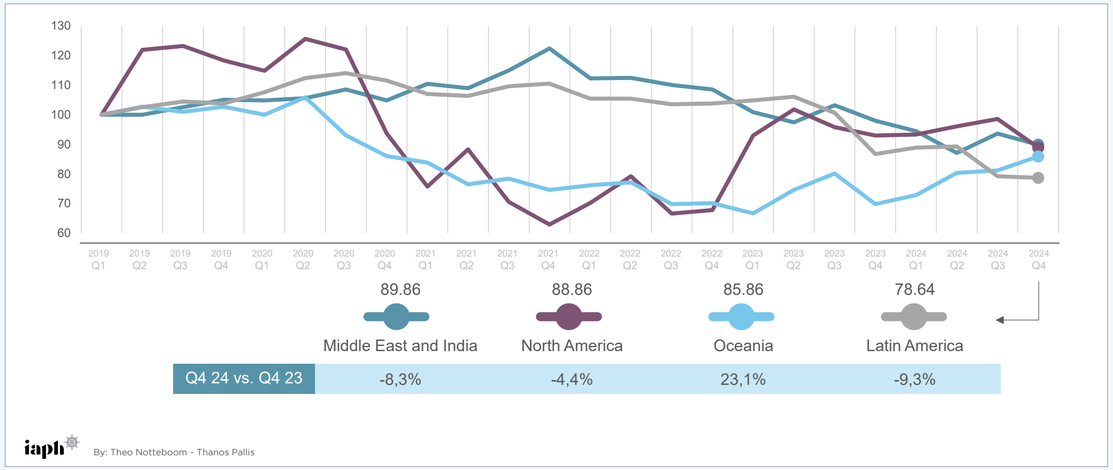
World Regions with the highest index values for container ports productivity compared to 2019 (Port Moves Per Hour per region)



Data Source: S&P Global

Figure 31

World Regions with the lowest index values for container ports productivity compared to 2019 (Port Moves Per Hour per region)



Data Source: S&P Global

8.4 Connectivity

The UNCTAD Liner Shipping Connectivity Index (LSCI) captures the levels of integration into the existing liner shipping networks by measuring liner shipping connectivity. Calculated at the country and the port level, it can be considered a proxy for accessibility to global trade:[1] the higher the index, the easier it is to access a high capacity and frequency global maritime containerised freight transport system and effectively participate in international trade.

The year-on-year development and the Q1 2019-Q4 2024 evolution of the country-based LSCIs in the ten most connected countries and/or territories of the world (Table 1) and the five best-connected locations per region, in terms of the LSCI values, are revealing (Figure 32 and Figure 33).

8.4.1 LSCI evolution for the ten best-connected locations in the world

On a year-on-year basis, the Liner Shipping Connectivity Index (LSCI) increased in six of the ten best-connected locations in the world.

The country-based Liner Shipping Connectivity Index (LSCI) reveals that key shifts are ongoing in all port regions. Yet a mixed picture occurs as regards the overall connectivity trends per world region, or throughout the globe. On a year-on-year basis, the Liner Shipping Connectivity Index (LSCI) increased in six of the ten best-connected locations in the world.

The LSCI continues to rise most rapidly in China and South Korea, with the locations ranked first and second globally, widening the gap with the rest of the world. China, which tops the list with an LSCI of 1,258.4, expanded its lead as its index rose by a higher percentage than in any other country or territory. Korea (LSCI = 640.5), the second-best-connected location and Vietnam are the two other Northeast Asian places that experienced a positive connectivity trend, although in this case the growth is marginal (0.3%). In contrast, the four other Asian locations in the list saw year-on-year declines in their connectivity, with the sharpest decreases in Singapore and Hong Kong SAR (both -3%).

Positive trends were also recorded in the United States (+2.2%) and the two European locations in the top 10. Spain, in particular, benefited from vessel diversions caused by the Red Sea crisis. As liners opted to sail around Africa instead of transiting through the Red Sea, Spain's LSCI rose by 3.3% yearly. Whether this increase is temporary or marks a more permanent shift remains to be seen. The United Kingdom re-entered the top 10 following a 1.4% increase in its LSCI, displacing the Netherlands, which fell to 11th place.

[1] The LSCI is calculated based on six components: (i) Scheduled ship calls: the number of ships that are calling on a weekly basis; (ii). Deployed capacity: the total capacity of the liner services; (iii) Number of shipping companies servicing the country or the port; (iv) How many scheduled services carriers are using to provide this coverage; (v). Maximum vessel size; (vi) The number of ports directly connected to the reference port.

These recent developments appear to reflect a longer-term trend. Since 2019, LSCI growth has been particularly strong in China (+25.3%), South Korea (+14.5%), Spain (+17.1%), and most notably Vietnam (+33.6%). These countries have outpaced the improvements seen in other top-ranked locations. Among the remaining best-connected locations, Singapore, the United States, and Malaysia also had higher LSCI levels at the end of 2024 compared to the beginning of 2019. On the other hand, Hong Kong SAR (-13.7%), the United Kingdom (-5.2%), and Japan (-1.9%) are the three locations among the top ten where liner shipping connectivity in Q1 2024 was lower than it was in 2019.

Table1

Liner Shipping Connectivity trends in the 10 best-connected countries and/or territories of the World (Index based Q1 2019 – Q4 2024)

Region	Country and/or Territory	LSCI Q4 2024	Q4 2024 vs Q4 2023	Change in Global Rankings Q4 2024 vs Q4 2023	Q4 2024 vs Q4 2019
Northeast Asia	China	1,258.4	5.6%	-	25.3%
Northeast Asia	South Korea	640.5	0.2%	-	14.5%
Southeast Asia	Singapore	582.7	-3.0%	-	4.3%
North America	United States	515.4	2.2%	↑ +1	5.8%
Southeast Asia	Malaysia	499.1	-1.0%	↓ -1	7.6%
Mediterranean	Spain	426.1	3.3%	↑ +2	17.1%
Southeast Asia	Vietnam	415.7	0.3%		33.6%
Northeast Asia	Japan	412.9	-0.5%	↓ -2	-1.9%
North Europe	United Kingdom	379.9	1.4%	↑ +2	-5.2%
Northeast Asia	Hong Kong SAR	376.2	-3.0%		-13.7%

iaph By: Theo Notteboom - Thanos Pallis

Source of Data: MDS Transmodal & UNCTAD

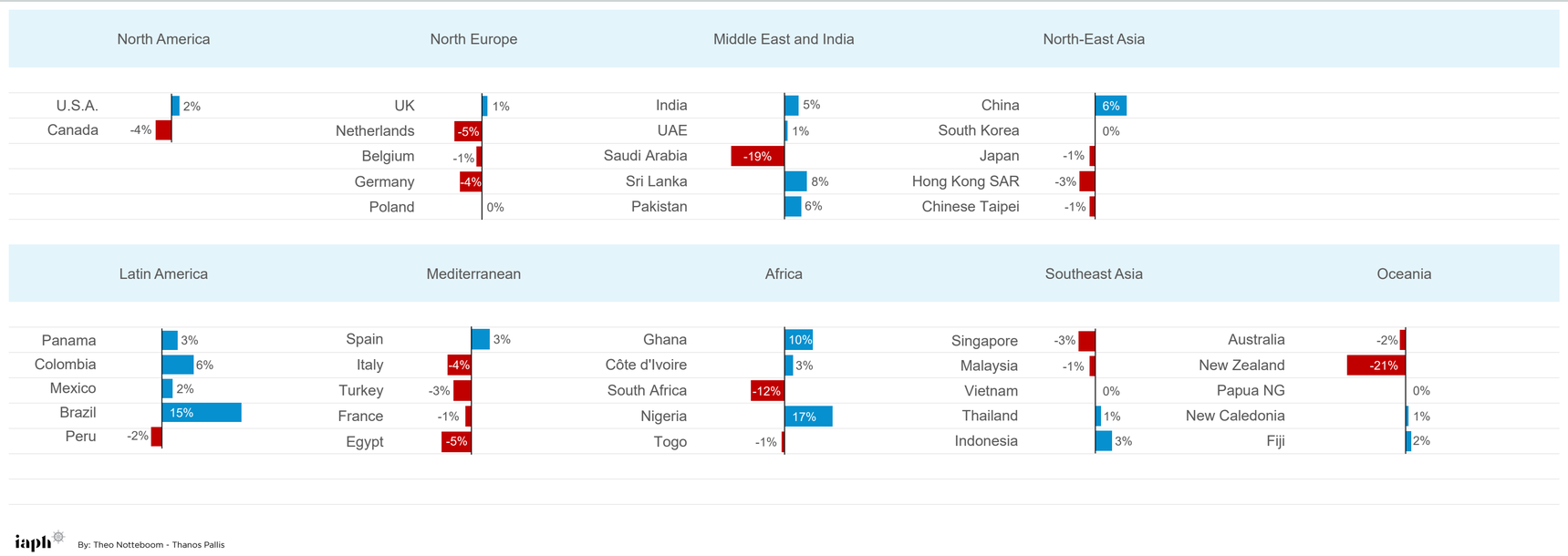
8.4.2 LSCI evolution for the five best-connected locations per region

A comparison of the Liner Shipping Connectivity Index (LSCI) in Q4 2024 with the same quarter in 2023 highlights the challenges faced by European and Mediterranean ports in maintaining liner shipping connectivity – largely driven by geopolitical tensions in other parts of the world. Except for Spain in the Mediterranean and the UK in Northern Europe, all other European locations among the top five most connected in their respective subregions registered a decline in LSCI. The most notable drop was in Egypt and the Netherlands, with a decrease of 5%.

In Asia, the picture was mixed. In Northeast Asia, China and, to a lesser extent, South Korea recorded positive LSCI trends. In Southeast Asia, marginal gains were observed in Thailand and Indonesia. Africa saw a more positive trend overall, particularly in its best-connected ports. Ghana and Ivory Coast experienced improved connectivity, while Nigeria recorded a substantial 17% increase. This contrasted with a sharp 12% decline in South Africa.

In Latin America and the Caribbean, the top four locations showed positive developments, with Brazil registering a significant 15% increase in LSCI. Similarly, in the Middle East and the Indian subcontinent, liner shipping connectivity improved in four key countries. India (+5%), Sri Lanka (+8%), and Pakistan (+6%) saw substantial gains, while the UAE recorded a modest 1% increase. However, Saudi Arabia, the third-best connected country in the region, experienced a significant 19% drop.

Figure 32
Evolution of Year-on-Year Connectivity in Top 5 locations per region (index-based evolution / Q4 2024 vs Q4 2023)



Source of Data: MDS Transmodal & UNCTAD

Comparing long-term trends in liner shipping connectivity between Q4 2023 and Q4 2019 reveals notable regional patterns. In Northeast Asia, China and South Korea – the two best-connected locations globally – improved their Liner Shipping Connectivity Index (LSCI) by 25% and 15%, respectively, while Hong Kong SAR experienced a significant decline of 14%. Japan and Chinese Taipei remain at the same connectivity levels of 2019.

In three world regions, all five of the best-connected locations experienced positive LSCI growth during this period: Southeast Asia saw strong upward trends, especially in Vietnam (+34%) and Thailand (+23%).

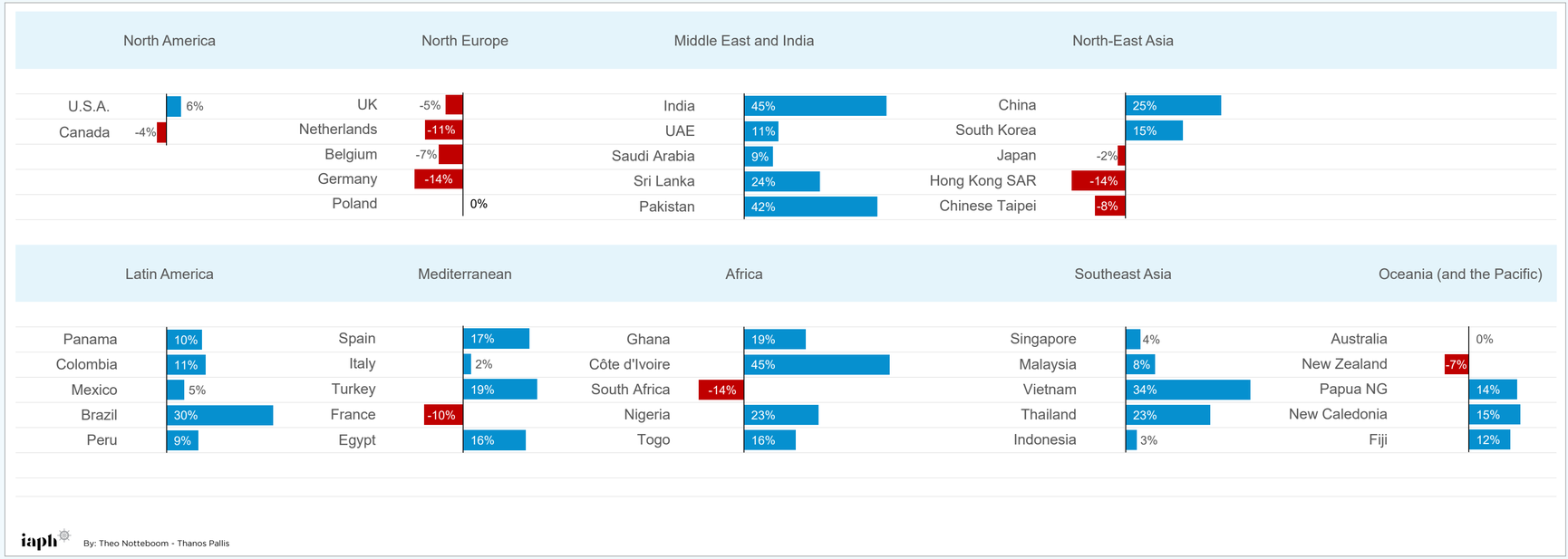
In the Middle East and India, the LSCI of India surged by 45%, that of Pakistan by 42%, and that of Sri Lanka by 24%. The United Arab Emirates and Saudi Arabia showed comparatively moderate but notable increases. Latin America and the Caribbean had all five top locations improve their connectivity. Brazil led with a 30% increase, while the region's two best-connected locations – Panama and Colombia – also posted double-digit percentage gains.

In Africa, four of the five best-connected locations registered double-digit LSCI increases. The exception was South Africa, which saw a 14% decline.

The Mediterranean displayed similar trends: four of the five best-connected locations improved their LSCI. Spain (+17%) and Turkey (+19%) recorded the most significant gains, while France experienced a 10% LSCI decline. France operates major ports in both Southern and Northern Europe, which may partly explain this divergence. Northern Europe is the only region where all five best-connected locations have become less connected than in 2019. Germany (-14%) and the Netherlands (-11%) showed the largest declines, followed by Belgium (-7%) and the United Kingdom (-5%), which proved slightly more resilient.

In North America, the United States improved its LSCI by 6%, while Canada experienced a 4% decline. In Oceania and the Pacific, Australia's connectivity levels remained stable, whereas New Zealand's LSCI dropped by 7%. In all other best-connected locations in Oceania and the Pacific, LSCI growth exceeded 10%.

Figure 33
Evolution of Year-on-Year Connectivity in Top 5 locations per region (index-based evolution / Q4 2024 vs Q4 2019)



Source of Data: MDS Transmodal & UNCTAD

Since 2019 China and South Korea – the two best-connected locations globally – have improved their Liner Shipping Connectivity Index (LSCI) by 25% and 15%, respectively. India, Vietnam, Spain and Brazil have recorded even more substantial improvements.

9

MARKET OUTLOOK

One of the survey questions aimed to capture the short-term outlook for cargo volumes at ports worldwide over the next twelve months. Traffic expectations are measured in TEUs for containers, metric tonnes for other cargo categories, and passenger movements for cruise ports (Figure 34).

The market outlook before the recent global discussions on international trade were notably more optimistic than those recorded a year earlier. The implications of the potential introduction of tariffs by the United States administration has yet to be assessed.

Although the responses were collected before the introduction of extensive tariffs by the US Government and the ensuing trade war, the results are notably more optimistic than those recorded a year earlier, when IAPH member ports participated in a similar survey published in the sixth issue of the IAPH World Ports Tracker.

For **container cargoes**, the overall sentiment of ports was positive. A majority – 53% of surveyed ports – expected a year-on-year increase in container volumes exceeding 2%. About a quarter of respondents foresaw growth between 2-5%, while 18% anticipated an increase ranging from 5%-10%. Additionally, 9% of ports expected growth to surpass 10%. The remaining 47% predicted stable container volumes. Notably, none of the responding container ports expected a decline in throughput in 2025 – a different picture from last year, when 9% projected a drop in TEU throughput.

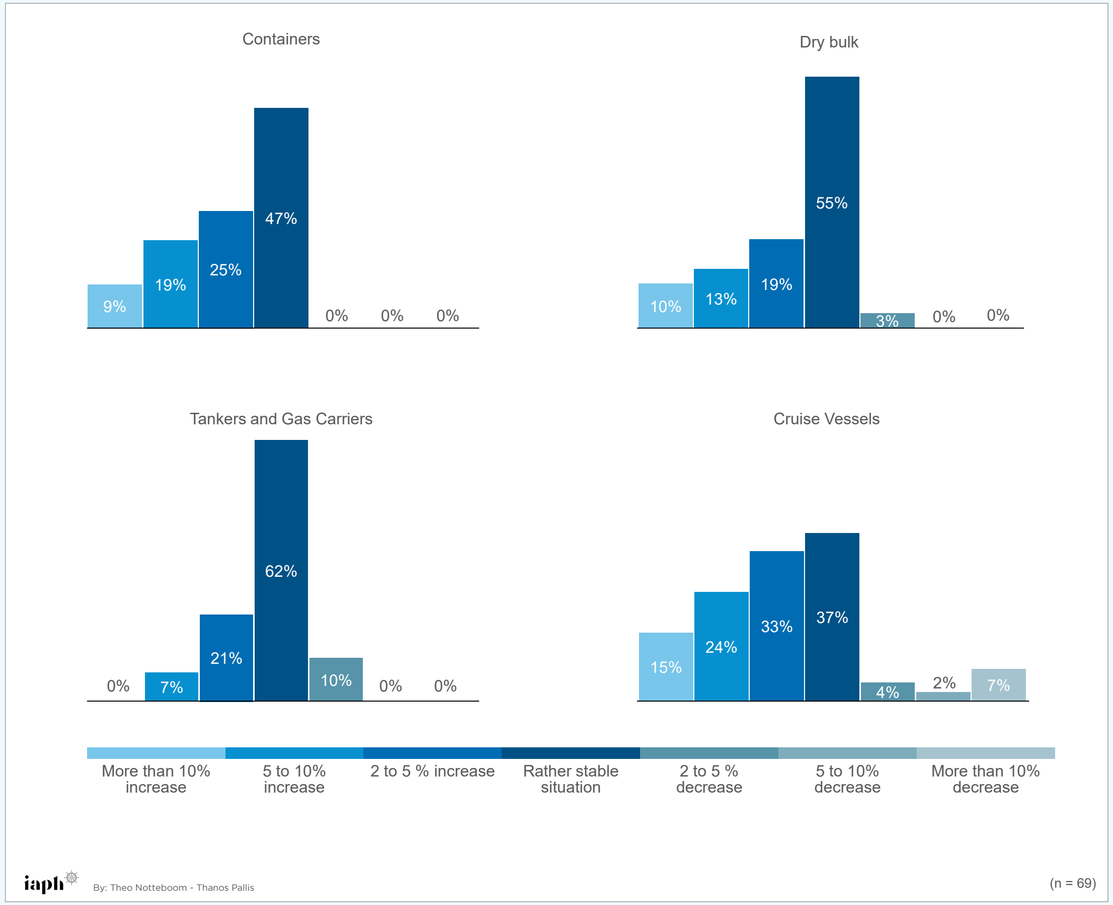
Expectations also shifted positively in the **dry bulk** segment. Forty-two per cent of ports anticipated volume growth exceeding 2%, with a 10% portion projecting gains greater than 10%. Only 3% foresaw a modest decline in dry bulk traffic – a significant improvement compared to the previous year, when more than one-third of ports forecast a drop in the dry bulk cargoes they serve per annum.

As for **liquid bulk cargo**, the outlook was essentially one of stability. Sixty-two per cent of ports expected volumes to remain relatively unchanged in 2025. No ports foresaw double-digit increases, while 28% projected a modest increase between 2% and 5%; the percentage of ports projecting a modest decline was lower than the respective 48% that was recorded a year earlier. Meanwhile, 14% expected a moderate decline, slightly better than the 17% who forecast a decrease last year. Importantly, no ports anticipated a decline of 5% or more in liquid bulk cargo volumes.

Expectations in the **cruise market** remained optimistic, with 72% of surveyed ports predicting continued growth in passenger movements in 2025. More specifically, 15% expected this growth to be over 10%, and another 24% projected increases of 5%-10%. However, 13% of cruise ports anticipated a decline, with 7% predicting a drop of more than 10%, primarily due to changes in cruise line itineraries. Given that cruise lines typically plan their cruise programmes and schedules two or more years in advance, the accuracy of these forecasts is considered higher than in other segments.

These responses were collected in late February and March 2025, before the announcement of the potential introduction of tariffs by the United States government. Once implemented, and depending on their scale, these policies have the potential to exert a significant impact on global maritime trade dynamics: they might affect bilateral trade volumes and container throughput on some, or many, major trade lanes such as the traditional east-west maritime corridors, with profound implications for global shipping demand and port services demand. Beyond shifting the short- and long-term outlook for the world's ports, this evolution underlines the importance of regularly tracking shifts in the market trends.

Figure 34
Expectation for ports' cargo throughput and passenger numbers (% of ports)



10

STRATEGIC DECISIONS

10.1 Investments in ports

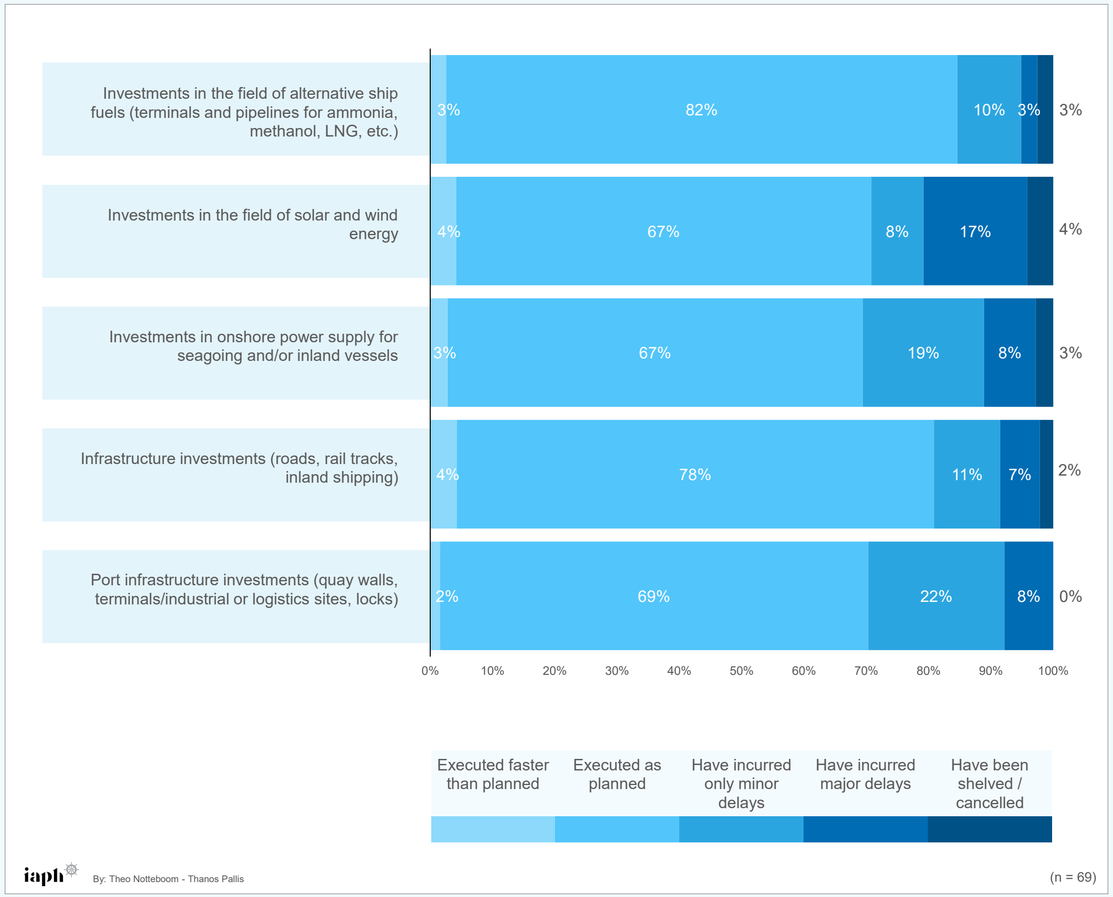
Decisions on investments, whether related to port facilities, hinterland connectivity, or energy transition, including their implementation plans, are a subject of strategic and operational importance for ports and all current and potential service providers, port users, and stakeholders (Figure 35).

In 2024, most ports demonstrated strong performance in executing **port infrastructure investments**. According to the survey, 69% of ports carried out these projects as planned, while another 22% experienced only minor delays. Significant delays were reported by just 8% of the ports, indicating overall efficiency in managing infrastructure timelines. Even more encouraging progress was observed in the case of **inland infrastructure** improvements. Nine out of ten ports reported either on-schedule execution or only slight delays. In this category, just 7% experienced major delays, and a very small portion – only 2% – opted to cancel or shelve such projects altogether.

Regarding sustainability-focused investments, such as onshore power supply for seagoing and inland vessels, and renewable energy infrastructure like solar and wind power, execution rates remained consistent. For both categories, 67% of ports reported that these projects were progressing according to schedule. However, investments in solar and wind power encountered more challenges than other sectors. Severe delays were experienced by 17% of ports, and an additional 3% cancelled or postponed these initiatives due to complications.

In contrast, investments in alternative ship fuels faced the fewest obstacles. Over 80% of ports reported that these projects were completed on time, and only 3% experienced significant delays or project cancellations. Notably, across all types of infrastructure initiatives, a small percentage of ports – ranging from 2% to 4 – reported progress ahead of schedule, reflecting instances of exemplary project management and execution. Another noteworthy observation is the global nature of these trends: the survey did not identify an unequal distribution of delays or cancellations of port investments in any region.

Figure 35
Execution of investments in 2024



10.2 Capacity expansion

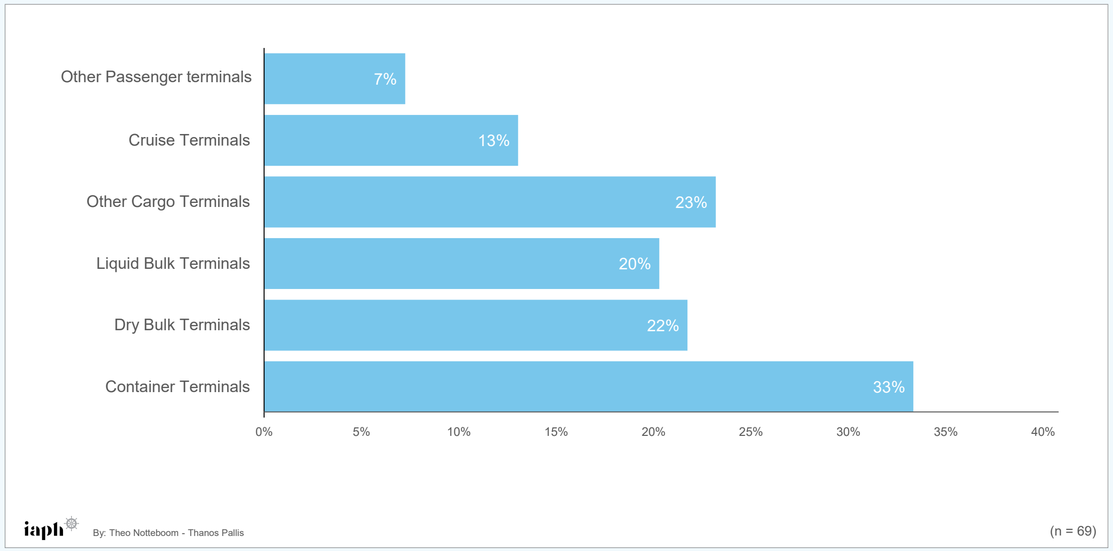
The choices made regarding expanding ports are closely tied to broader investment decisions (Figure 36).

In the container segment, approximately 33% of ports reported that major container terminal capacity expansions or upgrades are expected to become operational in 2025. Similar developments are occurring in the bulk cargo sector, with 22% of ports indicating forthcoming upgrades. In the liquid bulk market, capacity expansions are underway in 20% of the ports surveyed, while upgrades to other cargo terminals are expected in 23% of cases.

By contrast, the expansion of passenger terminal facilities is less common. Only 7% of ports handling non-cruise passenger traffic anticipate new or improved infrastructure in 2025. However, this figure rises to 13% in the case of cruise terminals, reflecting a somewhat more significant investment momentum in this segment of passenger port activities.

The port of Taipei uses construction surplus soil and basic oxygen furnace slag for a renewed logistics zone and a windbreak forest belt.

Figure 36
Ports where terminal capacity expansion or major upgrades will become operational in 2025 (%, per market)



10.3 Land Use

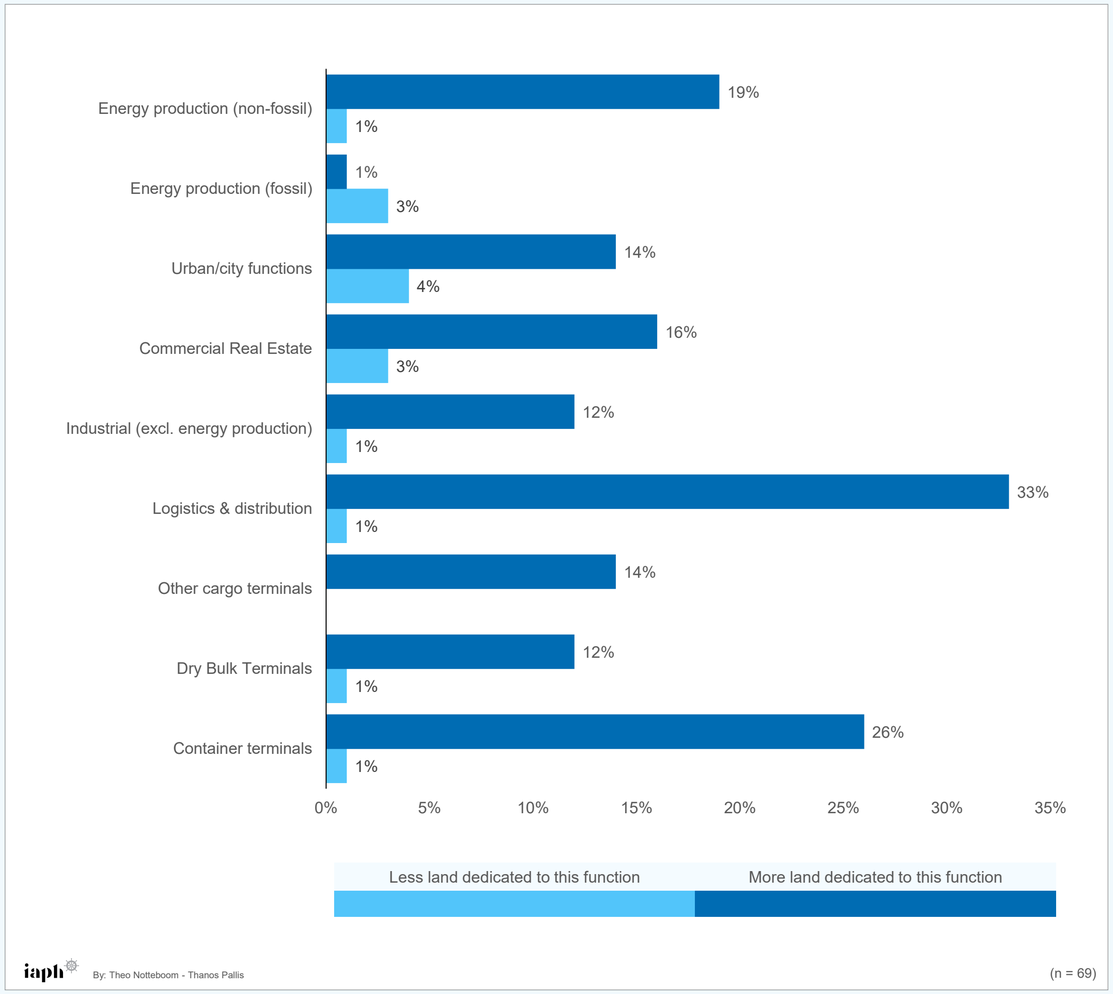
As maritime transportation – both containerised and non-containerised – continues to grow, it is increasingly integrated into complex and dynamic supply chains. These evolving supply chains place mounting demands on ports for additional capacity and space, not only to accommodate growing cargo volumes but also to support logistics and distribution operations. Simultaneously, ports are multifunctional spaces where land is also allocated to industrial activities, real estate development, energy production, and even urban or city-related functions. As a result, significant changes in port land use may be required to adapt to these shifting demands.

Some notable land-use transformations are expected in the coming months (Figure 37). According to the survey, 33% of ports plan to allocate more land to logistics and distribution activities, making this the most common planned land-use change for 2025. The second most frequent change involves the expansion of container operations, with one in four ports intending to dedicate more land to this purpose. Additionally, 14% of ports plan to increase land for other cargo terminals, 12% for dry bulk handling, and another 12% for non-energy-related industrial activities. Land dedicated to commercial real estate and urban/city functions is also set to grow, with 16% and 14% of ports, respectively, planning such expansions.

The energy transition is clearly influencing port development strategies. Notably, 18% of ports report plans to expand land use for non-fossil fuel energy production – an indicator of the growing focus on sustainable energy infrastructure. In contrast, only 1% of ports intend to expand land use for fossil energy production, highlighting a sharp pivot away from traditional energy sources.

However, it is important to note that the survey did not indicate a widespread reduction in land allocated to any specific use. Only 4% of ports expect to reduce land used for urban or city functions, while 3% foresee a decline in land devoted to commercial real estate and fossil fuel-related activities. These findings suggest a general trend of port land expansion. Nonetheless, this conclusion should be interpreted cautiously, as respondents may have hesitated to report which types of activities are being scaled back or abandoned.

Figure 37
Share of ports that plan a major change in the land use in 2025



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