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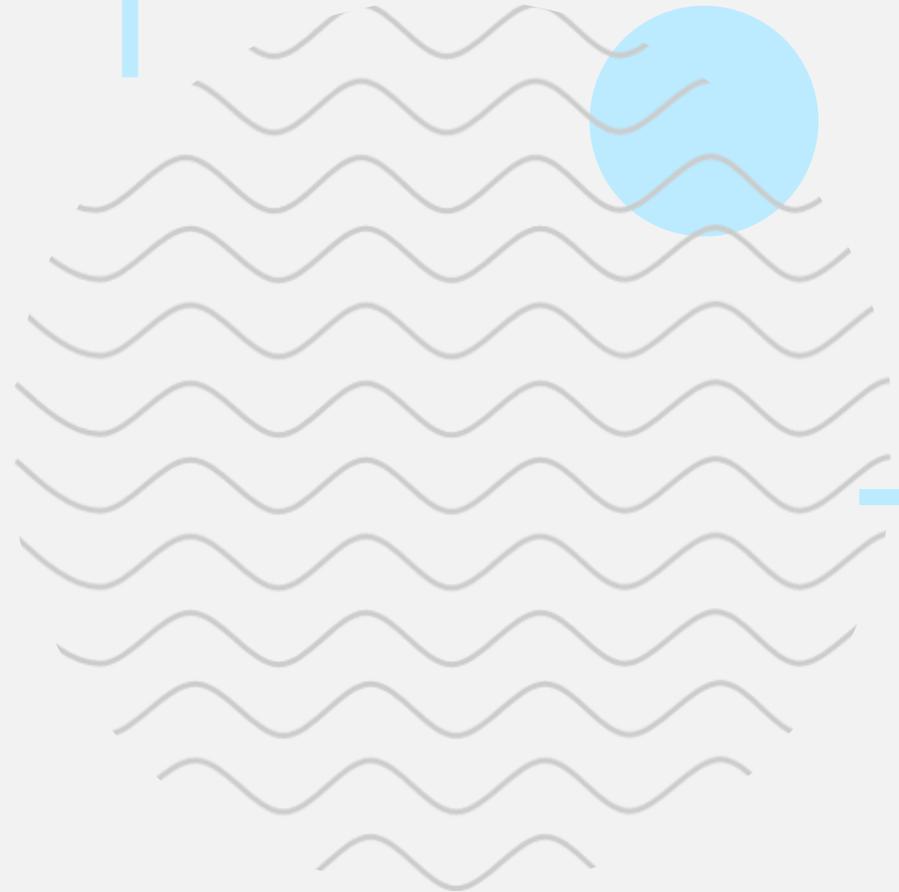


Europe's ports
at the crossroads of transitions
A Deloitte and ESPO Study

June 2021

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Message from the chair

The impacts of the COVID-19 pandemic, combined with the green and digital transitions and the changing global political environment mean a major transformation of Europe's economy and society. These developments create the perfect storm for Europe's ports and port industry. Ports are at the crossroads of these changing realities and transitions. How can port authorities in Europe respond best to these? To what extent can they drive change and decide to set course for a more sustainable and smart future? How to turn challenges and threats into opportunities? To answer these questions, we have to analyse the drivers, assess how the resulting trends impact ports and determine what this means for ports and port management today.

Ports in Europe are very diverse. The drivers and trends described in this study will affect each of them differently and to a different extent, but the European port ecosystem will certainly be changing.

Although the wide variety of port profiles in Europe, all are facing the common challenge of an increasing economic and societal complexity. More than before, port managers will have to play their important role as matchmakers, facilitators and neutral partners in the modern port ecosystem.

At the same time, while ports in Europe are exploring new areas of activities and need to develop new capabilities, their core business as crucial nodes in the supply chains, connecting maritime and hinterland transport for goods and passengers, has never proven more essential than during the health crisis we have been going through.

Ports were instrumental in keeping the economy and society going.

We hope this study helps port professionals in their reflection on the way forward. We also hope it helps policy makers in understanding what builds the port of tomorrow and how they can support a sustainable, smart, resilient and competitive European portscape.

The world will continue to change at a rapid pace. We consider this study a living document and starting point for discussion between port professionals within ESPO, but also beyond, with all port stakeholders and the wider port community.

I would like to thank all ESPO members and port professionals that have been contributing to this study, Deloitte and the ESPO secretariat for their efforts in putting this together.

Let's use this momentum for jointly discussing and reflecting further on Europe's seaports as an integral part of a sustainable, competitive and resilient Europe.

Annaleena Mäkilä
Chair of ESPO

Note from the author

Throughout this document trends in ports and responses undertaken by European port authorities are described. The insights presented were based on extensive workshops with a selection of European port authority representatives, public reports and ongoing research by Deloitte Port Advisory expert teams. Insights were gathered with the cooperation of ESPO which facilitated access to the ESPO network and provided valuable insights into this document. For more information on the exact definition of port authorities, ports and port industry used in this document, please refer to the glossary.

In order to keep the report as independent as possible the authors refrain where possible from using specific port related examples of ESPO members. Although this report aims to encompass actions and trends affecting all types of ports, some findings might be limited to a certain subset of ports. The European port community can be proud of the current market leadership of European ports in sustainable, digital and operational excellence related matters. We hope you enjoy reading this report as much as we enjoyed writing it.

Introduction

The European Sea Ports Organisation (ESPO) and Deloitte Port Advisory are delighted to present this report on the changing role of port authorities in the EU.

The port sector is vital for the European economy and the strategic resilience of its nations. This has become painfully clear over the past year and months, with exceptional trade route disruptions and a global pandemic sweeping the globe.

In a world faced with energy transition, accelerating technological innovation, and ever-changing shifts in demographics and geopolitics, port authorities are striving to deliver their traditional value to the community, as well as transform their organisations to better deal with these changes.

As a traditional landlord, they are, on the one hand, tasked to safeguard the economic growth of the region, attract investments and ensure seamless connectivity for goods and passenger between the maritime side and hinterland. On the other hand, they continuously and increasingly address and mitigate negative externalities from the port authority and port stakeholders together with wider port communities.

The objective of this report is to look at the actions already undertaken- and the possible strategic paths to be taken by port authorities to weather the storm of the changing market, legislative and societal environment. It is not an aim of this study to present any form of forecast on expected cargo evolution or provide any judgement of which port governance model might be preferable today- or in the future.

Report objectives

This research reflects the perspectives of 55 senior port leaders and experts from a variety of ports across the EU. It was developed with the following objectives:



Provide an overview of the perspective of the port authorities

Ultimately, those within the industry will together play the most instrumental role in transcending the port business to the next level. Accordingly, it is essential to collect, understand and build on their views in order to identify solutions that drive progress.



Increase knowledge about and visibility of the industry's challenges

Port leaders who participated in this research looked beyond the challenges of today to explore the solutions of tomorrow. This report aims to share their insights into the changing market environment in which ports operate.



Describe the evolving role of port authorities

The port industry has always been flexible and proactive in evolving together with the market environment. This report aims to outline a possible way forward for ports in dealing with the current game changers and the very disruptive market environment.

All interactions with participants were conducted in a manner that respects competition law boundaries and upholds local COVID-19 regulation.

Glossary

Port Authority: For the purpose of this report, the term “port authority” is used as an encompassing term for the various forms of port managing bodies. Regardless of ownership and other institutional features, the port authority assumes public and commercial responsibilities. Today, there is a broader range of tasks that adds value to the wider port community, the logistics chain, business and trade in general and the societal and environmental context in which ports operate

Port industry: all organisations active in a port, including but not limited to, logistics, shipping, blue economy, energy, ship building, industry, cruise, etc.

Near-shoring: relocation of (parts of) a business operation to a geographical location close to the original location

Re-shoring: relocating back (parts of) a business operation to the ‘original’ location (after near- or offshoring)

Just-in-time port call optimisation: optimised planning and alignment of port operations because of better vessel arrival and departure planning

Carbon neutrality: carbon neutrality will be achieved when any remaining human-caused GHG emissions are balanced out by removing GHGs from the atmosphere in a process known as carbon removal

We would like to thank following port authorities for their cooperation: Port of Amsterdam, Port of Algericas, Port of Antwerp, Port of Marseille, Ports de France, Le Havre Haropa Ports, Port of Hamburg, Port of Koper, Ports of Stockholm, Bulgarian Ports, Port of Constanza, Port de Sete, Ports of Genoa, Port of Gothenburg, Italian Ports Association, Ports of Nantes – Saint Nazaire, Port of Valencia, Port of Barcelona, Port of Helsinki, Port of Trieste, Port of Zeebrugge, Port of Rotterdam, Finnish Port Association, Port of Sines, Port of Klaipeda, Port of Rome, and Port of Oulu. As well as other ports which have indirectly contributed to the conclusions of this study.

Green deal & climate law: the Green Deal Communication is a plan to make Europe carbon neutral by 2050 and includes the ambition to reduce transport emissions by 90% by 2050. Other ambitions introduced in the European Green Deal (such as the goal of decarbonising by 2050, and reducing emissions by at least 55% by 2030) are translated into EU legislation through the recently adopted European Climate Law

Onshore power supply (OPS): provision of shoreside electrical power to a ship at berth while its main and auxiliary engines are shut down. The definition of OPS can be broader than “just a charging post at berth” it can mean a variety of technical solutions aimed at providing shore-based power

Cold ironing: other term for OPS

Shoreside electricity (SSE): see onshore power supply

CCS and CCU: carbon capture storage and carbon capture utilisation, respectively storing produced carbon underground and utilising the stored carbon for industrial or agricultural processes to reduce emissions

Single Window: allows businesses to complete border formalities in one single portal in a certain Member State

Member State: one of the Member States of the EU

Structure

This report focuses on two things. The changing market environment of the ports, the maritime and logistics sector and beyond and the role port authorities are taking up in order to further strengthen the industry into a resilient, sustainable and innovative business.

The report is structured as follows: it starts with a general overview of what is happening in the maritime market, followed by an outline on the impact of these developments on the ports. The report concludes with an insight in how these developments are changing the core role of port authorities.

The report consists of five chapters.

The introduction outlines the objectives for the report and provides some background information on the workshops.

The changing portscape focuses on the main drivers or megatrends that are transforming the port industry. Each trend is explained and the possible impact on the port (and port authority) is outlined.

Port trends, the third chapter, looks more into the impact that the trends are having on the ports themselves, and on responses by port authorities to the main drivers (environmental, technological, geopolitical, demographic).

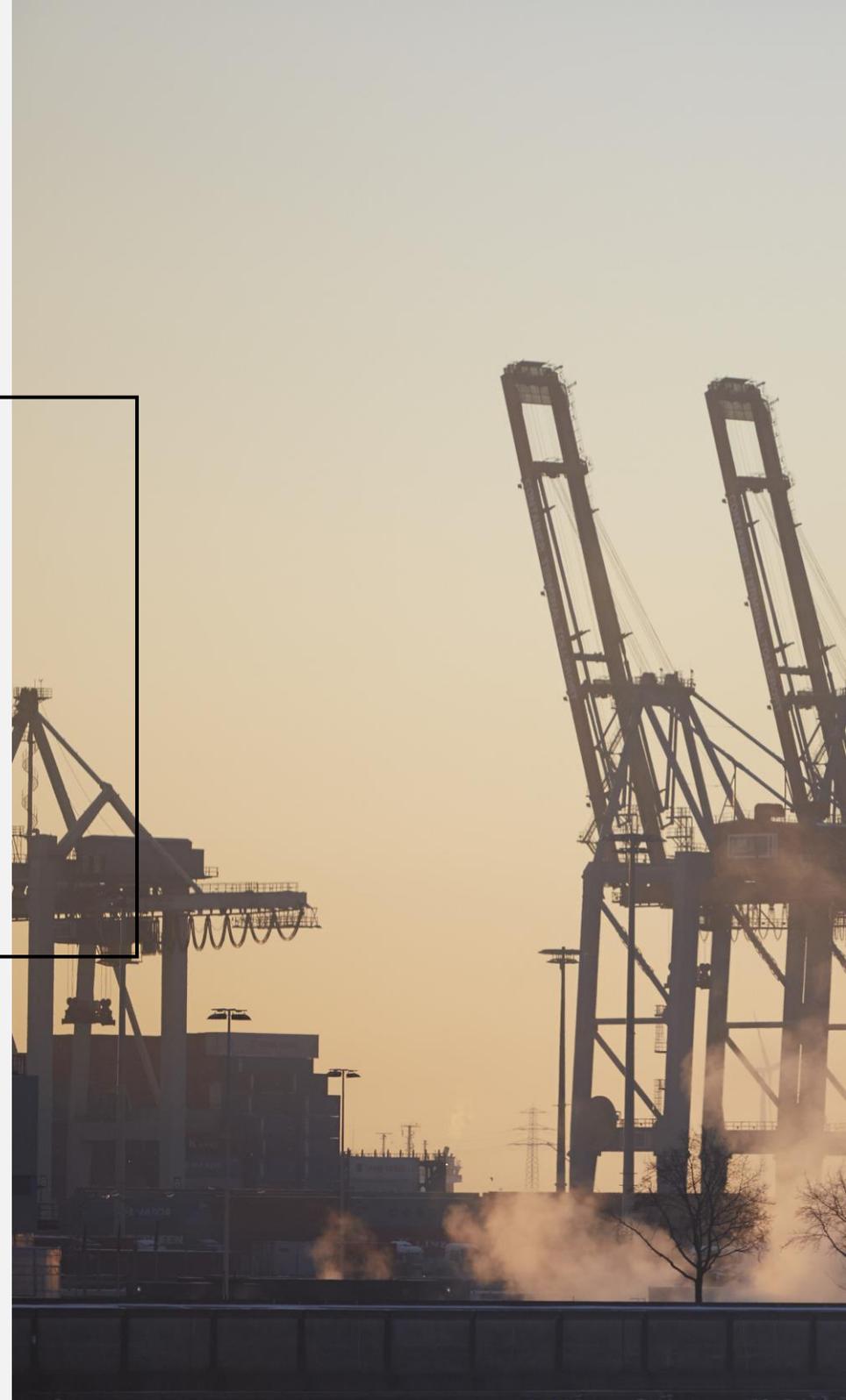
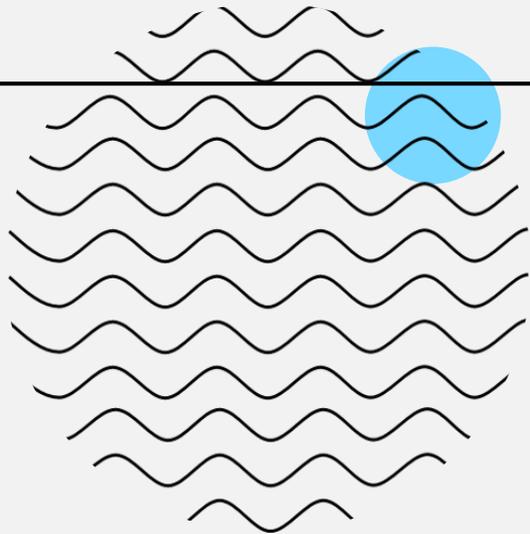
Changing role of the port authority, the final chapter explains how port authorities are either transforming their capabilities or taking up new roles to deal with the ever-changing environment described in the previous chapters.

Conclusions, this chapter summarises the key insights gained throughout the drafting of this document.

Structure of the report

	Content	Goal
Introduction	<ul style="list-style-type: none"> Background information and objectives of the report 	<ul style="list-style-type: none"> Introduce the report
The changing portscape	<ul style="list-style-type: none"> Description of “megatrends” and their impact on the port industry 	<ul style="list-style-type: none"> Provide insight into the forces driving change in the port industry
Port trends	<ul style="list-style-type: none"> More detailed description of main trends happening in the port industry and perspective of port authorities on these trends 	<ul style="list-style-type: none"> Describe the main trends and how they are understood by the port sector
Changing role of the port authority	<ul style="list-style-type: none"> Description of changing roles, mission and values, and capabilities for port authorities 	<ul style="list-style-type: none"> Understand how ports could respond to the trends
Conclusions	<ul style="list-style-type: none"> Closing and concluding comments 	<ul style="list-style-type: none"> Provide a conclusion to the report

Changing portscape



Changing portscape

The saying, “ports are more than piers” has been a longstanding common knowledge in the maritime and logistics industry. Whereas the prevailing vision of a port is one of large container cranes and mega vessels, the truth is far more diverse and complex. Within the EU there is a wide variety of ports, from ports focusing only on passenger- cruise and ferry vessels, to ports active in offshore and energy business, urban ports, island ports, logistic ports and large diversified ports, serving container markets, large chemical complexes, breakbulk- and project cargo, to smaller ports servicing either one or two segments or clients.

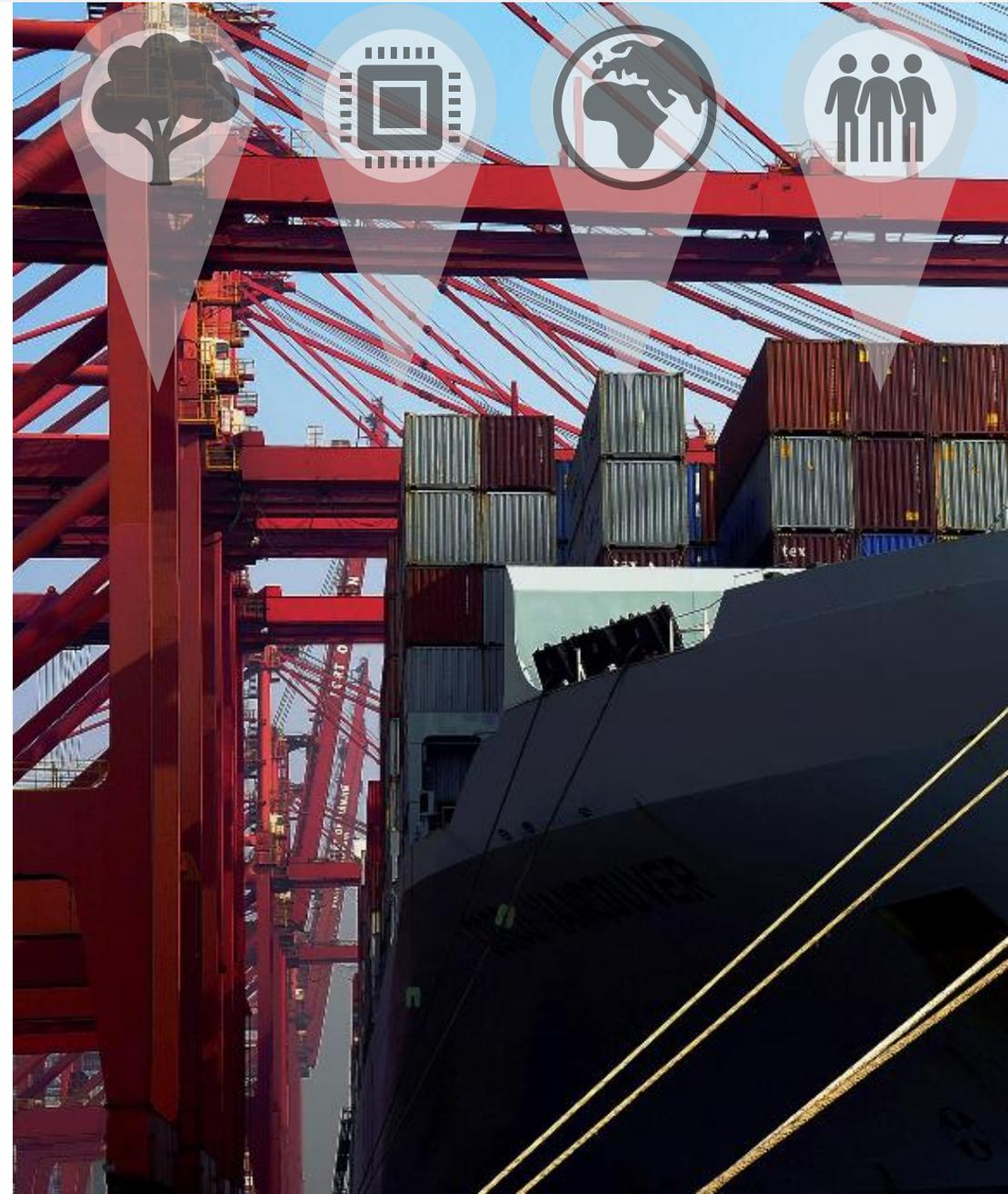
To add to this complexity, the port of today is not the port of tomorrow. Induced by sustainability, technological, geopolitical and demographic drivers, the European port sector is transforming and responding to several ongoing trends.

This report identifies four individual drivers, that are jointly influencing the outlook of the port industry towards 2030 and beyond. It will discuss how the

most important maritime trends follow from different drivers, and what these may entail for the future EU’s port industry.

During the workshops with port representatives, the following main drivers were identified:

1. **Environmental** where climate change impacts the ports at full force;
2. **Technological**, where new innovations allow port authorities to optimise their activities;
3. **Geopolitical**, with an ever increasingly complex environment in which European ports need to keep Europe trading;
4. **Demographic**, where the changing structure and size of human populations affects port growth.



Changing portscape



Environmental:

Ports evolving as climate change requires a green transition

The scale and severity of climate change on our daily lives is becoming increasingly clear. Climate change and the adaptation to it, is demanding a complete transformation of the economy. This impacts the maritime sector at large. First impacted is the shipping industry, but also the port industry, cargo types moved, and basic port infrastructure are affected.

Ports are on the frontline when it comes to experiencing operational challenges from the increased sea levels and extreme weather conditions. Therefore, ports are faced with increased infrastructure investments to counter this threat. More importantly, they are committed to enable a transformation of their own activities and the maritime and logistics sector at large. Ports mitigate, and adapt to, the effects of climate change in a proactive role, even going beyond regulatory requirements:

1. Sea level rise & extreme weather events put pressure on basic port infrastructure

Depending on how emissions evolve in the future, the global mean sea level is expected to rise in the next century between 0.29 and 2.4 meters. As a result, ports might need to adapt their infrastructure to the rising water levels. In addition, other more extreme weather events must be considered such as more frequent & severe storms, increased heat waves, etc.¹

2. Port industry clusters and hubs provide opportunities to enable the greening of the maritime and logistics sector

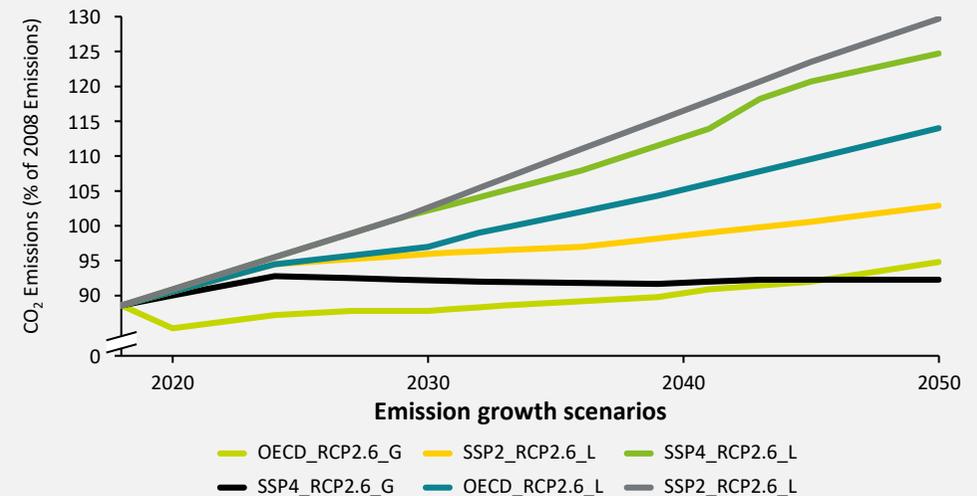
European ports are at the crossroads of supply chains and are clusters of energy, industry and blue economy. They can be a key strategic partner in achieving greening targets such as outlined in the Green Deal.

3. Green pressure on conventional port throughput

According to the ESPO Trends in EU Port Governance, 25% of European ports have more than 50% of their traffic linked to energy commodities. Conventional fuels moved through ports are impacted in three ways. First, the demand for combustibles used in energy generation is likely to shift away from ...



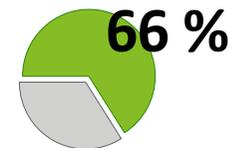
Maritime Shipping Emission projections 2018 – 2050*



Depending on the scenario followed, the share of maritime emissions (CO₂) as part of global emissions will either remain stable or grow with 40% by 2050

*The scenarios originate from a study in the Fourth IMO GHG study and are based on GDP and population projections from the so-called Shared Socio-Economic Pathways (SSPs) developed by the IPCC, as well as the OECD long-term baseline projection (OECD 2018). Source: Fourth IMO GHG Study 2020, Deloitte analysis

66 % of interviewed port authorities considered sustainability to be the nr 1 trend impacting their port.



Changing portscape



... fossil to renewables. Second, circular economy efforts can reduce waste volumes through waste reduction, reuse and recycling alongside sustainable waste management. Third, acceptance of new "green" fuels will shift bunkering of conventional fuels towards carbon neutral alternatives. Also policies like the Green Deal ambitions might affect underlying consumer behavior and consumption and thus the trade of certain commodities (e.g. less passenger cars, more bikes, more use of trains, etc.)

Possible impacts of environmental change on the European port industry

Not only new infrastructure will be required, but infrastructure that is already in place needs to be adapted and maintained in order to both mitigate and adapt to environmental change.

Increased investment needs in critical resilience and mitigation port infrastructure

Climate change is directly related to changes in the ports' basic infrastructure. For instance, rising sea water levels will change the accessibility of channels and increase the need for higher quay walls. Ports are the first hit when it comes to extreme weather events and thus the first defence for the coastal regions. Ports provide a safety buffer to the adjacent cities and regions.

Increased attention on the reduction of negative port externalities

"The greening of the port" means much more than greening the transport side. All industry players in the port should have their agendas, goals and plans aligned to maximise the impact of any greening initiative.

Port authorities have a pivotal role as facilitator and matchmaker. They can enable circular economies, support companies in making smart sustainable decisions and have the best visibility on where negative externalities can be reduced in the port ecosystem.

Monitoring and promoting greening through environmental management initiatives

EcoPorts is the main environmental initiative of the European port sector. It was initiated by a number of proactive ports in 1997 and has been fully integrated into the European Sea Ports Organisation (ESPO) since 2011. The overarching principle of EcoPorts is to raise awareness on environmental protection through cooperation and sharing of knowledge between ports and improve environmental management. The Ecoports Network is the flagship initiative of the European port sector developed by ports, for ports seeking to self-monitor their environmental management and improvement over time, and encouraging the free exchange of experience on environmental issues among its members. In this way, EcoPorts seeks to increase awareness about environmental challenges, deliver compliance with legislation and to demonstrate a high standard of environmental management amongst its 105 members from 25 countries.



The existence of port collaborative platforms on topics such as sustainability reporting shows that a significant number of port authorities believe that there is a strong added value in European wide reporting. When promoting these reports, it is important to realise that each port faces similar challenges but operates in a particular context– the added value of initiatives such as EcoPorts is that it addresses these specificities allowing for uniform quality but bottom-up flexibility.

Source: Source: ESPO 2020 Environmental Report, available at: www.ecoport.com/publications/environmental-report-2020

Climate change is considered the top 2 priority in the ESPO 2020 Environmental priorities

TOP 2

Changing portscape



New business opportunities in renewable energy (generation and facilitation)

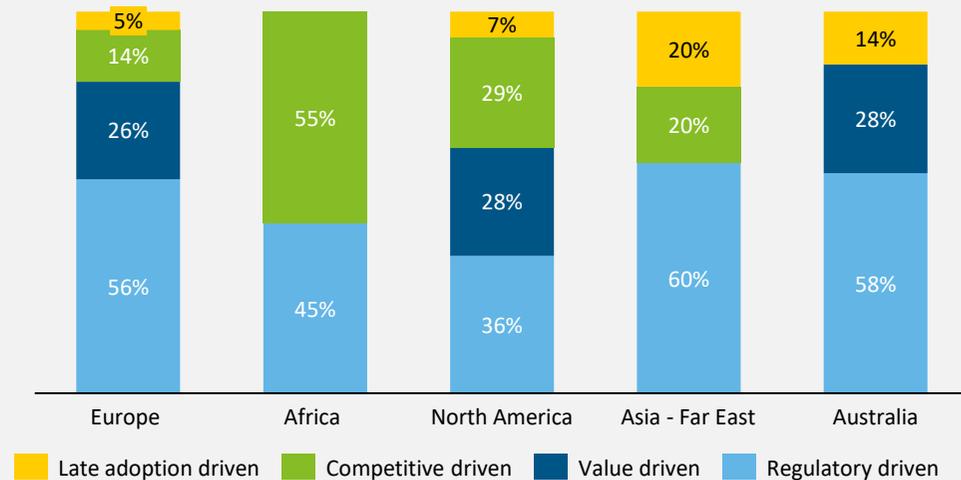
Whereas high volume fossil fuel cargos are traditionally the main source of income for certain ports (throughput dues, and rental and leasehold income), there is now a tendency to move away from fossil fuel due to the need for transition to a carbon neutral economy and a decarbonised shipping sector (with a key role for alternative fuels). This is both an opportunity and a threat. On the one hand **port authorities can benefit from taking a proactive stance in readying the cluster for new cargo types** through improving circular economy synergies, investing in new infrastructure (e.g. offshore energy), redeveloping existing port areas to support the space requirements for new types of cargo, etc. On the other hand, the traditional revenue model of high volume fossil fuels is under pressure.

In addition, generating and bunkering renewable energy will require new infrastructure. **Offshore generated energy often comes ashore in- or close to ports**, in particular in northern European ports. **This often requires novel or adapted infrastructure** such as import and export infrastructure of renewables (e.g. hydrogen), wind mills, electricity networks, etc.

Higher transparency through improved sustainability reporting

The ESPO Environmental report 2020 showed that transparency is considered important by ports, with 91% of ports communicating their environmental policy to stakeholders, and 86% of ports making it publicly available on their website³. This is mirrored by the success of the EcoPorts Network, which encourages exchanges of good practices between European ports, and promotes transparency and systematic reporting of environmental management indicators over time.

Drivers of sustainability reporting



Late adoption driven: similar practices that have been applied by successful actors within an industry. **Competitive driven:** following the drive to improve the level of operational efficiency. **Value driven:** internal values stemming from a uniformly trained pool of employees and consultants. **Regulatory driven:** resulting from formal and informal pressure from governments, or even from other stakeholders that influence an organisation, such as powerful customers.

Within the EU the majority of responding port authorities of the research by Geerts indicated that sustainability reporting was mostly regulatory driven, the amount of value driven initiatives are in line with the results of other developed regions like North America and Australia. Sustainability reporting is on the contrary not present in more developing/emerging countries/regions such as Africa and Asia. This shows that economic growth is taking the forefront in these ports, where sustainability is still a question of availability of resources.

If European ports wish to promote sustainability reporting as a general standard in sustainability thinking, it is important that reporting is focused on enabling sustainability and improved environmental management rather than compliance with regulation or environmental certification bodies. Since ports are already proactive and involved in bottom-up initiatives, there is the need for a flexible, ambitious, and goal-based regulatory framework. This allows for a tailor-made approach per port ecosystem, potentially improving both the sustainability (reporting) of the cluster and of the port authority itself.

Source: Adaption of the implementation of sustainability strategies in ports, Geerts 2020 - 'REGION' and institutional pressures

Changing portscape



Technological innovation: Kilotonnes to kilobits



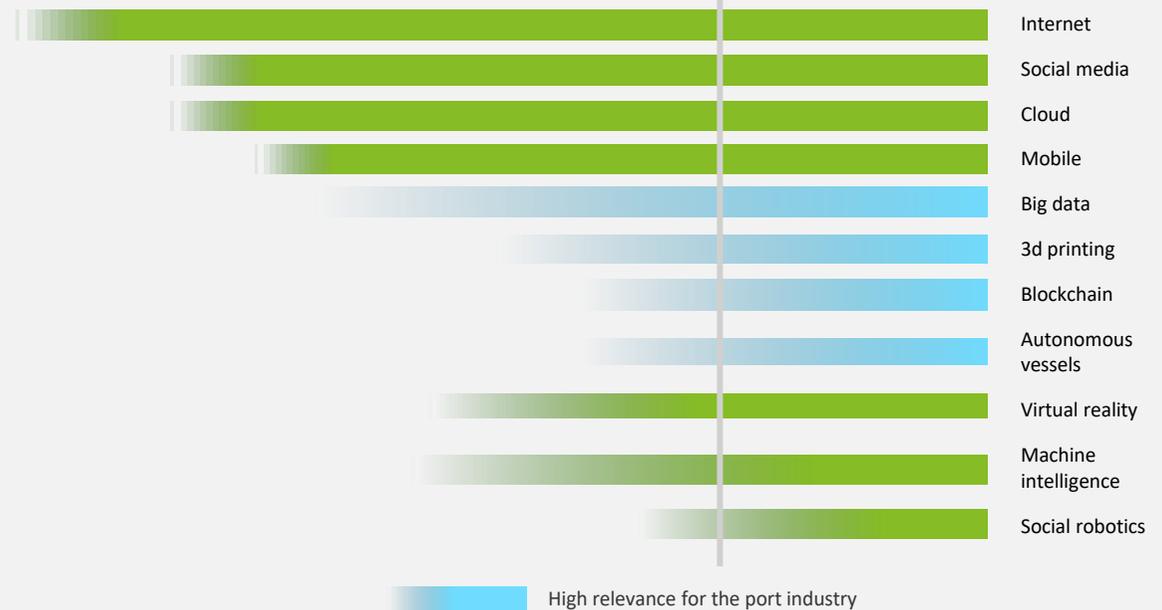
Technological innovations have always allowed for faster and more efficient global transport. Containerisation is one of the prime examples of such a technological development which transformed the maritime and logistics industry over a relatively short timespan.

The maritime and logistics industry is sometimes considered a traditional industry, more reactive than proactive, mostly due to the long asset cycles involved in shipping and port infrastructure. Over the past decade there has been a shift, mostly driven by collaborations between port authorities and technology providers, towards a more innovative portscape.

The different solutions listed in the figure on this page showcase some disruptive technologies that affect(ed) global businesses over the past few years. Some of these technologies are commonplace in major ports today (e.g. IoT-5g networks, big data platforms, trade blockchain solutions, etc.) and others are expected to influence the day-to-day operations of the port industry in the (near) future (e.g. autonomous vessels).

Maturity of innovative solutions

1995 2000 2005 2010 2015 2020 2025 2030



Disruption stemming from the technological driver is nothing new. The internet has been transforming the way the world works since the early 90s. Even though the maritime and logistics industry is by its nature quite traditional, going forward, it is to be expected that the way of working for the entire port will be affected by rising usage of novel technologies.

Not only the port activities will be disrupted but also the way of working for port authorities themselves. Examples include artificial intelligence for better port planning, digital twins for port scenario impact mapping, better control due to more automated back office software, etc.

Source: Deloitte Industry 4.0

Changing portscape



Impacts of technological change on the European port industry:

Higher efficiency in usage of infrastructure

Increased transparency in both trade flows and operations will allow public and private organisations more qualitative insights in asset utilisation and resource distribution. On the other hand, digital infrastructure needs to be replaced faster (every three to five years) compared to traditional infrastructure (20 – 25 years) generating a pressure on investment costs.

Higher transparency towards users and stakeholders

Better communication channels and increased data gathering & dissemination allow for more transparent communication of positive and negative externalities of port activities.

Better control of health and safety

Technologies like IoT networks and remote & automated operations allow for a higher efficiency of port operations and safety in the port area. Both through better information on the whereabouts of all moving parts (IoT track and trace) and more remote working possibilities, this reduces the risk of accidents and now with COVID-19 the risk of infection transmission.

Changing staff characteristics

In a study done by ITMMA, where maritime leaders were asked how their staff characteristics would be affected by digitisation, circa 80% indicated that new profiles are required today and in the short-term⁴. This generates a potential synergy between port and city, since a city has a pool of highly educated inhabitants.

Increased pressure through rising E-commerce

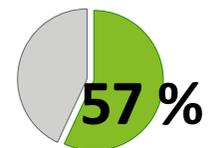
The E-commerce model changes how physical goods flow, as consumers can easily purchase foreign products online. These E-commerce flows with high value goods are, more time sensitive than most container flows, putting extra stress on the just-in-time cargo flows.

Impact of technology on ports and port trade

		Impact on trade flows				
		Impact on Ports	Primary resources	Manufactured goods	Services	Data
Digital platforms	E-commerce	++	-	▲	▲	▲
	Port community systems	+++	▲	▲	▲	▲
	IoT platforms	++	▲	▲	▲	▲
Logistics tech	Smart materials	+	▲	▲	-	-
	Autonomous vehicles	++	▲	▲	-	-
	Blockchain	++	-	-	▲	▲
	Cloud	++	-	-	▲	▲
Production alteration	3d printing	+++	-	▼	▲	▲
	Automated operations	+++	-	▲	-	-
	Virtual assistants	-	-	-	▼	▼
	Back office automation	+	-	-	▲	▲
New products	Renewable energy	+++	▼	-	-	-
	Electric vehicles	+	▼	▼	-	-

Source: Deloitte interviews and workshops

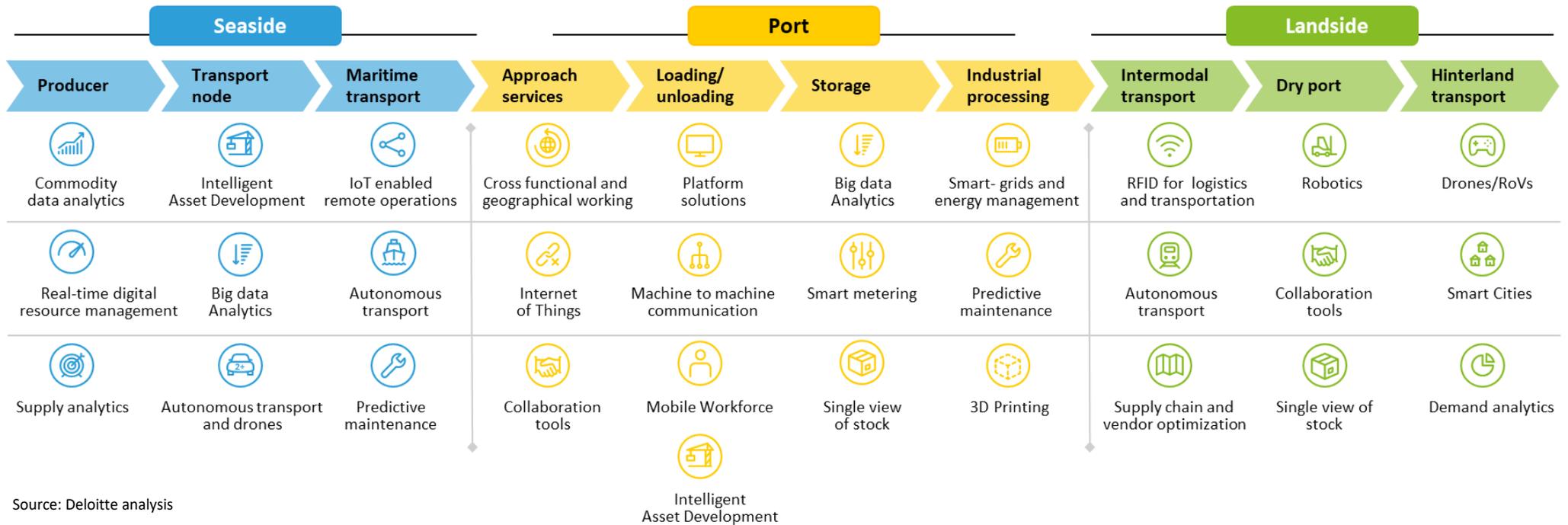
57 % of interviewed ports considered technological innovation to be the **number 1 or number 2 trend** impacting their port



Changing portscape



Technological innovations in and around the port ecosystem



Source: Deloitte analysis

Example: Wartsila Intelitug

In close cooperation with regulators, PSA and Wartsila created the Intelitug, a tugboat retrofitted to enable autonomous navigation.



Example: DCSA – port call optimisation*

DCSA, the Digital Container Shipping Association, is currently developing standards and a platform to optimise just-in-time port calls of vessels.



Example: Maersk IBM – tradelens

TradeLens is a platform aimed at maritime companies based on blockchain technology. The platform is open and industry-neutral, and aims to make global trade more efficient and safer.



*See glossary

Changing portscape



Geopolitical: Increasingly complex environment



In the last decades, the deepening of European integration, economic globalisation and increased openness of markets worldwide has benefitted the European port sector greatly, with international trade both within the EU as well as between the EU and the world growing. However, in the last years this beneficial environment for trade is being challenged by geopolitical developments, protectionism and some major EU trading partners not willing to play according to the same free trade and market principles. A challenging situation for ports, as openness to international trade is of paramount importance for the competitiveness and growth of European ports.

The European port industry is affected by this geopolitical uncertainty on three levels:

Level 1 – Physical proximity to geopolitical hotspots

Even though most of the European ports are in a relatively stable and safe environment, certain border conflicts are heating up at the fringes of the European Union. Crises that can be named in this regard are the ones in Afghanistan, Libya, Syria, Yemen and other areas in Africa. Closer to home, tensions arise around offshore natural gas reserves in the eastern Mediterranean, Turkey becoming more active in the Balkans, a harder stance against Russia emanating from the Baltics, etc.

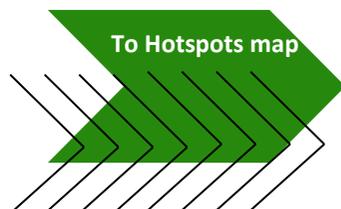
Level 2 – Affected underlying cargo streams through trade barriers

Trade barriers are a political weapon. Globally 56 new trade-restrictive measures, not related to COVID-19⁵, were implemented between mid-October 2019 and mid May 2020. The measures are mainly tariff increases, import bans, export duties and stricter export customs procedures. The WTO estimates that the cumulative trade coverage of import-restrictive measures implemented since 2009, and still in force today, amounts to 8,7 % of world imports. This trend has grown steadily since 2009 and the increase in protectionism has led to a notable decline in global trade growth.⁶

Level 3 – Affected investment schemes and geopolitical strategies

In order to guarantee the optimal functioning of European ports, an open investment environment is of the utmost importance. Over the last decades ports in the EU have benefitted from (substantial) investment from outside the European Union, both directly into assets and in some cases into significant equity stakes in port owners.

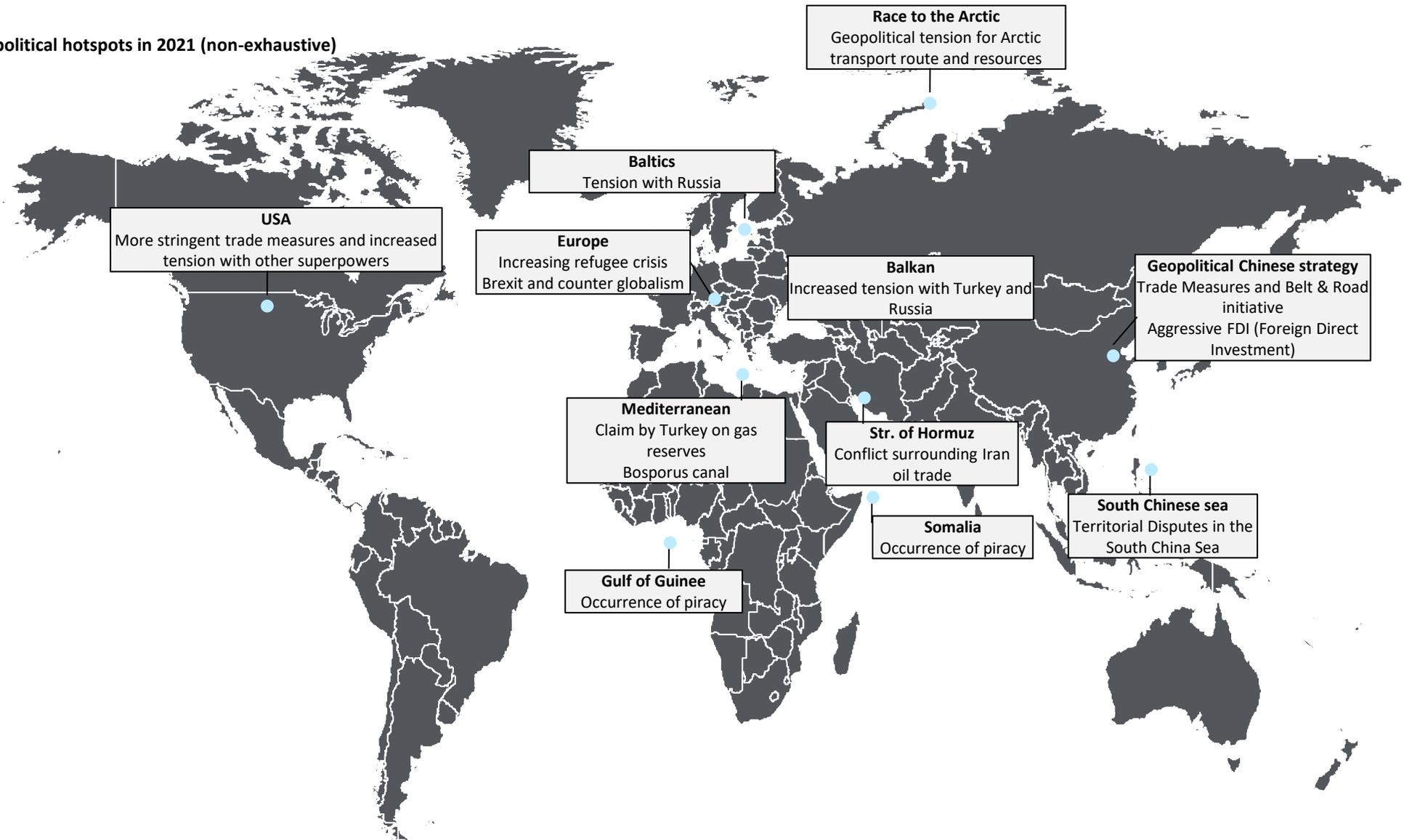
Ports are classified as critical infrastructure by the European Commission. Under the current circumstances, supply chains and strategic assets might risk becoming vulnerable targets of investors, be it state agencies or large private investment funds. If this were to happen, the very production and delivery of essential goods within the EU Member States and within the EU borders could be put at risk.



Changing portscape



Geopolitical hotspots in 2021 (non-exhaustive)



Changing portscape



Where ports can play an active role in mitigating climate change or stimulating innovation, they cannot influence the geopolitical environment. Within the geopolitical context, ports have an important function: to safeguard strategic resources and to keep the EU trading. In addition to the impacts of the developments mentioned on the previous page, three sub drivers are worth discussing in greater detail:

1. Rise in the East

The two major superpowers to the east of the EU (China and Russia) have different strategies when it comes to influencing the European port industry. Where Russia is more protective of its own trade flows and tends to favour Russian ports for cargo movements, China uses large scale FDI. Despite China's admission to the World Trade Organisation in 2001, it has become more assertive in terms of trade practices and military show of force. The European Commission states that China should still be considered a strategic partner, but a systematic rival as well.⁷

The expanded influence of China in the EU is expected to play a larger role in the future. One of the main instruments in this is the Belt and Road Initiative (BRI), of which country membership is increasing. The BRI offers potential trade gains for the EU by improving physical connectivity with countries along the route to China, but it also poses potential challenges for the EU, mainly due to loss of control over strategic assets and skewed investments between certain European regions.

2. Race for resources and routes in the North and South

In the 19th century, Europe's great powers carved up the

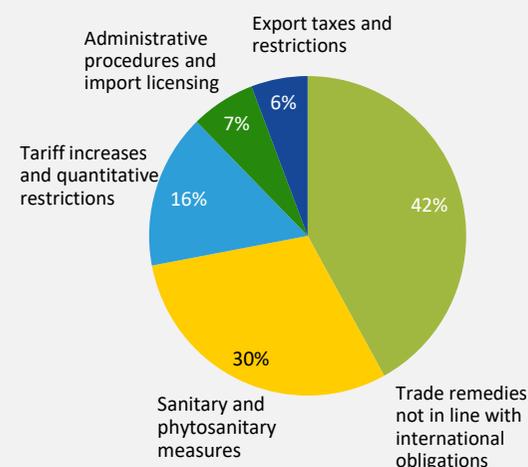
global map according to age-old rules of sovereignty: the first person to plant the flag controlled the resources⁸. This tendency is today still visible in two particular cases. First the Arctic. As polar ice melts, the world's biggest players (Russia, US, China, etc.) are eyeing the region as a new "no man's land".

Forecasts suggest the Arctic Ocean will be ice-free during the summer as early as 2040. Two new shipping routes, the Northern Sea Route, which runs along Russia's north coast, and the North-West Passage, which threads through Canada's northern islands, are already under development and will most likely reshuffle the European port market.

In addition to trade routes 13% of the world's undiscovered oil, 30% of its undiscovered gas and an abundance of uranium, rare earth minerals, and fish stocks are located in the Arctic. The second region where resources are exceptionally abundant is Africa, especially the Sub-Saharan region remains one of the fastest growing regions in the world. Nations are competing with different models to gain access to these resources.

Both the North and South regions surrounding the EU are under a lot of pressure. The established powers in the European port market could very well be impacted given new developments in these regions.

Total trade-restrictive border measures against the EU registered in 2019



On a European level, 438 active trade and investment barriers in 58 third countries were present in 2019. This indicates that protectionism is becoming structurally ingrained in EU's trade relations with many partners. In 2019, for the first time, border measures (52%) took up the largest share, followed by behind-the-border measures (43%). From the newly added trade measures in 2019, 65% consisted of border measures.

Source: European Commission, Report on trade and investment barriers, 2020

Changing portscape



3. Deglobalisation and its effect on trade

Economic globalisation is at a crossroads. In the last decade, trade and financial integration advanced much less than before the 2007-2009 global financial and economic crisis⁹. A notable sign of deglobalisation is the decline in the global trade to global GDP ratio since 2010. Within the EU there is a mixed vision on this, where trade (taking into account both intra-EU and extra-EU trade) as a share of GDP was higher in 2019 than it was in 2008, suggesting that the EU has defied trade deglobalisation tendencies.

Calculations based on bilateral trade data show that intra-EU trade/GDP continued to grow, while extra-EU trade as a share of GDP fell from 2012 to 2016 but increased afterwards.¹⁰ Therefore, the fall from 2012 to 2016 in the global trade/GDP ratio originates from developments in non-EU countries.

Looking forward, the EU continues to have pressing social problems (e.g. unemployment tensions, migration pressure, etc.), concentrated in some member countries with weaker economic outlooks. With global and European economic growth slowing and the risk of a European recession increasing, deglobalisation tendencies could arise again. In addition, developments like Brexit might result in a new era of protectionism and decreased intra-European trade.

Brexit and UK style Freeports* – attracting FDI to the UK

The UK has recently announced the statement that several (eight) of its ports will be labelled as Freeports, an area that is exempt from customs duties and tariffs to enable added value processes to take place. Supporters say Freeports can help increase manufacturing and encouraging jobs and investment in areas that would otherwise struggle to attract them.

Assuming a stable market, they do not boost employment or trade growth overall, they just move economic activity from one place to another – a zero sum game, potentially from the EU to the UK mainland. The largest risk for the European port sector is the possibility for displacement of existing businesses. As was clear with Brexit, certain port related industries (head offices of maritime firms, water bound production plants,...) are rather footloose. Tax benefits such as Freeports might disbalance the location factors of these industries and cause an exodus from European ports.



Source: BBC: Freeports: What are they and where will they be, 2021; * This section only deals with freeport status in the UK since it is a direct policy aimed at the improvement of the port market outside Europe. Other ports exist within Europe with a variety of freeport statuses but these do not bring the risk to skew competition within the European portscape

Official UK figures in March '21 showed the UK recorded a record fall in trade with the EU in January, as the economy struggled with post-Brexit rules and the pandemic. Goods **exports plunged by 41%** and **imports by 29%** as the UK's departure from the EU's single market had a major impact¹¹

Changing portscape



Impacts of geopolitical change on the European port industry:

Focus on FDI control mechanisms

Due to the increased strategic importance of ports as critical infrastructure, more emphasis by Member States is put on screening new FDI in the EU. Because of the geopolitical situation and their location, some European ports are, or can become at some point, an essential part of an emergency supply chain. It is of high importance that frameworks and regulations implemented do not jeopardise, either through action or perception, the ongoing inward investment that has benefitted the European Ports sector.

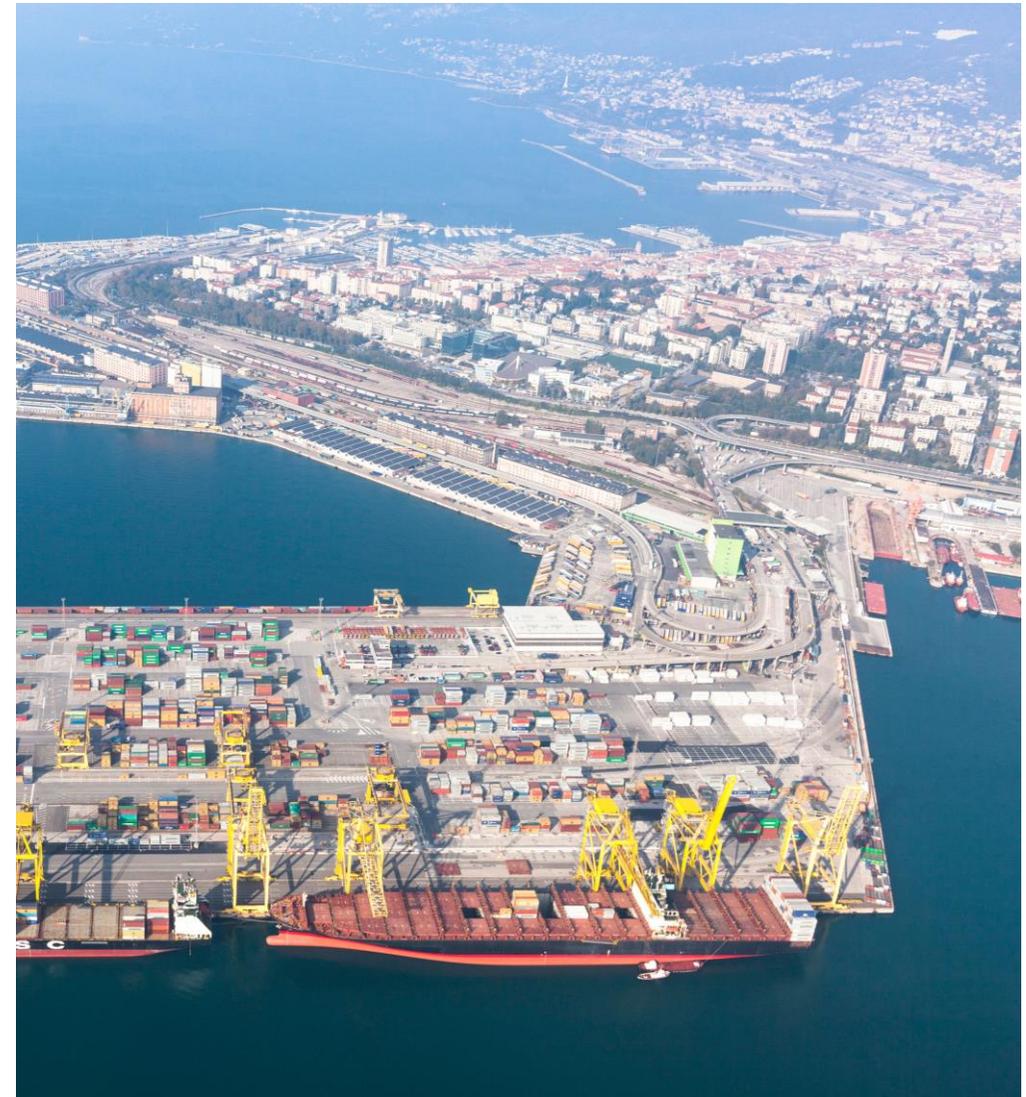
This results in a difficult balance between being open for FDI and losing control. There is a risk of becoming a “puppet” to the investing party through mechanism such as debt traps, especially when it is a state-owned enterprise.

Higher uncertainty in cargo flow continuation

Recent crises like the COVID-19 pandemic and the Suez blockage have shown that global supply chains are still vulnerable to disruption. Even though ports are important buffers and ensure that in case of disruption, trade continues as smoothly as possible, the overall increasing uncertainty is putting pressure on the continuous supply of goods and passengers through European ports. This translates into increased uncertainty in planning and utilisation of long-term port infrastructure. Traditional masterplans are lacking in flexibility when it comes to dealing with short-term peaks and drops in port throughput, making long-term asset & infrastructure planning an increasingly complex matter.

Higher international competition (e.g. UK Freeports)

The port industry at the fringe of the European union is becoming more competitive. In addition to investments in infrastructure and capacity, certain countries are implementing favourable planning and fiscal ease for new port activity (e.g. Freeports in the UK). These developments could put pressure on both new investments coming to –and on cargo being transhipped through – European ports by displacing them to non-European locations.



Changing portscape



Demographics: Ports, it's a population story



The rise and fall of major maritime centres has been historically linked to population growth (growing demand), population distribution (demand concentration) and imbalance (shifting demand and supply costs).

The expansion of port capacity within the EU was, until today, largely a result of growing demand in cargo and passenger transport needs, be it for throughput, production or storage. This changed over time when the main driver became more about imbalance, with cheap labour shifting the production centre of the world to the East and starting the major East-West trade flows. For the European port industry, the status quo is slowly but surely changing for the following reasons:

1. Population growth is taking place in new regions

Economic growth stemming from population growth will come mostly from other parts of the world. The major population growth engine is expected to be Africa, followed by several countries in the Middle East. The overall population growth is only part of the picture, the expected workforce (and subsequent purchasing power) is the main driver of cargo movement for European port industry. Given the strong growth and rising population spending power, following regions are expected to be in prime position to be the new factories of the world: Vietnam, Myanmar, Bangladesh, Indonesia, India, Kenya, and Mexico (see page 22).

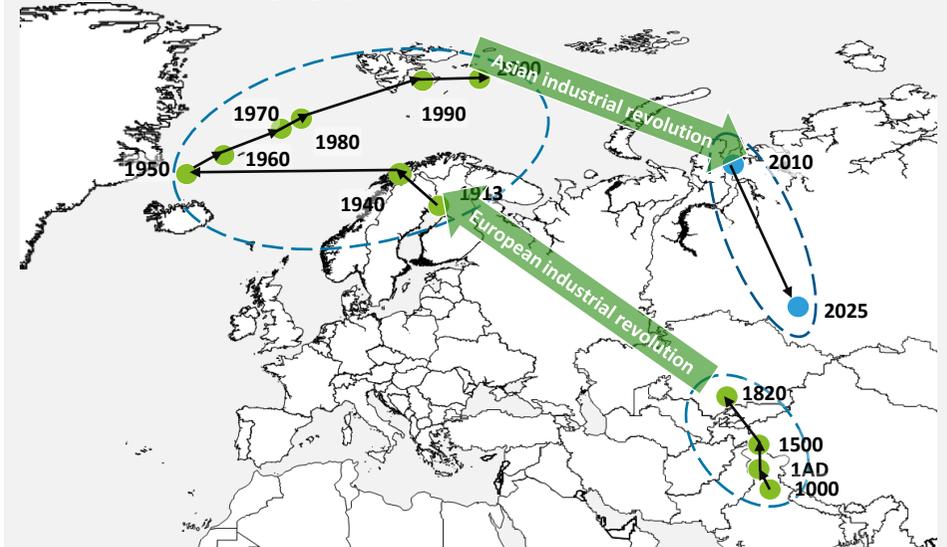
2. Population income is shifting

Counter to popular perceptions, today only 18% of goods trade is based on labour-cost arbitrage. In other words, over 80% of today's global goods trade is not from a low-wage country to a high-wage country. **This is having a spin off effect on large global trade flows versus intraregional flows, where the latter has increased by 2.7 percentage points since 2013¹².**

3. Urbanisation is increasing

Even though COVID-19 has shown the associated vulnerabilities of urbanisation, the major consensus remains that global urbanisation will continue. **By 2030, two-thirds of the global population will live in cities.** The EU's level of urbanisation is expected to increase to 83.7% in 2050.¹² Furthermore, worldwide about 60% of cities have seen an increase in land consumed per new resident.¹³

Evolution of centre of geographical trade



European portscape today, is for a large part the result of China being the factory of the world and the EU being the transshipment hub for Southbound flows. There is a slow shift visible towards more (re-shored) production within the EU, mainly due to shifting demographic (and technological) trends.

Source: Angus Maddison; University of Groningen; Economic centre is calculated by weighting locations by GDP

Changing portscape



The demographic driver is creating a challenging environment for the European port sector. Over the next ten years a strong growth in port volumes coming from pure demographic growth should not be expected in the EU.

Impacts of demographic change on the European port industry:

Growth will increasingly come from different geographical areas

If local growth in the EU is lagging, expected (income) growth in developing economies such as in Africa (e.g. Kenya, Nigeria, Ghana), can be leveraged to keep volumes steady. If not, given the space scarcity, it is to be expected that the more urban ports will be faced with increased pressure from their respective metropolitan areas. This in turn might cause an increased wave in waterfront redevelopment for mixed urban use, more on these effects in the following chapters.

Urban nodes

Ports and their adjacent metropolitan area are interdependent. When the urban area desires to transform, it is (partly) dependent on the port, for instance for production of renewable energy and the application of digitisation initiatives. The port on the other hand, also benefits from the city, for instance from its commercial market & related warehousing demand and the presence of node facilities such as airports, rail which enhances its multimodal connectivity. Quite often, the urban area and port require more and more space, putting increased pressure on this well balanced relationship.

Value to the community will have to come from new sources

Added value for the community has traditionally been created through growing cargo volumes, the employment and economic growth related to it. Whilst this is still the main added value of ports, with the rise of sustainability perception in surrounding communities, more emphasis is put on responsible sourcing and recycling, changing the size and type of cargo volumes. It is expected that ports will search for new ways to stay relevant for the surrounding community, for example through becoming the driver for innovation or sustainability. Ferry transport is a prime example, in the European ambition for greener transport, ferry plays an important role by being a crucial link in modal flows & corridors, and by reducing the need for more pollution transport modes like flights over short distances.

Changes in trade intensity as share of gross output

		2000-2007 (%)	2007-2017 (%)
Global innovations	Chemicals	7,8	-5,5
	Transport equipment	11,0	-6,2
Labour intensive	Furniture and other manufacturing	7,3	-0,8
	Textile and apparel	8,2	-10,3
Regional processing	Paper and printing	3,7	0,3
	Glass, cement, ceramics	2,2	-3,1
Resource intensive	Agriculture	0,6	-0,7
	Basic metals	5,1	-6,2
Labour intensive	Wholesale and retail trade	3,5	2,4
	Transport and storage	1,7	-2,5
Knowledge intensive	IT services	5,6	4,9
	Professional services	2,3	0,1

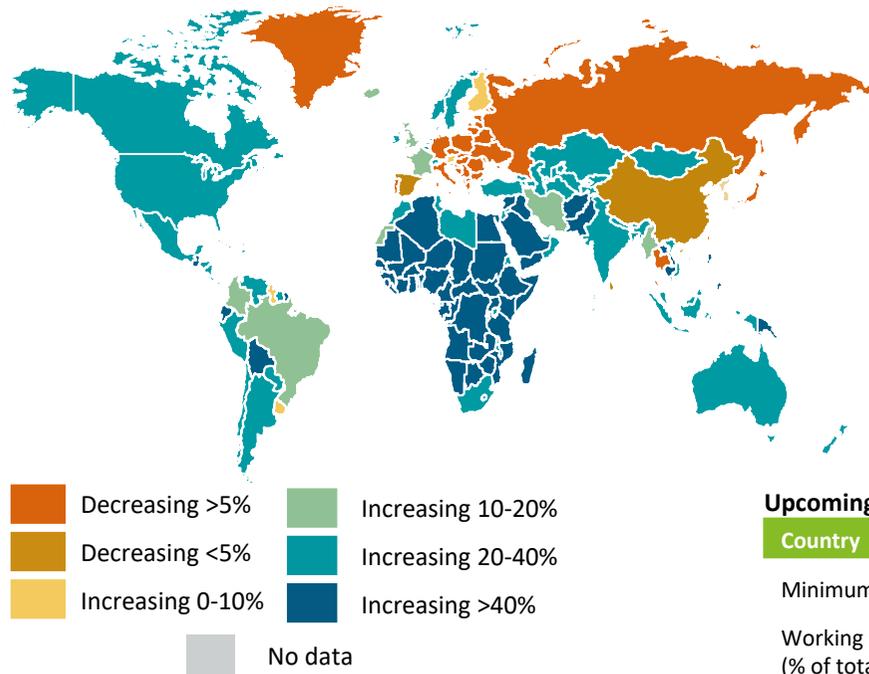
Trade intensity (the ratio of gross exports to gross output) in almost all goods-producing value chains has fallen between 2007 and 2017. Trade is still growing in absolute terms, but the share of output moving across the world's borders has fallen from 28.1% in 2007 to 22.5% in 2017.

Source: World input output table 2017

Changing portscape



Expected population growth till 2050^a



With regards to where the hubs of mass-consumption will be located over the next decades experts are inconclusive. Some say mega-cities will still drive consumption, resulting in hotspots across the globe. Others indicate growing population as shown in the figure above and yet others look at income per capita which places the US, Australia, Germany, South Korea and Canada as frontrunners in 2050^c.

a) UN Population growth, 2020 ; b) DMCC: future of trade, 2020; c)PWC 2019

When trying to assess where future world trade hubs will be, demographics offer a strong foothold, but it is not the only parameter. As mentioned, population growth is only one aspect of the equation. Others are lower costs of transportation, the growing speed of communications, growing purchasing power, shift of low-wage economies, political parameters such as protectionism, etc.¹⁵

In the past two decades, China has established itself as a leading global manufacturing hub, based not only on its low labour costs, but also on increasing quality of production. As China shifts towards more advanced manufacturing, around 100 million labour intensive manufacturing jobs could move to other low-cost countries.

The table below gives an indication of which countries could be the future manufacturing hub of the world. It remains to be seen if these countries can create the optimal circumstances to become the new true manufacturing centre of the world – or if other deglobalisation factors (like re- and near-shoring) bring a long-term structural change in our global trade patterns.

Upcoming manufacturing countries^b

Country	Vietnam	Myanmar	Bangladesh	Indonesia	India	Kenya	Mexico
Minimum monthly wage	165	80	65	100	110	160	280
Working age population (% of total)	70%	67%	55%	67%	66%	56%	66%
FDI inward	12,6	2,2	2,3	2,6	44,4	0,4	26,7
Average real GDP growth	6,2%	7,2%	6,7%	5,1%	7,2%	5,5%	2,5%
Logistics performance index	64	113	87	63	35	42	54
Manufacturing as of GDP	16%	23%	18%	21%	17%	10%	19%
Ease of doing business	68%	171%	177%	72%	100%	80%	49%
Effective Corporate tax	20%	25%	25%	25%	35%	30%	30%
Regulatory quality score	35,1	18,8	22,1	50	41,3	41,8	64,6

Changing portscape

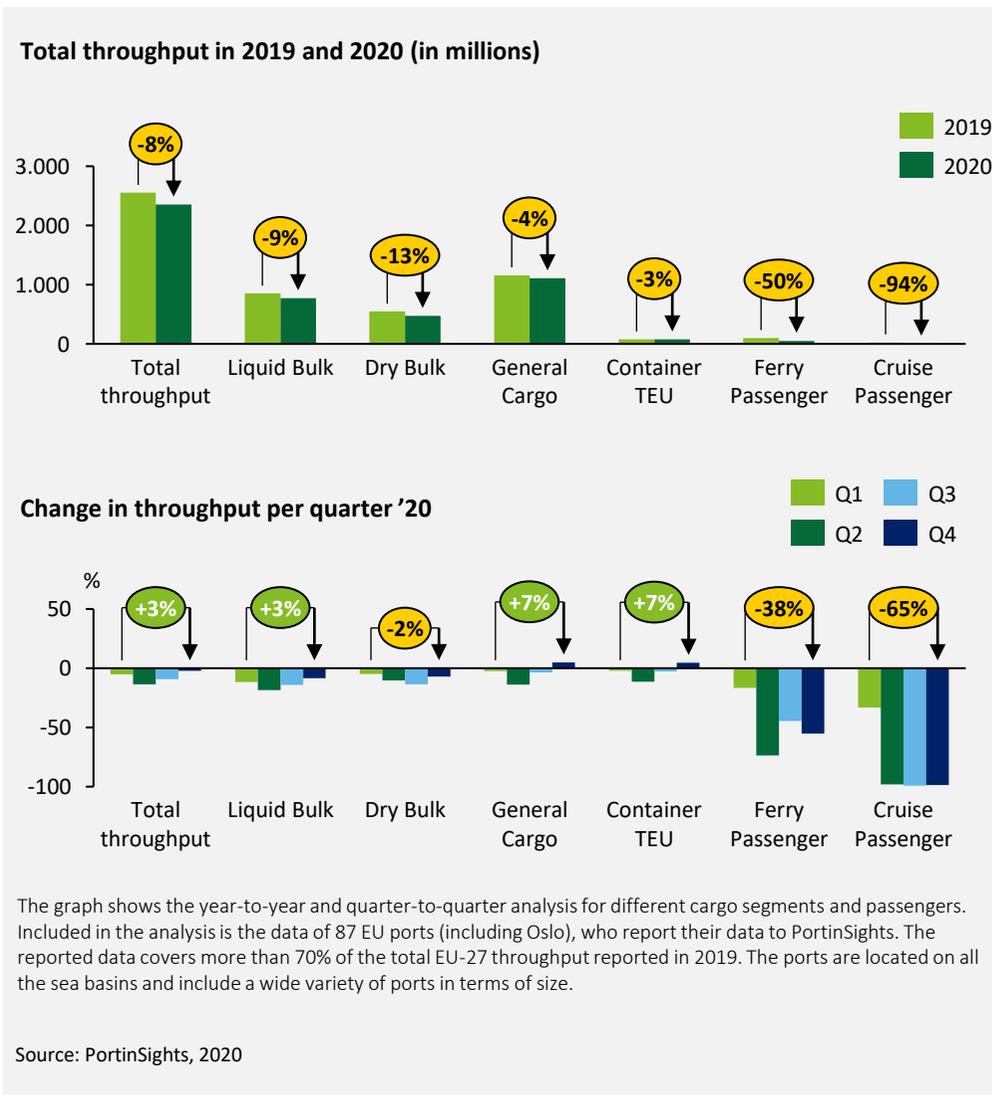
Note on COVID-19

This report was developed in the middle of the COVID-19 pandemic – one of the largest disruptions in the history of modern trade. Even though the situation is improving, effects of the virus are still felt around the globe. The maritime and logistics industry had to respond to a very challenging business environment. In a sector that is already strained with increased uncertainty, the extended closure of manufacturing plants and the disruption of transport networks severely impacted the continuity of maritime transport. COVID-19 directly impacted the supply chains and ports around the world. It became increasingly important to develop more resilient and shorter supply chains, which can react better to future disruptions.

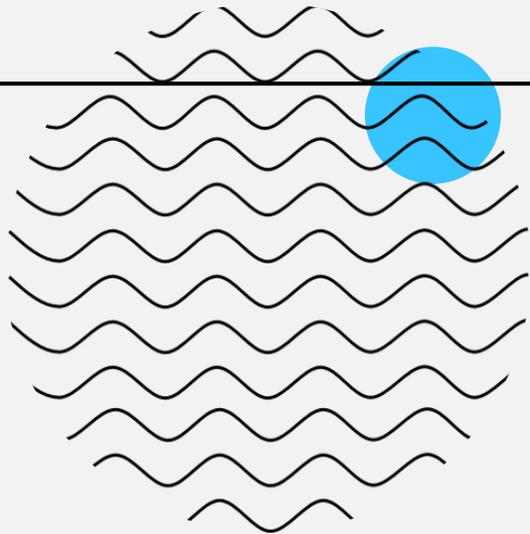
As can be seen from the figure to the right, port throughput was down across the board in Europe in 2020. The bounce back of traffic can be seen in the quarterly throughput figures with general cargo and container traffic increasing again towards the end of 2020. This shows that ports are being used again as strategic stockpiles and buffers to offset any congested supply chains that arose due to the short-term imbalance in supply and demand.

Increased use of technology and increased collaboration is moving to the forefront as dependencies on large labour forces operating in close proximity are reduced. This fits into larger strategies that will focus increasingly on diversification of cargo and services for increased resilience (both physical and digital through cyber security), emphasising spatial use strategies and niche markets.

Where the European port industry was indispensable to offer a strategic stockpile when supply chains were disrupted, today they act as strategic buffers to provide necessary slack in cases where global supply chains are less aligned. In addition they play a crucial rule in the delivery and storage of medical supply chains.



Resulting trends in the port industry





Resulting trends in the port industry

In the previous chapter the changing market environment for the European port industry was introduced through four distinct drivers. For each of the drivers, certain high-level impacts on the wider European port industry were outlined. This chapter goes into more detail, covering the impacts of these drivers and looks at ways in which the port ecosystem is evolving due to the changing market environment.

Workshops with selected port authorities were used to gather insights in the actual changes occurring in European ports. Each of the main drivers was discussed and subsequent trends, challenges and opportunities were identified. It was concluded during the workshops, that the drivers led to four main groups of trends:

1. Increased focus on sustainability

Resulting from the demographics and sustainability driver, and the increased attention on reduction of negative port externalities, ports authorities are taking a more proactive stance on the facilitation of green initiatives;

2. Increased focus on innovation

Resulting from the technological and demographics driver, ports are becoming ecosystems of innovation and are driving transparency and technological (r)evolution in the maritime and logistics industry;

3. Increased community awareness of ports

Resulting from the demographics, sustainability and technology driver, ports are increasingly aware of the challenges and opportunities generated by the wider stakeholder network and the need for close community engagement; and

4. Shifting trade developments

As a result of all drivers, ports are faced with several trade developments, changing cargo streams and the potential competitive position of the European port industry.

Overview of trend categories and underlying trends

Increased focus on sustainability

- Greener transport
- Greener energy in ports
- Greener port industry
- Increased focus on sustainability
- Green recovery from COVID-19

Shifting trade developments

- Alternative trade routes
- Near-shoring and TEN-T
- Supply chain integration
- Security and migration
- E-commerce

Increased focus on innovation

- Efficiency through port community systems
- Automation of port infrastructure
- Improving environmental performance
- Improving safety and security

Increased community awareness of ports

- Limited visibility and awareness to port generated benefits
- Port-city integration

Resulting trends in the port industry

Increased focus on sustainability

An increased demand for sustainability is a direct result of demographic and environmental drivers, and to a certain extent also of the technological driver. Port (authorities) have known for a long time that part of their license to grow and to operate lies with involving local communities and improved sustainability in port operations. Greening the port ecosystem is therefore an important pillar in many port authority strategies.

Ports and port authorities are at the core of the transition of the transport sector and the EU economy towards a new decarbonised normal. The hub function is a blessing and a curse: a lot of emissions come together in port ecosystems– but since hub ports are often relatively big, this also generates the largest financial opportunities to tackle these emissions.

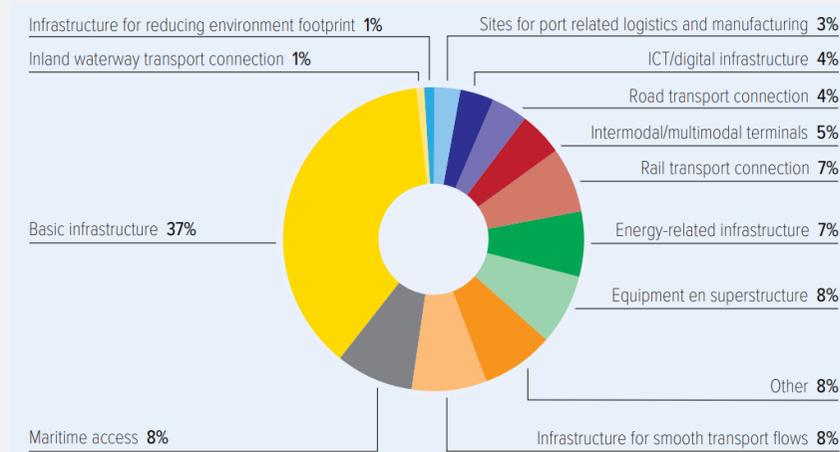
Since a lot of activities converge in the port, sustainable solutions or solutions to increase sustainability are ample. Today there are numerous initiatives in ports aimed at greening transport, generating and transporting renewable energy and greening (port) industry.

Ports are the location where innovation, greener transport, circularity, economies of scale, scope and skill join up, making them well placed to truly push for impactful green solutions. In addition, greening can be part of their core license to grow and operate, depending on the type of port and activities, as many European ports are near cities. Ports act as an (on- and offshore) energy generator and engine for the city, making sure sufficient energy is available for the wider metropolitan area. Due to the nature of the activity of ports, there are ample opportunities to promote green solutions for the city, circular economies, “green” city heating, green urban mobility services, etc.

The mandate of the (European) port authority on greening

When discussing trends and developments in the European portscape, it is important to take a moment to discuss the traditional role of ports as landlords (owning and managing the area and leasing it out to operators). The (future) role of port authorities is discussed at length in the next chapter, but some basic notions are important to understand developments in the port industry, especially regarding sustainability actions.

Most European ports operate under a landlord structure, meaning they have a small regulatory role, a (very) small operational role, a large community building/facilitating role, and a large landlord role (although these roles might vary across ports). They are not directly responsible for greening industrial activities, but are as frontrunners leading by example and greening activities within their own remit. They can facilitate greening through provisions of common renewable infrastructure (e.g. hydrogen networks), through incentives such as green charging, through community building activities such as promoting- and finding connections for circular economies. The ESPO Port investment study (2018) shows the importance of the different sustainable investment categories, ranging from the infrastructure for reducing the environmental footprint, to the energy related infrastructure, the IWT and rail connections, and to some extent as well the ICT investments. All these investments contribute to reaching the Green Deal objectives and the importance of these are likely to increase in the coming years.



Source: ESPO : The infrastructure investment needs and financing challenge of European ports, 2018

Resulting trends in the port industry

Greener transport

“Whilst the transport sector brings many benefits for its users, it is not without costs for our society. By far, the most serious challenge facing the transport sector is to significantly reduce its emissions and become more sustainable.”¹⁶

Transport accounts for one-third of the overall EU CO₂ emissions. The European Commission advocates that greening mobility must be the new license to grow for the transport sector. Transport is no longer considered a "nice to have", it is instead considered the backbone of society and economy. A large share of emissions in the port area usually come from shipping emissions at berth or in port navigation. Overall, emissions from shipping at berth account for 6% of total CO₂ emissions produced by ships calling on ports in the EEA in 2018. However, reducing emissions needs to be done jointly, and therefore the total transport chain is required to make fundamental transformations. Emissions from shipping must be reduced through increased operational and design efficiency of vessels, the use of alternative low- and zero-emission fuels, and better planning by vessels calling on ports to reduce waiting times.

The EU's mobility should be based on an efficient and interconnected multimodal transport system, for as well passengers, as freight. The European Green Deal calls for a 90% reduction in transport emissions by 2050, for the EU to become a climate-neutral economy by 2050. To achieve this, all transport modes have to become more sustainable.

Ports are at the crossroads of transport networks, they merge road, rail, barge and seagoing vessels. The greening of transport is taking place in three ways in ports;

1. Due to the high intermodal linkages, ports are the perfect location for modal shift to less polluting/more energy efficient modes (such as ferry & shipping).
2. Given their often-large industrial clusters, ports are prime locations to pilot renewable fuels on both waterborne and land-based modes of transport.
3. Ports facilitate the greening of transport through facilitating technological innovations. For example, improved port planning, enabled by more accurate and reliable ship arrival schedules.
4. By clustering industries and activities together in a compact ecosystem, ports limit unnecessary transport between production and storage sites.

Rise of renewable fuels

Technological development and regulatory/societal pressures is making renewable fuels (economically) interesting. Non-fossil fuels are increasingly becoming of importance in the energy mix. The cost of renewables has fallen since 2010 and is expected to continue to fall until 2040.

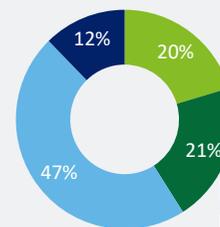


Source: Eurostat, EU-28 countries plus the EEA countries Iceland, Norway and Turkey

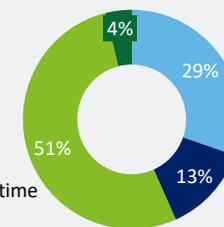
Modal shift

Ports play an important role in enhancing the modal shift, an important share of rail and inland waterway transport being seaport related. Efficient last-mile connections between the terminals and the national transport network are crucial for well-functioning sustainable hinterland transport for all modes.

EU external trade modal share, 2018



EU Intra-trade modal share EU-27, 2018



Source: Eurostat, EU-27 countries

Resulting trends in the port industry



Ports have an important role to play in the greening of the shipping market, as they are the location where a lot of the fuels are either consumed, stored, bunkered, transported or produced. Even though they do not have a direct say in what kind of fuel goes into the vessels, and that responsibility primarily lies with the shipping sector itself, ports are crucial players to facilitate the transition, and are willing to take up their responsibilities. Today ports are using tools such as green charging (providing green incentives) to promote greener fuels in their port area when it comes to fuel selection. Also, investments in renewable infrastructure aimed at providing alternative fuels are already well established (e.g. LNG) and the next generation is in full development (shore power and hydrogen). The table below shows the results of a large study performed by Shell and Deloitte where leaders in the maritime and logistics industry were asked on their opinion on which fuels will be most relevant in the future (2030). Even though hydrogen is listed as prime contender, there is still no strong consensus. Methanol for example, considered a low probability fuel in the research, is named as an important fuel to achieve a net-zero state of the transport sector by the European Commission, and is likely to be named in upcoming EU legislation as an alternative fuel.

Maritime industry perspective on alternative fuels

Fuel	Part of future mix? (% participants)	Engine type	View on technology maturity	View on applicability to shipping	Advantages	Disadvantages
Green Hydrogen	65%	Combustion	Medium	Medium	Cross-sector applications – possibly faster R&D	Cost Relatively low energy density Cryogenic storage conditions Need for renewable electricity Inefficiency in conversion/production
		Electric (fuel cell)	Low	High	Less space for engine and better specs than combustion	
Green Ammonia	55%	Combustion	Medium	High	Relatively high energy density Already developed experience	Cost Toxicity
		Electric (fuel cell)	Low	High	Less space for engine and better specs than combustion	
Biofuels	10%	Combustion	High	Low	Easy to implement in current engines	Limited feedstock, unlikely to be available, large difference between types of biofuels, difficult to check compliance
Methanol	10%	Combustion	Rarely mentioned	Rarely mentioned		
Batteries	< 5%	Electric	High	Medium (ship size dependent)	Mature technology	Extremely low energy density Size and weight of batteries
Nuclear	< 5%	Heat	Medium	Low	Mature technology	Very high investment, social aversion, rarely mentioned by decisionmakers

Source: Decarbonising Shipping – All hands-on deck, Shell and Deloitte, 2021

Resulting trends in the port industry

Greener energy generation in ports

A significant amount of energy is produced in ports, both for local consumption and for export. Where today fossil fuels are often used as preferred feedstock, tomorrow ports have a great potential to become new clean energy hubs for integrated electricity systems, hydrogen & other low-carbon fuels, and pilot locations for waste reuse and the circular economy. The greening of energy generation in ports can take many forms and is today already well underway. **Once again not all actions are open to port authorities, a lot of the initiatives described in this chapter still lie with the actual energy producing entities, but ports can take various stakes or facilitating roles.**

Production of wind and solar energy

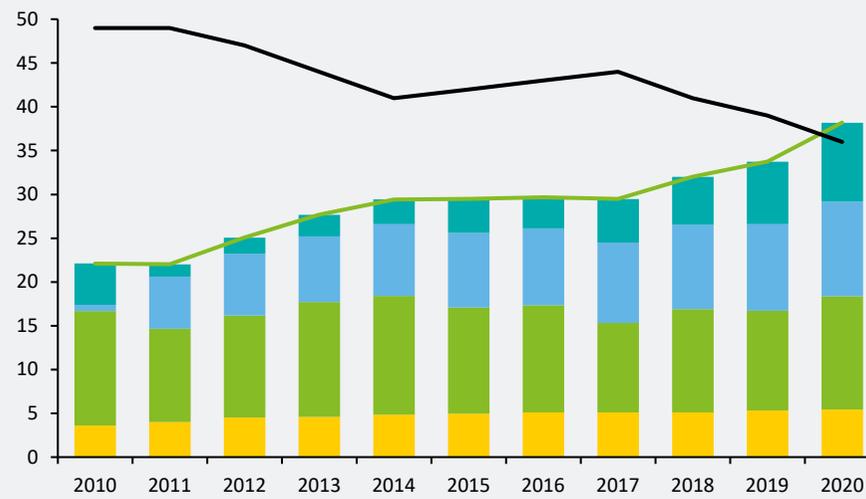
Seaports are unique onshore landing points and storage places for offshore renewable energy¹⁷. Ensuring a sustainable and responsible roll-out of offshore renewable technology with respect to maritime and seaport activities is a top priority for European ports. On the one hand industries in the port need notable amounts of renewable electricity – and on the other nearby urban centres can benefit from a large renewable source of energy nearby. Timely realisation of adequate infrastructure will be crucial to ensure capacity of the electricity network, as well as commitment from shipping companies, and alignment from existing and future legal requirements for ship side and shoreside.

Windfarms need connections to grids, the cables, in particular seabed cables under the access lanes to and from ports, need careful planning. These developments should consider future needs in terms of port access, anchorage and potential fairway deepening. Moreover, investments in the base infrastructure of the ports (which could also be used to improve the infrastructure for overall trade) will be necessary to facilitate these types of projects (e.g. adapting quays and access lanes to ports to larger wind blades).

Feedstock replacement

Today most energy generation in ports is still based on fossil fuels such as oil and coal. The emergence through pilot initiatives such as transforming waste into energy, but also larger scale green solutions, are proving their worth such as biofuels and biomass plants is becoming visible. Towards the future, other greener feedstocks such as hydrogen are also considered and even sometimes already used. Ports have a purely facilitating role in this part of greening. Unless they own shares in any powerplants or other parts of the supply chain, the responsibility for feedstock replacement lies solely with the private parties in the port area.

Share of electricity production in EU-27 (%)



Renewables generated 38% of the EU's electricity in 2020, overtaking fossil to become the main source of electricity for the first time ever in the EU.

— Renewable — Biofuel — Solar
— Fossil — Hydro — Wind

Source: Ember and Agora Energiewende, 2020

Resulting trends in the port industry

Greener port industry

European ports are amongst the largest chemical and production clusters in the world, and industries such as refineries, steel, iron, non-metallic minerals production and chemical industries emit almost 75% of the industrial emissions according to a recent Deloitte –Vlaio study. These industries will need to cut greenhouse gas emissions by 45-55% and improve energy efficiency with at least 32,5% by 2030¹⁷. Several actions are currently undertaken to make the industrial activities in the port area more sustainable, the most prominent are electrification and hydrogen, carbon capture storage and utilisation (CSS and CCU) and where possible promoting ecosystem integration through circular economies. In addition to the trends mentioned in this document, overall efficiency of processes and better isolation are also solutions applied to greenify industrial activity.

Electrification and hydrogen in industrial port use

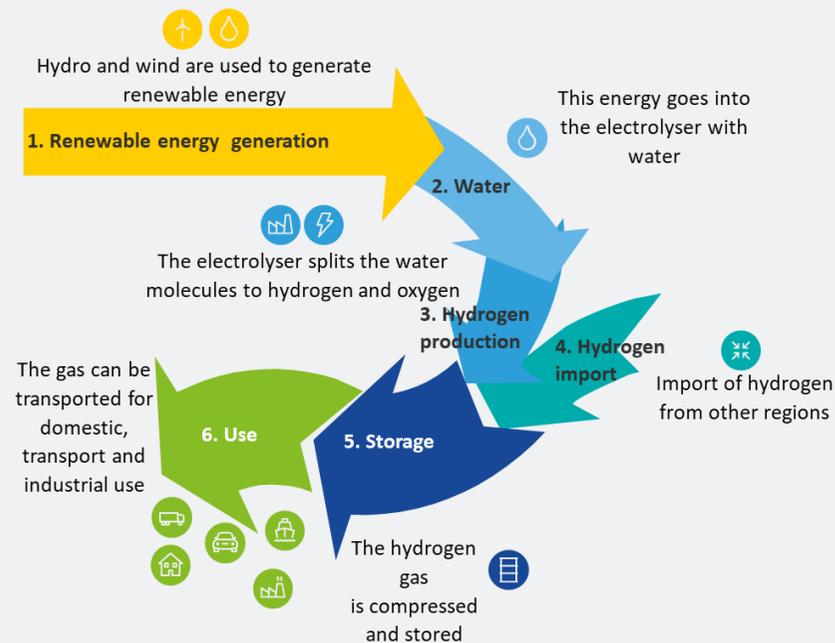
Electrification is one of the most discussed topics today in the port industry both on production, storage and use of electricity. Electrification is however only green if the grid available is based on renewable energy. In order to facilitate the electrification of port-connected transport and industry, an immense capacity upgrade is required for the local electric distribution infrastructure.

Hydrogen is a promising energy carrier for electrification, and it can be used as feedstock for several industrial processes (mostly in the chemical and petro-chemical industry). It can thus not only support the energy transition, but also decarbonise industrial processes. In addition, hydrogen can provide balancing capabilities to the power system by storing abundant electricity generated by wind or solar after electrolysis, as if it was a battery.

Hydrogen, as a feedstock, can be used to produce renewable fuels for difficult to decarbonise sectors, such as aviation and intercontinental shipping. When produced from electricity, these fuels are called electro or e-fuels and include ammonia, methanol, formic acid, synthetic methane (SNG) or higher hydrocarbons so-called synthetic fuels (syn-fuel). **Given the (current) low production capacity (less than 2% of the energy mix) of hydrogen in European ports, resilient and safe transport chains need to be established to import industrial use volumes.**

Measures such as investment promotion or secure demand mechanisms can help create attractive market conditions for hydrogen transport from producing countries.

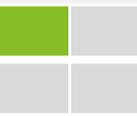
Production process of green hydrogen



Whilst hydrogen production is expected to play an important role in the future ecosystem of European ports, it will be several years until the EU will be able to produce significant volumes of green hydrogen. Until sufficient capacity is reached, import of hydrogen will be the prime focus for many ports.

Source: Hydro Tasmania, Deloitte modification; European commission A hydrogen strategy for a climate neutral Europe

Resulting trends in the port industry



Carbon capture storage and utilisation

Carbon capturing and storage (CCS) captures CO₂ from emissions at the source, then transports it to the storage site and permanently stores it in underground reservoirs, such as depleted gas fields. CCU (carbon capture utilisation) is an additional step where the CO₂ is used as feedstock in new chemical processes.

Most known CCS developments are capture systems at fossil fuel fired power stations, nonetheless the capture systems can also be applied at industries that emit CO₂, like the cement, steel, hydrogen or and ammonia industry. Some ports could play an important role in the process of CCS since the North Sea has great potential to store CO₂. In addition, the ports can provide infrastructure for shipping to capture CO₂ to the storage locations.¹⁸ Today some major ports are developing intra-port CCS networks. The infrastructure investments for these networks can be substantial and are often done with support of other private and public entities.

The possibilities of storage are of course not endless. Besides, not all locations are suitable for CCS. For the EU, mainly the seas close to the northern European countries are suitable, mostly because of the empty gas fields.

Circular economy

Most sectors active within ports have one main energy carrier, such as electricity for power applications, natural gas for heating and feedstock, oil as a fuel and off-grid electricity generation. With the switch to renewable energy, there will be an increased need for flexibility in the demand and supply of energy, efficiency gains and optimisation. As a result, sector coupling (circular economy) will be a trend that will integrate energy systems, starting with coupling of energy vectors between sectors.

A circular economy works in a system of closed cycles, in which resources and materials will lose minimal value by re-using materials and resources after the lifetime of a product and therefore use less raw materials. **A circular economy does not stop at the port border. Integration with the wider port region can lead to environmental benefits such as recycling streams for cities, usage of manure from surrounding agriculture or connecting waste-and feedstock streams from other industrial areas.**

Energy buffering

With the increased usage of renewable energy, more space for storage capacity will be needed. A large share of renewable energy types, wind-energy for instance, are dependent on an intermittent source. Storage capacity is needed to buffer the volatility of renewables. The port, as a future energy hub, has much potential to use its land to function as a buffer/battery area to provide the port and the nearby region of energy. This also applies to the re-usage of steam from the industry located in the port and the storage of reusable feedstock.

Resulting trends in the port industry

Increased focus on sustainability

It is expected that sustainability will become a more important competing value proposition in the future under the form of sustainability performance. Sustainable ports increase their attractiveness with a huge variety of port-specific sustainability measures (see the annex to the ESPO Green Guide 2021: www.espo.be/practices). This provides sustainable ports advantages over traditional ports.

Successful ports will be recognised for their socially and environmentally sustainable operations. It is to be seen if this will be a true long-term differentiating factor, or a new normal to which all ports in the EU must adhere.

The figure on the next page (ESPO Top 10 environmental priorities of the port sector over the years) shows that ports increasingly prioritise environmental issues such as energy consumption and climate change.



Sustainability – beyond green

Sustainability is more than “just” the environment, one of the most used frameworks is the triple bottom, triple p or PPP framework outlining the interaction between People, Planet and Profit:

People

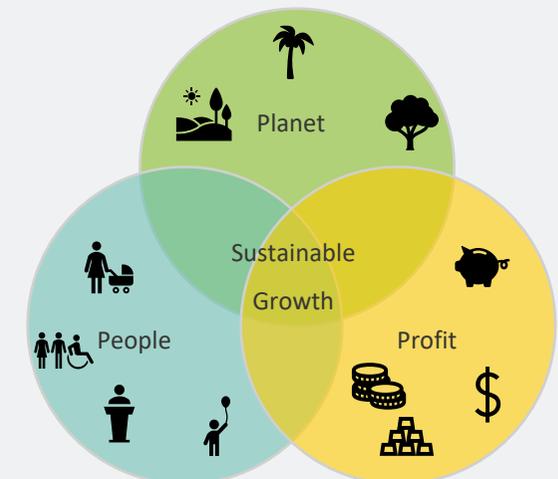
“People” considers employees, the labour involved in a corporation’s work, and the wider community where a corporation or port does business. Another way to look at “people” is, how much does a company or port benefit society? A triple bottom line company or port pays fair wages and takes steps to ensure humane working conditions. The people aspect is growing again in port related operations now that ports are taking a more central role in sustainability related matters.

Planet

The “planet” piece of the triple bottom line outlines that an organisation tries to reduce its ecological footprint as much as possible. These efforts can include reducing waste, investing in renewable energy, managing natural resources more efficiently, and improving logistics. The figure on the next page (ESPO Top 10 environmental priorities of the port sector over the years) shows the focus area of the European ports when it comes to “planet”.

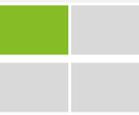
Profit

Sustainable organisations also recognise that “profit” isn’t diametrically opposed to “people” or “planet.” For the European ports this has 2 meanings, (1) generate profit for the region (2) generate sufficient income to be able to afford qualitative infrastructure, both base infrastructure and infrastructure aimed at the people and planet segments of the triple P model.



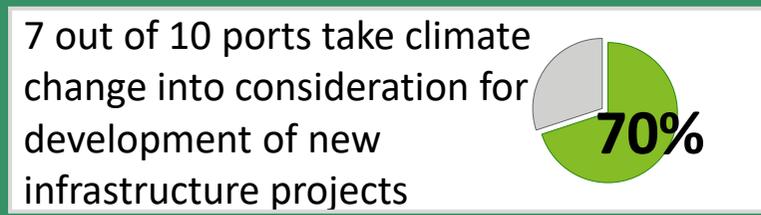
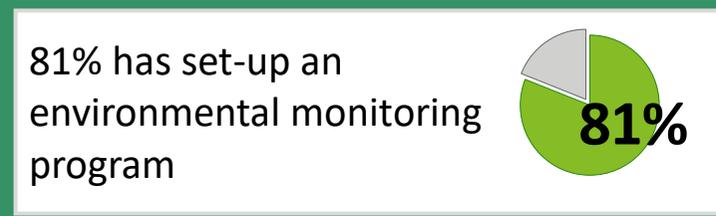
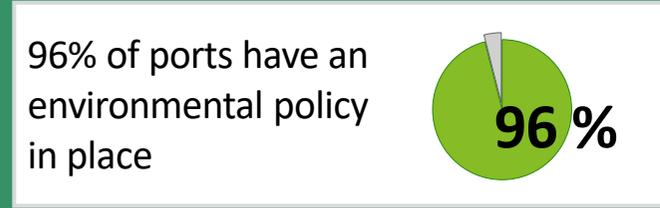
Source: Deloitte analysis, Elkington 1997

Resulting trends in the port industry



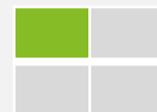
Top 10 environmental priorities of the port sector over the years

	1996	2004	2009	2013	2016	2017	2018	2019	2020
1	Port development (water)	Garbage/ Port waste	Noise	Air quality					
2	Water quality	Dredging operations	Air quality	Garbage/ Port waste	Energy consumption	Energy consumption	Energy consumption	Energy consumption	Climate change
3	Dredging disposal	Dredging disposal	Garbage/ Port waste	Energy consumption	Noise	Noise	Noise	Climate change	Energy efficiency*
4	Dredging operations	Dust	Dredging operations	Noise	Relationship with the local community	Water quality	Relationship with the local community	Noise	Noise
5	Dust	Noise	Dredging disposal	Ship waste	Garbage/ Port waste	Dredging operations	Ship waste	Relationship with the local community	Relationship with the local community
6	Port development (land related)	Air quality	Relationship with the local community	Relationship with the local community	Ship waste	Garbage/ Port waste	Port development (land related)	Ship waste	Ship waste
7	Contaminated land	Hazardous cargo	Energy consumption	Dredging operations	Port development (land related)	Port development (land related)	Climate change	Garbage/ Port waste	Water quality
8	Habitat loss/ degradation	Bunkering	Dust	Dust	Water quality	Relationship with the local community	Water quality	Port development (land related)	Garbage/ Port waste
9	Traffic volume	Port development (land related)	Port development (water)	Port development (land related)	Dust	Ship waste	Dredging operations	Dredging operations	Dredging operations
10	Industrial effluent	Ship discharge (bilge)	Port development (land related)	Water quality	Dredging operations	Climate change	Garbage/ Port waste	Water quality	Port development (land related)



Source: ESPO 2020 Environmental Report, available at: www.ecoport.com/publications/environmental-report-2020

Resulting trends in the port industry



Green recovery from COVID-19

The Green recovery represents an opportunity to build back greener in cases where sustainability is an integral part of the recovery of the maritime sector. Even during the COVID-19 pandemic, investors continued to show interest in greener companies while showing less interest in carbon-heavy incumbents. Companies in the port industry can take the opportunity to professionalise sustainability at the core of their business, while prioritising investments into clean energy and low-carbon projects.

In the previous recession of 2007-2009, the EU invested €565 million to help advance project maturity of offshore wind projects²⁰. In addition, it supported wind feed-in tariffs totalling €25 billion to make other offshore wind projects economically viable.

As a result, today the EU is the world leader in offshore wind power, representing a growth of about ten times over a decade²¹. Promoting innovation to drive the shift to renewables is therefore not new in the EU, and a necessity given the large investment gap between the current state renewable infrastructure and the infrastructure required for a carbon neutral port environment. **Because the EU, compared to other areas worldwide, remained in a relatively strong economic health despite the COVID-19 pandemic, it is now in a good position to continue the energy transition.** Extensive levels of sustainable investments are included in stimulus packages announced in relation to the COVID-19 global pandemic. While greening, digitalization and growth are the clear priorities put forward for the national recovery plans, the national implementation very much differs both in terms of the size of the envelope and the way it will be spent, more in particular as regards investments for infrastructure and greening of transport. Different Member States have no port projects included at all.

Conclusion on trends in sustainability

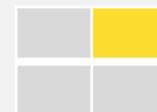
Climate change and resulting energy transition trends impact ports at their core. Port authorities are taking a more active role in the overall greening and continue active participation and accommodation of the energy transition to help their ecosystems transform and deliver sustainable value to their stakeholders.

Many ports are industrial ecosystems, and all ports are modal hubs where transport modes combine. **This results in negative externalities being clustered in one spot. It also means that port areas are front and centre when it comes to high impact greening initiatives.** Many of these initiatives will require (large) investments, be it to the critical infrastructure for climate adaptation or to increased renewable infrastructure. In these investments, port authorities do not stand alone. Getting to a carbon neutral environment is a responsibility of all actors in the ecosystem, from government to the user of the transportation modes.

Where promoting sustainability used to be a more value driven choice for ports, it is evolving into a basic economic necessity, both to keep the license to operate from the stakeholders and transform the traditional businesses to more environmentally friendly options.

The EU's long-term budget, coupled with NextGenerationEU, the temporary instrument designed to boost the recovery, will be the largest stimulus package ever financed in the EU. A total of €1.8 trillion will help rebuild a post-COVID-19 EU. **It strives to create a greener, more digital and more resilient EU.**

Resulting trends in the port industry



Innovation and digitisation

The innovation driver takes many forms, transforming ports and port authorities alike. The maritime industry has been relatively behind the curve when it comes to overall digitisation, mostly due to the very traditional nature of its activities. Today, increasing market uncertainty caused by the other drivers, combined with the accelerating speed of technological innovation in the wider maritime and logistics industry, is pushing ports towards mass innovation.

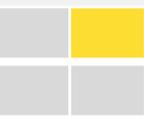
There are hundreds of use cases for technology in ports, it goes beyond the scope of this document to explain them all, in the figure and pages below some are introduced. Looking at the overall trends, four main goals of the technological tidal wave can be distinguished:

1. **Increased efficiency, reliability and transparency through platforms**
2. **Increased efficiency and transparency through automation**
3. **Improving environmental performance**
4. **Improving safety and security**

Use cases of digital and innovation in ports based on industry 4.0

		Use case (non exhaustive)	Example of use case in ports	Value generation
Connectivity	Internet of things	Sensorising of infrastructure and assets	Computer vision solutions e.g. smart harbour master systems	   
	Wearables	Tracking for safety and security	IoT and 5g applications for on terminal security	   
	Augmented reality	Virtual twin of infrastructure	Virtual twin of terminal or of entire port	   
Big data	Optimisation and prediction	Optimisation of transport flows	Just-in-time port call optimisation & port community systems	   
	Machine learning	Self improving algorithms	Addition to other use cases	   
	Cyber security	Preventive cyber units	Port wide cyber prevention and response teams	   
Advanced manufacturing	Additive manufacturing	3d printing for parts and commodities	3d printing of spare parts for port assets	   
	Advanced materials	High tensile materials, smart materials	New materials for quay/flood wall	   
	Robotics	Automation of processes	Automation of port processes (e.g. locks) and terminals	   

Source: Deloitte analysis



Resulting trends in the port industry

Increased efficiency, reliability and transparency through platforms

“Platforms” are a term coined where many actors come together to share information and data on their activities. Within the port industry there are two types of platforms that can be distinguished.

1. Port community systems
2. Cargo community systems

In addition, one could state that terminal operating systems are also platforms, but since those are aimed purely on the operational aspect of ports these will not be discussed in this document.

Given their neutral position in both the supply chains and port ecosystem, ports are the perfect spider in the web to manage the digital oceans of platform datasharing.¹⁹ Individual ports’ initiatives can optimise the supply chain when integrated, both in the internal and external port network, but even higher efficiency gains can be made through collaboration and the sharing of ideas among ports and other stakeholders in the value chain.

Platforms increase efficiency by reducing paperwork and a lowering administrative burden. In addition, by sharing real-time information, they allow for increased transparency in the ecosystem and value chain, generating possibilities for just-in-time operations and optimisations.

Within the logistics industry, cargo community systems have been quite prominent in the past decade. A lack of relevant and accurate information in the supply of data can result in inefficient processes and other 'hidden costs' such as excessive inventories. By sharing more information, it is possible to optimise these processes and reduce cost. **Fast and reliable cargo information systems become increasingly indispensable for international transport hubs.**

Port community systems

On a port level, platforms take the form of Port Community Systems (PCS). An electronic platform which connects the multiple systems operated by a variety of businesses and stakeholders that make up a seaport. Most PCS are neutral and open in their set-up, often facilitated by the port authority, enabling intelligent and secure exchange of information between public and private stakeholders.

PCS connect the administrative with the commercial aspect, making both the port itself, as the underlying businesses more efficient and effective. It is not to be confused with national single windows, which many European Member States are developing in response to recent directives and policy from the European Commission. A PCS has the ability to act as a National Single Window or to integrate into a National Single Window and is therefore pivotal in the Single Window concept by reducing duplication of data input through efficient electronic exchange of information.

PCS provide advantages to business to business (B2B). For instance, container companies, transporting goods on behalf of manufacturers and wholesalers, will benefit from the open accessible real-time information, which increases efficiencies throughout the port ecosystem.

The flipside of port community systems is the (large) investments and inhouse capabilities needed to be developed and maintained. Certain ports are doing the developments inhouse and others are outsourcing this to other parties (see Future role of ports). The implementation requires thorough analysis of the processes of the involved stakeholders, for a PCS to be a success.²⁰

Source: EPCSA, How to develop PCS, N.d.

Resulting trends in the port industry

Increased efficiency and transparency through automation

Within a port setting, automation can quickly be considered something that is restricted to terminals. Even though the largest efficiencies with automation might be gained in high volume transport operations, use cases of automation are seen in the entire port ecosystem.

The European port sector has been leading in new port technologies, automation and digitisation. It had the first port that introduced a high-voltage onshore power supply and the first automated terminal. In the recent years, leading European ports have been pushing automation by inter-connecting technical components and integrating various stakeholders. Quay walls and roads with sensors to gather data streams are used to support decision making. An IoT network dispatches maintenance staff in the facility and identifies the location of the ports' maintenance fleet vehicles in real-time. 5G is being partly tested and implemented in a real-life industrial environment at a European port. In addition, artificial intelligence and related developments might bring autonomous shipping and driving, drones and other possibilities.

Automation is generating benefits for port authorities and port users alike. Next to increased efficiency and transparency, it also gives the opportunity for a more diverse workforce. **However, it is of great importance for use cases to be connected to the wider ecosystem in order to reach their maximum potential.** In addition, the needed investments are substantial, even more so due to short technical lifespan of the infrastructure, which depreciates in 5 years. Furthermore, it will be required to retrain the existing workforce. Together, this can put pressure on the smaller ports with lower financial means to automate and digitise.

Port authority use case description: The port virtual twin

A digital twin is a virtual copy of an asset or ecosystem, allowing the user to run simulations where either processes are so complex and critical that you can't risk failure by experimenting with a different approach, or not go offline to test an innovative method. Digital twins can simulate any aspect of a physical object or process and are gaining momentum thanks to rapidly evolving simulation and modelling capabilities, better interoperability and IoT sensors, and more availability of tools and computing infrastructure.

Today, digital twins are used port wide to optimise mooring and departure, tracking of cargo, scenario planning for exceptional weather and cargo events, etc.

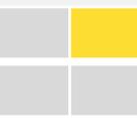


Port user use case description: Autonomous vessels and drones

Development towards fully or partly autonomous ships will pose both opportunities and challenges for the sector in terms of safety, security, sustainability, existing legal frameworks, and operations. Oceangoing autonomous (or remote controlled) vessels might still seem far away, but smaller autonomous floating drones are already present in the portscape. Automated tugboats, smart dolphins for water monitoring, automated survey vessels, etc. are being used by port authorities to generate more insights into the actual port environment.



Resulting trends in the port industry



Improvement of environmental performance

Many of the industry 4.0 use cases have environmental benefits, since they generate efficiencies in the value chain. For example: an optimised PCS gives increased transparency in port operations and allows for a reduction in waiting times for all transport modes with a direct effect on emissions.

Improvement of safety and security

Digitisation can improve safety and security in multiple ways, providing contactless options (COVID-19), increasing compliance, increasing situational awareness, allowing remote operations where human presence is unsafe, etc.

Speed of transformation cannot come at the expense of risk, or the entire initiative can cause more harm than good. It is critical that cybersecurity and other risk factors are considered in the design stage of digital transformation initiatives, so the new digitised process does not weaken the overall risk profile of the organisation.

It is however also important that cybersecurity frameworks are developed without curtailing the rapid pace of digital innovation. Certain policies like the NIS legislation should therefore be focused on those ports that need high levels of protection, as European ports are diverse in nature and vary in size and in activities performed and their strategic importance in a given Member State may vary.

Port user example: Robotised vessel cleaning

Fouling is a major issue for vessels both with regards to maintaining optimal operational speeds and reducing drag through the water. Today multiple companies are working on remotely operated underwater drones that inspect the hull underwater and keep the hull free from fouling. These types of innovations help high frequency ships maintain their schedules (RoPax) and help vessels lower their overall fuel consumption and emissions.



Port authority example: just-in-time port call optimisation

Just-in-time port call processes aim to facilitate vessel speed optimisation, reduce CO₂ emissions, improve schedule reliability and increase arrival efficiency overall. Many actors in the industry are working on standards and platforms to implement just-in-time port call on a global scale, such as DCSA, PortXchange, portcalloptimisation.org, etc.



Port user & port authority example: 5g-IoT enabled asset tracking

5G enabled IoT solutions are being implemented in a variety of terminals and wider port areas. Driven by faster 5G communications, large amounts of sensors are placed on several assets to increase safety and operational awareness. Examples include the tracking of heavy machinery & worker location, tracking of exact vessel locations for quay wall planning and protection and smart camera systems for terminal and port access (digital ISPS)

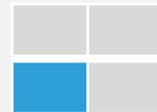


Port authority use example: dedicated cyber response teams

Cyber defence in the port community often lacks a community approach. Today, individual companies are focused on protecting their own systems, with limited or no coordination with other members of the port community. As ecosystem orchestrators, ports are increasingly setting up systems to promote a holistic approach to cyber security and take a more central role by setting up dedicated teams and responsible cyber security officers.



Resulting trends in the port industry



Trade developments

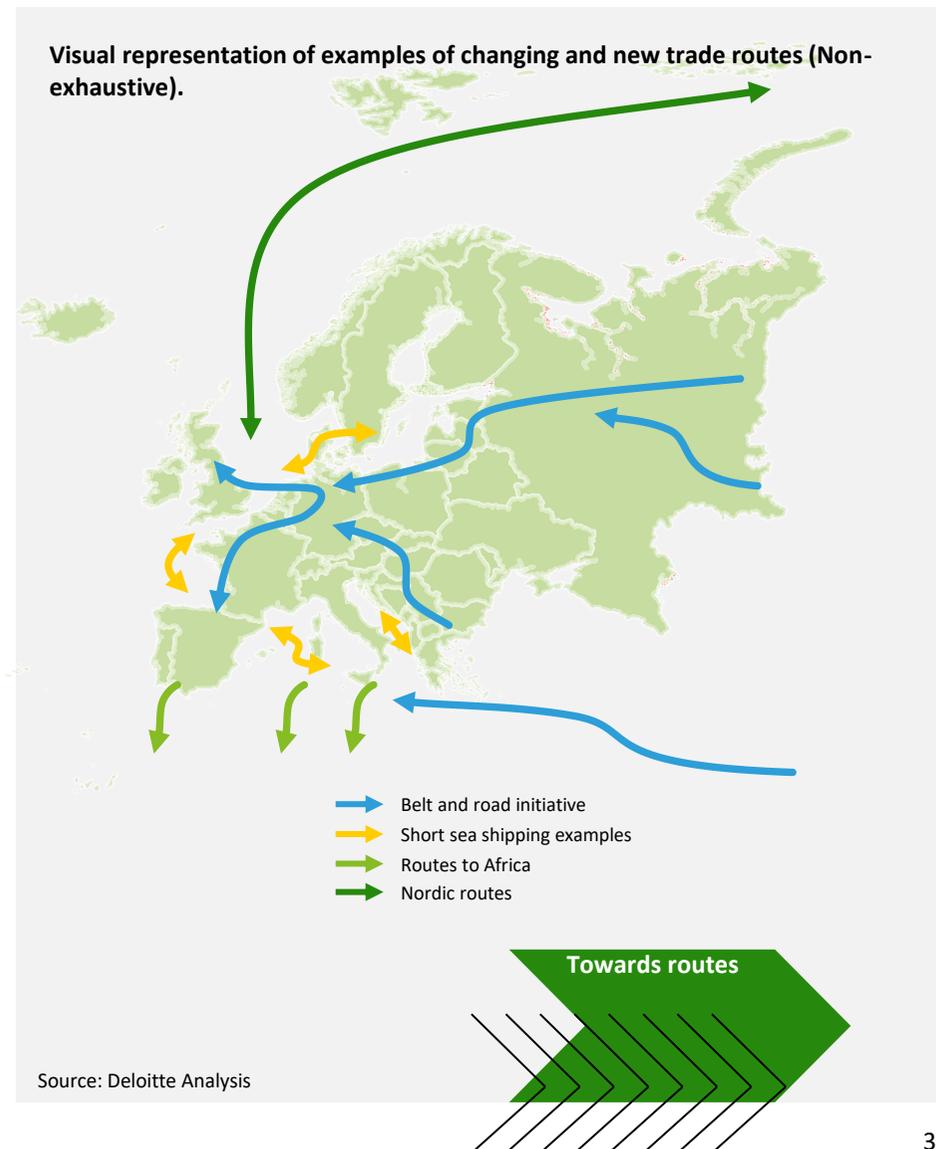
The EU is the world's largest trading power, accounting for 16.7% of the global trade in goods and services. External trade accounts for 35% of the EU's GDP, and one in seven jobs depends on exports²². Trade is therefore key to the EU's economy, and the newest trade strategy of the European Commission, Open Strategic Autonomy (OSA), sets course for an open, sustainable and assertive way of trading. It builds on the EU's openness to contribute to economic recovery by supporting green and digital transformations, strengthening multilateralism and reforming global trade rules to ensure their fairness and sustainability. Trade within the EU is however under pressure by a wide variety of factors such as economic protectionism, geopolitics, climate ambitions, digitalisation, and COVID-19. During the beginning of COVID-19, there have been slight disruptions to global transport. However, overall, the **COVID-19 pandemic showed the robustness of the current global maritime supply chain, with ports being buffers and safeguarding strategic global commodity flows**. Next to occasional disruptions, multiple trade developments are happening that are expected to change the current trade patterns; i.e. changing trade routes, supply chain integration, E-commerce, and security/migration.

Changing trade routes

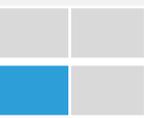
A lot has been written on new trade routes disrupting traditional trade lanes. This study is limited to the ones which are currently developing and transforming the European port market (see figure to the right).

Carbon Border Adjustment Mechanism (CBAM)

In addition to the routes discussed in this document the EU is currently working on a CBAM, which is an instrument that puts a carbon price on imports from less climate-ambitious countries. As the EU is determined to become carbon neutral in 2050 and maintains the highest environmental and climate protection goals in the world, it wants to implement such an instrument in order to raise the global climate ambitions of EU trading partners, to preserve global competitiveness of EU companies and to prevent the relocation of EU industry to countries with less ambitious emissions rules (carbon leakage). This development might also have an impact on import and export flows in the future.



Resulting trends in the port industry



Short sea shipping (SSS)

A key challenge of the EU is to maintain the port sector's dynamism and competitiveness whilst at the same time improving its environmental performance and energy efficiency.

Short sea shipping is impacted by the shift towards re- and near-shoring. Both concepts increasingly gain in importance, since they offer more sustainable supply chains, more transparency, and less dependency on production companies in Asia and more production in the EU. This will most likely result in more and smaller near-shoring vessels sailing at a higher frequency between neighbouring countries in the EU. To ensure connectivity to these countries, the corridors will need to be integrated into the multimodal TEN-T network.



Routes to Africa

Similar to the EU strategy of improving trade with Western Balkans and Eastern Europe, the EU aims to reinforce its engagement with African countries. One proposed action by the EU is a continent-to-continent trade agreement based on a successful implementation of the African Continental Free Trade Area. Together with the rising economic potential of Africa, increased cargo shipping in the southern direction can therefore be expected.



The Belt and Road Initiative

In 2020, China temporarily became, by replacing the US, EU's greatest trading and investment partner²².

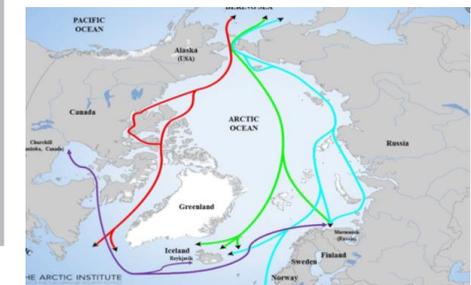
China's Belt and Road Initiative (BRI), a program to invest over \$1 trillion over a period of ten years in infrastructure, presents an important opportunity for the EU to benefit from improved connectivity and reduced trade costs. The investments related to the Belt and Road Initiative will have its impact on current routing. However, it is still uncertain what that effect will be, this will depend on the procurement for BRI projects. Italy was the first big European economy to join China's BRI, although the outcome of it is still uncertain, an increase in traffic flows from Asia to Mediterranean and Adriatic ports is expected.

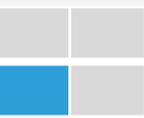


Nordic routes

Due to global temperature rising and the melting of ice, the Northern Sea Route and the Transpolar Passage could become viable alternatives for maritime freight. The development of Arctic port infrastructure is mainly driven by oil and gas mining. In 2018, these products accounted for almost 90% of the transshipments on this route²³.

ITF transport expects that by using the Northern Sea Route for maritime freight between Northern Europe and Asia compared to routing through the Suez Canal could reduce voyage distances by 17% to 37%²⁴. It therefore offers a viable alternative to the Suez route.





Resulting trends in the port industry

Supply chain integration

It should not come as a surprise that various players in the supply chain are consolidating their market position. Outside of the container market, other players in logistics, shipping and services for instance, have started an integration process both horizontally and vertically. Ports have sometimes tried to counter this move by cooperating with other non-port stakeholders, or by merging with neighbouring ports to create synergies and have a stronger position towards the market.

It is possible to distinguish two kinds of collaboration; horizontal and vertical. Horizontal collaboration is collaboration across rather than along the supply chain, whereas vertical is along the supply chain.

Horizontal integration

On the terminal and port side, horizontal integration, or horizontal collaboration is sometimes realised between ports and terminal operators, ranging from ad-hoc joint projects to mergers. Driven by, among others, the growth of vessels, capacity constraints, and sustainability demands, these ports and operators aim to improve their efficiency through collaboration. In addition, there is a tendency of ports to either cooperate more intensively or to even to merge. On the demand side, horizontal collaboration is increasingly done through alliances, and through digital ecosystems. The Digital Container Shipping Association (DCSA) is a confirmation that the sector is also willing to collaborate to transform and digitise the shipping industry.

Vertical integration

More vertical collaboration is clearly visible in the market. Within the supply chain, this occurs between terminal operators in the form of designated terminals or through system integration and closer cooperation with hinterland connection providers.

Vertical integration is the port industry in clearly visible with the rise of PCSs. PCSs are neutral and open electronic platforms that optimise, manage, and automate seaport logistics processes through single submissions of data, enabling intelligent and secure information exchange between public and private stakeholders²⁵.

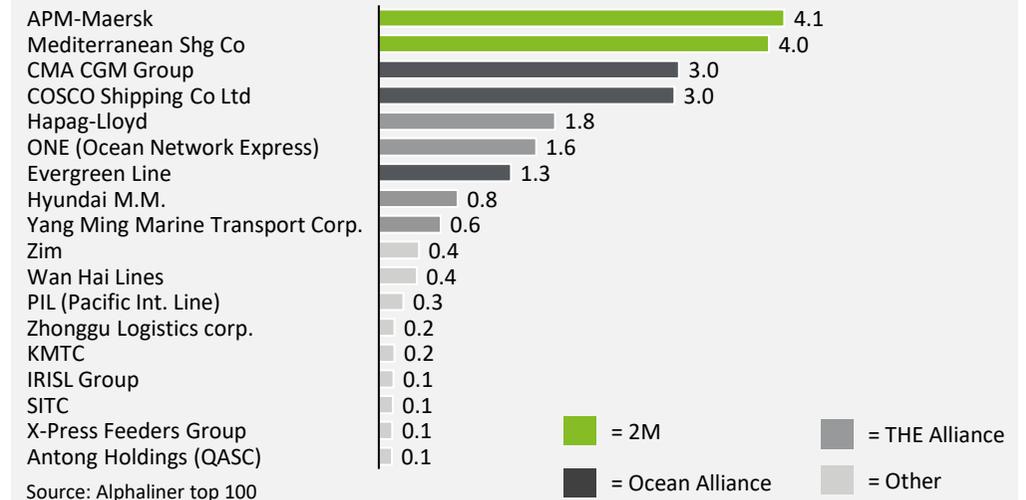
Cooperation across modes

Due to the increased demand for shorter delivery times, more collaboration is seen between sea- and airports to facilitate the transportation of high value and time dependent cargo. This push on shorter delivery times, but also flexible services, lower risks, and margins is expected to push vertical integration even further, as large players, such as Amazon, are now starting to offer their own logistics services. Amazon is for example now focusing on ocean freight forwarding with plans to invest billions of dollars in its own container shipping fleet²⁶.

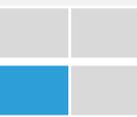
Evolving power balance in the maritime sector

Both the vertical and horizontal integrations have resulted in changing power balances. It has, on the one hand resulted in bigger and more powerful clients for ports, and on the other hand in bigger and more powerful alliances between carriers. Ports will have to respond to this changing power balance. Increased cooperation between ports is named as a possible solution.

Consolidation in the maritime industry (TEU capacity in 2021):



Resulting trends in the port industry



Security & migration

Contraband and drugs – a growing issue

Narcotics are smuggled to the EU from the producer countries of South America by both air and sea using a range of methods and routes. Trafficking of cocaine into the EU appears to mainly take place through western and southern countries, with Spain and Portugal in the south and ports in the Netherlands and Belgium in the north being the most important entry points for South American cocaine reaching the European market.

Curbing drug trafficking in ports is only possible through increased investments in scanning software or increasing physical security. However, it isn't that simple. While the probability of detecting illicit cargo would increase, logistics operations would slow down, meaning higher costs that most operators try to avoid. The change is also likely to lead to crime displacement outside the port and may not disrupt trafficking in isolation.

Tackling this complex issue is only possible through close cooperation between port authority-operators and the many different competent authorities at local and national level and by using smart technological innovations to optimise scanning without affecting cargo flow.

Migration - a pressure on infrastructure

Stowaways in freight transport present, apart from putting themselves in life-threatening situations, legal, financial, safety and security problems for the shipping sector. Ports are at the frontline when it comes to migration and protecting both the migrants and port workers.

The migration problem hits the European port system on two levels. In the south (e.g. Melia) ports are used as access points to Europe. In the north the ports across the channel are used as transshipment points to the UK. Cargo trucks attempting to cross the English Channel from France to the United Kingdom are faced with (significant) delays, increasing shipment turnaround times by as much as nine hours due to increased security checks along the route²⁷. In addition to the logistics impact, there is a large pressure on the ports to provide high level expensive safety and security

measures. The problem in the south ports are more seen as an entry point into the EU. In both cases the complexity generated is similar: more infrastructure is needed for physical controls, flows are disrupted, port personnel is not trained for these interactions and the responsibilities of the port authority vis a vis the government (e.g. handling cases of death) is often an unclear grey zone.

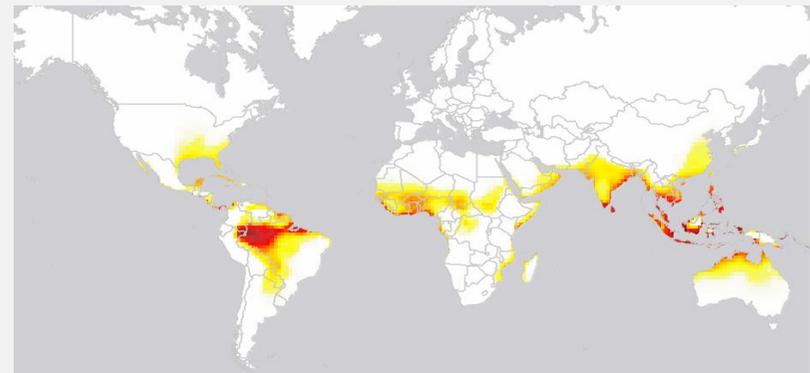
Climate – the novel source of displacement

Where migration today is more of an economic and political nature, tomorrow climate change will be the prime cause of people displacement.

The UN Migration Agency projects over 100 million people will live in areas where the average heat in the hottest month is likely to be too high for a human body to function well in the case of a two-degree temperature rise. Millions of people in low- and middle-income countries, but also in developed countries, will potentially be unable to maintain their activities, even in the case where the Paris Agreements are met.

For ports, the migration and adjoining security issue is expected to only grow in the coming years. Geopolitical tensions show no short-term outcome and climate will force a lot of groups to relocate to more temperate areas.

Global risk of deadly heat, 2050



Source: ESRI, moderate mitigation scenario

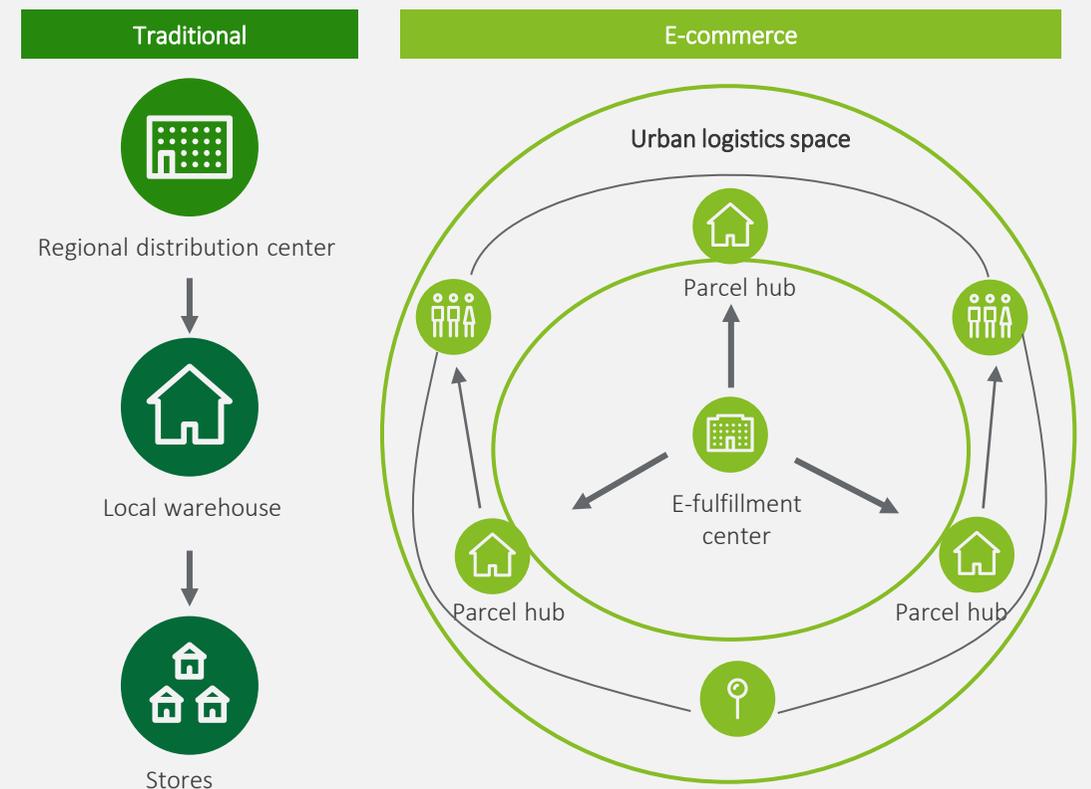
Resulting trends in the port industry

E-commerce

COVID-19 resulted in a large increase of E-commerce, this shift is likely to stick post-pandemic. A study on E-commerce by SearchNode²⁸ pointed out that during 2020's summer period, when the lockdown was less strict, 92% of the respondents to the study still experienced a growth in their online revenues. 57% of the respondents indicates the pandemic imposes challenges because of a disrupted supply chain, in addition 43% indicates challenges regarding fulfilling demand for products²⁹. The pandemic accelerated the expansion of E-commerce towards new firms, customers (e.g. elderly) and types of products (e.g. groceries and everyday necessities). A global consumer survey measuring the adoption of digital and low-touch activities, suggests that new users drove over 50% of the increase in online grocery shopping, pick-up from restaurants or other stores³⁰. Distribution companies are experiencing an overwhelming demand for fast last-mile delivery, raising the question of flexible warehousing, logistic partnerships and auto-replenishment models to manage profitability.

E-commerce and short sea shipping and/or near-shoring, as described earlier, can go hand-in-hand. E-commerce consumers require quick delivery times, which can benefit from the shorter travel distances due to the closer proximity of the supplier, allowing for greater flexibility.

The E-commerce supply chain



Where shipping firms, logistics providers and terminal operators are pursuing as much scale and mass as possible. Consumers increasingly expect faster and more flexible services for the delivery of goods. Ports will have to manoeuvre between a changing demand and supply side, where they need to serve both "customers". This leads to a push for more storage and buffering capacity in the port area.

Resulting trends in the port industry

Community expectations

Ports and cities have co-dependent relationships, but in light of sustainability, this relationship is often challenged because there are conflicting interests at play. Many ports are located close to either urban centres or smaller communities. These communities often receive and perceive negative externalities from ports, but are unaware of the benefits of crucial infrastructure for national and regional economic development. Traditionally this was covered through the strong municipal embeddedness of the port authority and entrenched in the port-culture of many cities. However, partially due to growing port authority independence and the physical distance between port and city, today this balance is more challenging.

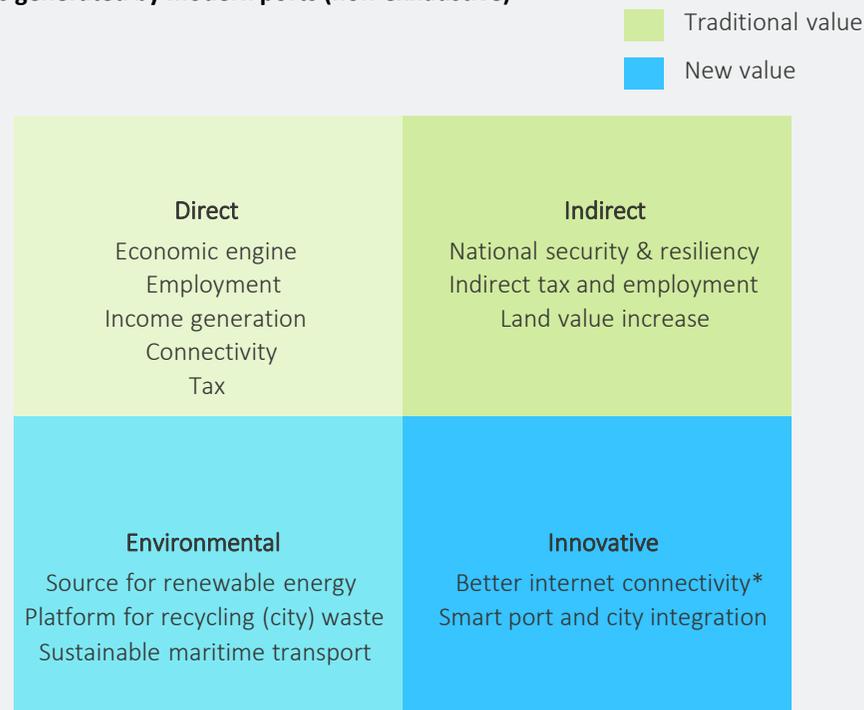
Community expectations are not a new trend but have been steadily growing over the past years. Because of demographic drivers like urbanisation, urban space is becoming more and more scarce. Therefore, public authorities, like municipalities, exhibit pressure on ports to redevelop land for real estate development and sometimes push the port further out of the city because of the negative external effects of the port, such as air pollution, noise and congestion.

Limited visibility of port generated benefits

It appears that the “*connection or integration*” between several communities and ports has deteriorated over time. Communities in proximity do not always know or understand the role and function of ports and value chains. This used to be less of an issue when ports were pure municipal departments, but today, linked to growing port independence, the perceived distance between the wider community and ports has increased.

Communication on the benefits (see figure) that the port – and port ecosystem, brings to its surroundings, is growing in importance. Port authorities are actively addressing this challenge through improved sustainability reporting and numerous community outreach programs.

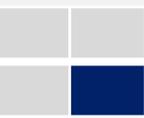
Benefits generated by modern ports (non-exhaustive)



The direct and indirect financial benefits of ports are often considered the traditional port benefits. Due to an increasing awareness for sustainability, other types of indirect benefits are also becoming more prominent in the port-city interaction.

*presence of datacentres and access points to international data cables

Resulting trends in the port industry



Port-city interaction

Ports and their neighbouring cities have strong co-dependent relationships. A city provides ports with brains; qualified people and access to universities. Also, a city provides the port with multiple opportunities for collaboration, demand for commodities and supply of feedstock such as recycling materials.

A port on the other hand provides numerous benefits for the city, starting with employment and added value (wealth) generation, but also generation of (clean) electricity, heat and provision of numerous goods from global sources. In addition, the presence of a port often indicates strong improvements in connectivity related infrastructure.

In an increasingly digital and green world the port also offers additional direct benefits to the city. Examples are the availability of clean energy sources, recycling potential (urban mining) and being a source of import and production of renewable fuels.

An interesting trend currently ongoing in urban ports is the synergy between the port area and urban mobility. Initiatives such as ride sharing require large fleets of vehicles which need to be stored and serviced. Several European port cities have started initiatives to perform these activities in the port area, conveniently located close to the city, with ample space, good connectivity and a strong know-how.

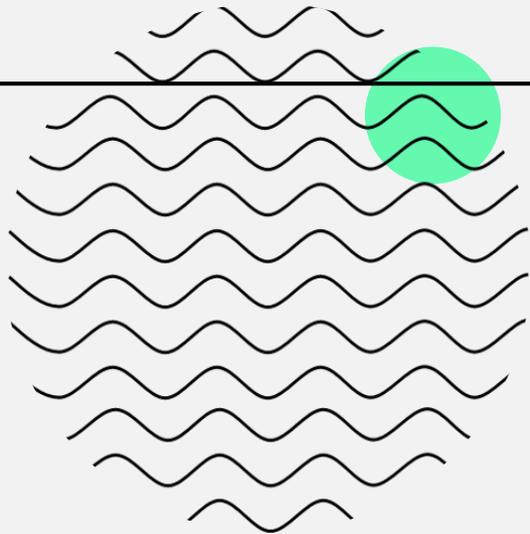
The switch to circular industries and economies in ports will require more space, for storage of reused materials and as green buffers. But also, growing urbanisation is pushing the boundaries of the cities ever further and bringing a disbalance between land allocated for port activities and land allocated for urban activities.

A final notion to consider when considering the port-city interaction is the availability of short sea passenger connections. In the push to decarbonise transport. The EU intends to shift travel below 500 km as much as possible to low-carbon modes.

In this respect, ferry connections are a sustainable alternative to short haul flights and short sea cargo connections can make intermodal links with inland transportation where possible. This would also support port cities with a large tourism sector, building back better this service industry.



Changing role of the port authority



Changing role of the port authority

One size does not fit all

Given the uniqueness of every port in the EU, it is logical that not every port authority has the ability or need to adapt to the trends in the same manner. Not every trend has the same relevance to- and impact on each port. And even though this study strives to give a full helicopter view of the future world of the maritime industry – European ports will have to assess which trends are most important for their future, and how their role within the ecosystem will need to change accordingly.

With regards to sustainability & community expectation trends, all port authorities are taking at least certain actions. Not just urban ports and ports with a large industrial footprint, but all ports can- and must play a crucial role in the EU's decarbonisation agenda and the energy transition. Ports are a prime location for sector coupling and energy system integration, as they are often home and key partners to industrial clusters, including maritime, oil and gas, cruise-tourism, heavy transport, bulk transfer, manufacturing industries and (sustainable) power generation³². It is important to note that the presence of private sector players has a strong effect on the sustainable transition potential of a port. Ports can actively attract and promote green activities, but the private sector must do their fair share in the inevitable transition of the ports.

The reaction to and the impact of trade developments on port authorities are dependent on the port type. For certain ports near-and offshoring will be of great importance, for others safety and security will be a top concern, as can be seen on the next page which gives an indication of the relevance of the trends for certain port types. This is also the reason why this study does not go into detail on market developments per cargo group.

The core activity of a traditional port authority remains similar: managing, creating and optimising infrastructure for trade development, safety of navigation, cluster management, etc. However, in order to deal with the changing market environment, to serve their clients in an optimal manner, to fulfil public interests and sometimes to generate diversified revenues, port authorities have extended their core activities, as well as taken up additional tasks next to existing functions.

Port environment, stakeholders and interests



Changing role of the port authority

Estimated impact of trends on different types of ports

● Strongest effect ○ No effect

	Larger ports	Smaller ports	More industrialised ports	Less industrialised ports	Urban ports	Capability match of traditional governance
Increased focus on sustainability	●	○	●	○	●	Low
Increased focus on innovation	●	○	○	○	○	Low
Shifting trade developments	Near-shoring	○	○	○	○	High
	Alternative trade routes	○	●	○	○	High
	Supply Chain integration	○	○	○	○	Medium
	Security	○	○	○	○	Medium
Increased community awareness	○	○	●	○	●	High

This table shows through Harvey ball structure the estimated impact of the trend categories on different types of ports. The impact is to be considered relative to the other port types. A single port can be a combination of two- or multiple port types, and for simplicity, the impact per port type has been shown. The list of port types is just as the overall list of trends, non-exhaustive. Furthermore, the capability match with the traditional governance structure is presented. This indicates how flexible a traditional port authority with a landlord model can respond to the trends.

As mentioned on the previous page, the port authorities of all port types are impacted by sustainability related trends. Smaller and less industrialised ports to a smaller extent as urban or more industrialised ports. **Innovation and digitisation is mostly relevant for the larger ports due to the high investments**, although it is important not to leave the smaller ports behind since this could cause an imbalance in digital capabilities across European ports. This trend is also to a certain extent **relevant for the less industrialised ports, assuming they reap more benefits from optimised logistics systems**. The trade development trends vary across the port spectrum and are largely dependent on port ecosystem composition and geographical location. The community expectations impact are similar to the sustainability trends with the exception that these are less relevant for the less industrialised ports.

Source: Deloitte analysis and workshop input

Changing role of the port authority

Governance for an increasingly digital and green world

The landlord function can still be considered the principal function of a port authority in the EU. Depending on the size of the port (port authority back office strength), industry mix (complexity), and location (surrounding pressure), ports within the EU can be plotted on the figure on the evolution of port governance from far left to far right.

The majority of European port authorities is currently somewhere in between the entrepreneurial port and proactive initiator role (see figure). Over time, many names, like conservator, entrepreneur, facilitator and others, have been given to the different roles that port authorities undertake when they are in this transition. They all indicate that **most port authorities are becoming more active and are taking on a more conducting role, mainly with regards to energy transition and digitisation.**

This increased position in the “driver seat” is reflected in the traditional roles of a port authority:

Landlord: more proactive ecosystem management when it comes to attribution of certain activities to certain port areas

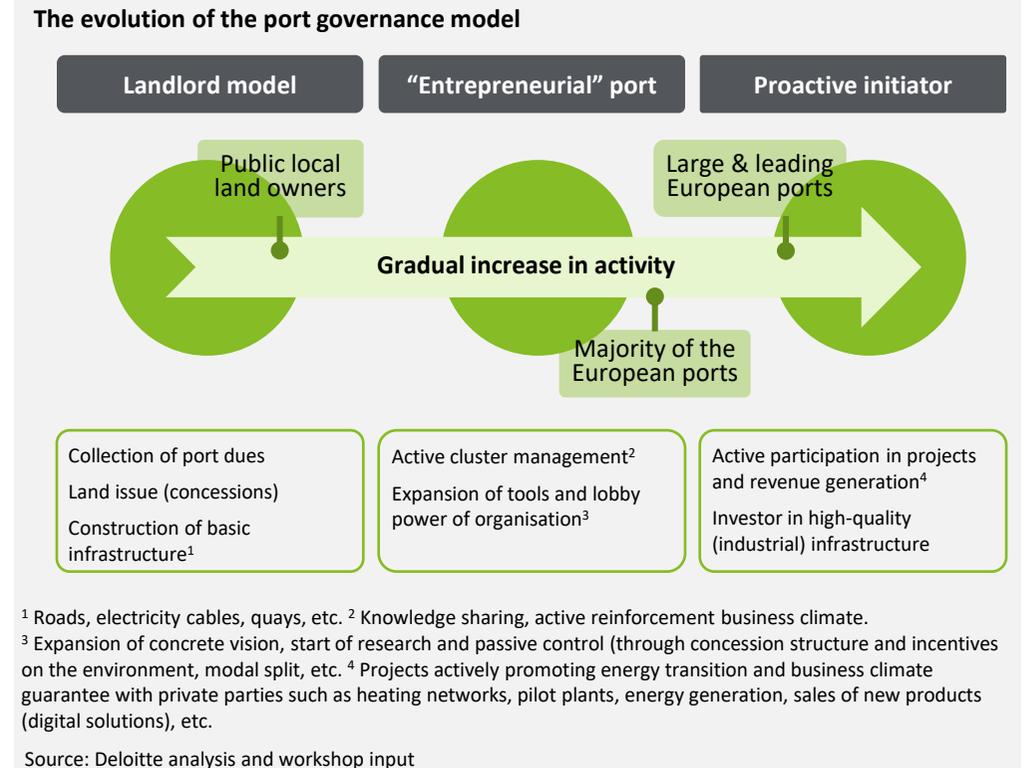
Community builder: more complex community interactions due to increased specialisation and options for land use

Regulator: more complex environment given automation, cyber security, etc.

Operator: possibility to grow the operator role (e.g. utility provision or digital use cases like digital twin and 5g networks)

It is important to note that not all these roles are applicable to all European seaports. This variety and flexibility of roles is mirrored in the European Port Services Regulation (EU 2017/352) which does not prescribe a single governance model for European ports, different port governance models are allowed as long as certain rules were respected.

In addition to the traditional roles, **a new role is coming to the forefront. The role of investor**, closely related to the operator role. Overall, the hybrid character of port authorities remains: first there was a trend from a narrow public- to a more entrepreneurial role, now both public and entrepreneurial dimension are becoming more important.



Changing role of the port authority

Evolution and development of port authority roles*

	Regulator*	Landlord	Operator	Investor	Community builder
Traditional role	<ul style="list-style-type: none"> Focus on controlling, surveillance, and policing functions to ensure the safety and security of ship and cargo operations (VTS) 	<ul style="list-style-type: none"> Focus on management, maintenance, and development of the port area, the provision of infrastructure, and the implementation of policies and the development of strategies 	<ul style="list-style-type: none"> Focus on technical-nautical services and the physical transfer of cargo between sea and land 		<ul style="list-style-type: none"> Focus on aligning different stakeholders in the port area to improve the business climate, reach their sustainability goals, increase cohesion with city
Expected evolution of role	<ul style="list-style-type: none"> Possible expansion of traditional role on for example: <ol style="list-style-type: none"> Regulation of autonomous drones/ships Regulation of renewable fuels (e.g. bunkering requirements) Regulation on cyber security 	<ul style="list-style-type: none"> Ports take an even more proactive role and orchestrate all area developments within the port, leading to a strategic landlord role (such as strategic/pro active attraction of port industry, new industries/sectors, etc.) 	<ul style="list-style-type: none"> Operations can increase, depending on the chosen revenue model behind the sustainability transition (facilitating services or investing in infrastructure) and the digital transition (develop or not develop digital tools) 	<ul style="list-style-type: none"> Investments in sustainable and digital solutions increase, as part to be more diversified in their income streams and to offset a potential stagnation of trade and passenger movement, influencing revenues 	<ul style="list-style-type: none"> A driving (e.g. PCS) and entrepreneurial role going beyond the port area and the port stakeholders, followed by a facilitating role in external logistics and maritime data sharing initiatives

Future port authority role



* Very limited and dependent on port in question

Changing role of the port authority

Building resilient port strategies for the future

Strategy is about making choices that uniquely transform a port to better its position. This also goes for ports considering the changing market environment. **Port authority strategies were always a difficult balancing act.** Which areas to redevelop, which connectivity issues to tackle, which investments to make, development of new land vs. redevelopment of obsolete port area to urban use, etc. This has only become more complex. The drivers and trends mentioned in this document, and rapid unpredictable events such as COVID-19 and the Suez blockage, put increased uncertainty on port planning (master planning) and long-term port strategy development due to an increased need for agility and flexibility.

The aspiration and mission remains the same for most port authorities

Even though the external environment is changing at an increasingly rapid pace and ports are rethinking the optimal way to deliver value to the community, **the core mission and vision of most port authorities remains unaltered.** For example: contributing to state-of-the-art connectivity for the region (the EU), acting as a (intermodal) hub for the local region, ensure safe, efficient shipping traffic, maximise added value and employment, etc. The shifting environment is however putting extra layers on top of this ambition. For e.g. promote a innovative start up environment, ensure sustainable port development, facilitate environment-friendly transport, etc.

“Where to play” is increasingly complex

The different activities performed within the port area have become more numerous over the past year. Where in the past the focus was on infrastructure provision for activities such as containerised and non-containerised logistics, fossil fuel & chemical industry, fisheries, etc., today there is a large differentiation of possible uses. The rise of notions like the blue economy, the incursion of urban activities on port land, the specialisation of industry (e.g. renewables) and logistics (e.g. project cargo vs. containerisation) all lead to different choices on facilitation and strategic focus. Each port ecosystem is one of a kind, the mix of companies, modes and activities is

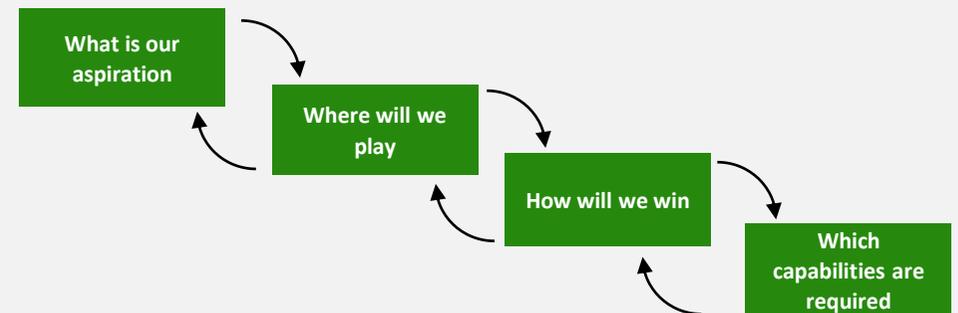
unique. **Given the changing market environment, it is expected that port authorities will play more towards their own strengths.** By targeting and building on what made the port cluster successful in the past, port authorities can build a better port for tomorrow and service their region in the most optimal way.

More “ways to win”

There are numerous niches for port authorities to focus their port ecosystem development on. As stated in the prior paragraph, the existing ecosystem is important when selecting “where to play”. When it comes to the “how to win” in the selected segments, a similar range of possibilities exists and is ever growing for port authorities.

(continued on next page)

Deloitte strategy cascade™



Crafting a successful strategy is the result of a set of interrelated choices. A strategic focus can become diffused over time as new opportunities are pursued. Using the Strategic Choice Cascade as a guide we can map the new options and determine the impact for the ports of these new choices

Changing role of the port authority

As is the case with the ambition and “where to play”, the “how to win” for the port of the future is still very similar to the traditional “how to win”. Providing seamless connectivity, safe navigation, prime infrastructure, competitive prices, etc. In addition, port authorities have more tools at their disposal for attracting new cargo, industry or diversifying revenue streams.

Winning in the “new economy” industrial and energy generating clusters requires a solid “how to win” approach. First of all, **the link with the current ecosystem needs to be in place (testbed for innovation, research and development cooperation's, etc.), and second, the correct infrastructure needs to be in place to allow firms to invest in the cluster.** Ports are taking various degrees of involvement when it comes to securing new investments. Some are approaching this by building joint infrastructure (e.g. pipelines, heat exchange, CCU). The structure of these investments is dependent on each port, some take a participation in utility companies, whilst others use more traditional means. Other, more hands-on approaches include investing with capital in certain renewable developments to de-risk the private investments, examples include waste to chemical initiatives and wind on land and sea farms.

A similar approach can be found in digital/innovative investments where certain port authorities are taking a **more controlling approach in the development of new tools such as PCS, digital twins or 5G networks.** Some authorities develop these tools inhouse whilst other cooperate with other port authorities or IT providers.

In order to successfully convert a strategy in a winning roadmap, large investments are required. The investment gap in IT and renewable infrastructure remains challenging for both larger and smaller ports. In case of IT, the investment frequency and the frequency of required maintenance is relatively high. This is due to IT infrastructure having a depreciation period of approximately five years, compared to 20 years for the traditional physical infrastructure. Ports will have to ensure they have sufficient capital to adapt to these additional digital requirements.

Building the correct capabilities with economies of scale, scope and skill

For ports to be the engine of the transition to sustainable energy or to industry wide digitisation, ports should strengthen the business climate for the purpose of the transition, to attract new companies and retain existing companies.

In order to be able to successfully carry out this role, **port authorities should build up knowledge and capabilities around the technical aspects of the required investments, as well as the financial aspects.** They will have to develop human capital agendas to be able to train their workforce in these new knowledge and capability requirements. Where in the past a strong focus on economies of scope and scale was seen, today a shift to economies of skill is visible.

Port cooperation – from memorandum of understanding to merger



Port cooperation comes in many forms and sizes. Recent market examples of full mergers and investment/acquisitions exist inside and outside of the EU, but far more frequently cooperation occurs under a less invasive form. Cooperation agreements and alliances and even joint ventures are prime tools to achieve digitisation and sustainability goals, be it in cross industry clusters or directly through bi- and collateral deals.

Changing role of the port authority

Developing a holistic view

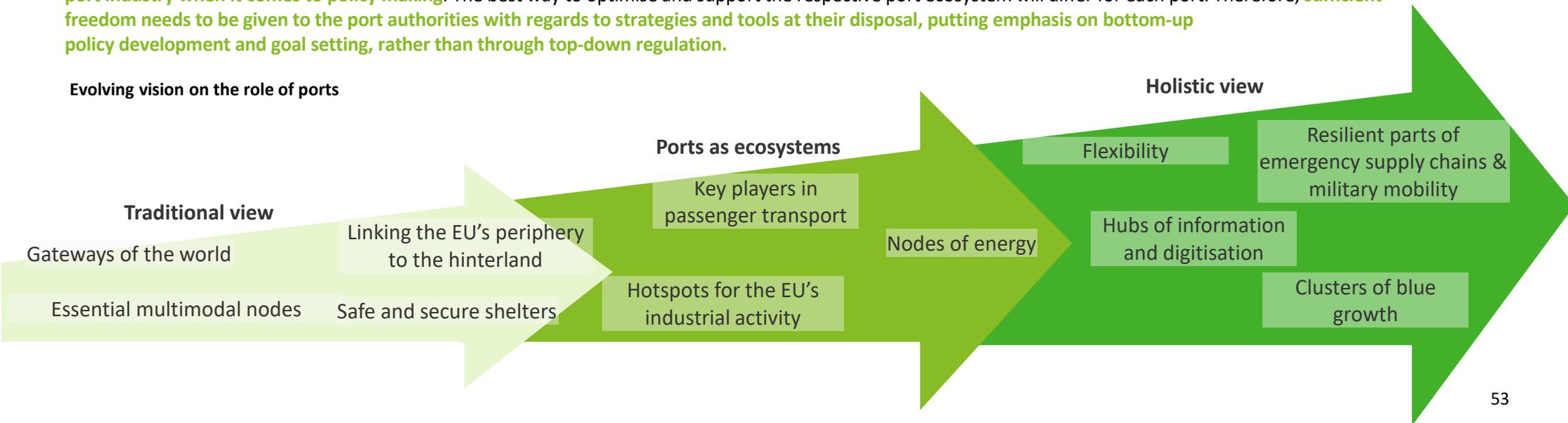
When looking at a port, be it from a policy maker, port professional, academic or advisory angle, it is important to consider all the port authority's facets and roles. Ports must be recognised for their value for and impact on the surrounding region (see community expectations). The diversity present in the European port network, be it through specialisation on certain cargo groups or connectivity to a specific hinterland via certain transport modes, allows for more resilience of the European transport sector, well balanced and diverse connectivity and a spread of strategic industrial activities.

Each port has a different internal ecosystem. In some cases, this ecosystem is diversified, which reduces the risk of economic shocks and which can be beneficial in the set-up of circular economies. Sometimes it is specialised, which generates substantial economies of skill in the specialisation in question. It needs to be understood that the current developments in the maritime and logistics industry will affect every port in a different way.

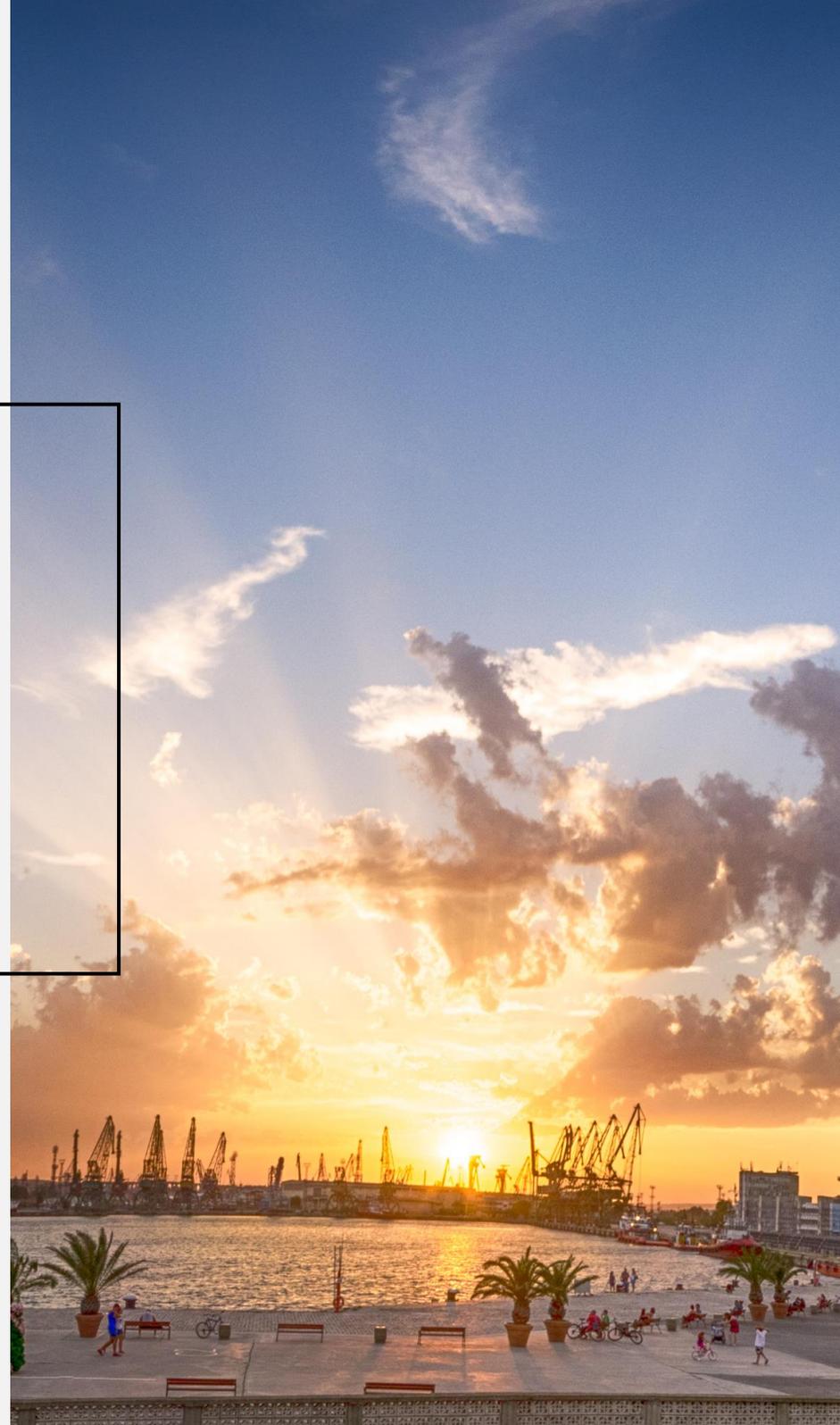
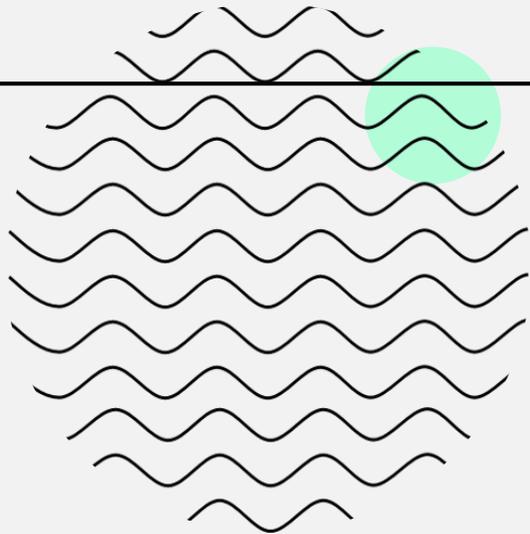
Ports are nodes in European passenger & cargo transport networks and hubs of industry and energy. They play an important role going beyond port operations, to bolster local innovation, wealth generation and national & supranational resilience. Only if ports are recognised for the key role they play in the various areas, ports can keep serving society now and in the future.

On the one hand, this large diversity enables ports to generate many benefits. On the other hand, it makes it **challenging to find many common denominators amongst the port industry when it comes to policy making**. The best way to optimise and support the respective port ecosystem will differ for each port. Therefore, **sufficient freedom needs to be given to the port authorities with regards to strategies and tools at their disposal, putting emphasis on bottom-up policy development and goal setting, rather than through top-down regulation.**

Evolving vision on the role of ports



Conclusion



Conclusion

The study looked at the major drivers and resulting trends impacting the European port industry, resulting in a vision on the evolution of the role of the port authority to navigate this new environment. The following section summarises some of the main findings.

The first set of findings of the study, brought on by interviews and desk research, reveals that at the core, port authorities are not only taking on new activities. They are transforming their existing activities as well. Whereas certain ports are focused on pure traditional activities such as managing, building and maintaining port infrastructure, others go beyond the traditional landlord function and take on new tasks and roles.

Ports do more than before

The world in which ports are tasked to facilitate global transport flows and create stable, resilience port infrastructure has become far more complex over the past decades (see chapter on demography and geopolitics). This has not lessened the core role and function of port authorities, but only added to their complexity.

Port authorities are still neutral players in an increasingly competitive market environment, improving connectivity, facilitating private companies, attracting investments, but they are also developing new roles to better serve customers, to increase added value to customers, to meet general interest obligations.

These evolved, and new roles are sometimes a direct result of the for an increased demand for public tasks such as more focus on sustainability or a need for a neutral innovation facilitator. In other cases, they have become a business opportunity (although never in competition with the port clients), for e.g. through investment in renewable energy generation or through the development- and sale of inhouse digital tools.

Ports do things differently than before

Port authorities have always had a number of tools at their disposal to perform their function. Depending on the port authority in question, the landlord, regulator, operator and community builder roles occur in varying degrees across the European portscape. **In addition to these roles, ports are leveraging a more strategic and active role as investors** (see chapter on Governance for an increasingly digital and green world) **taking a more hands-on approach, especially with regards to energy transition.**

One of the core functions of ports which are handled differently today is the facilitation of energy production. Facilitating energy creation in ports is a traditional function of port authorities. What is new however, is the requirements to facilitate the new wave of both sustainable energy and industrial activity. The “new economy” of renewables builds upon lower volumes and new infrastructure. Ports are at the cusp of this transformation and will remain the energy hubs of the future, albeit with (mostly) different feedstocks. This leads potentially to new winners and losers, where some ports can grow exponentially due to an improved position in renewables whilst others might lose market share due to a shift from fossil to (lower volume) renewables.

Even if existing activities have not changed for some ports, the way of working has changed. **By utilising advanced technological innovation** (see technology and innovation chapter) **port authorities can optimise their insights into the port cluster, identify underutilised assets through digital twins, optimise safety and security through IoT networks and optimise their own back office operations.**

Conclusion

A second set of findings focuses more on the role of ports in the wider network and the importance of diversity within- and outside the port. Where ports were traditionally regarded as moving away from their municipal department roots, today there is an increase in public benefit related functions. One of the more notable developments is that employers need to proactively set up strategies how to attract the needed profiles to the port and to re-train the existing workforce.

The public importance of ports is growing (again)

Port governance evolution showed a clear evolution of the port authority focus towards a more independent type of “entrepreneurial” port, away from the traditional municipality structure. Today this is still very much the case a ports are expected to be commercially focused entities. But on top of this evolution, the public function and role of ports is growing again.

The main drivers for the **increase in public benefits generated by the port are the increased importance of ports as strategic assets** (protection form aggressive FDI, critical infrastructure for military and healthcare supply chains, etc.) **and the role they can play (and already play) in the greening of transport, industry and energy generation.**

The tension between ports being considered commercial, revenue generating entities, and yet being expected to address public interests and deliver societal value is only expected to increase in the near future.

Nodes of critical infrastructure and strategic value

As explained previously in the “Developing a holistic view” segment, ports are growing in complexity. They are at the crossroads of many activities, modes and stakeholders. They are essential multimodal nodes, hotspots for industrial activity, hubs for information, clusters for blue growth, etc.

Ports authorities have an important role in the value chain, as neutral matchmaker and facilitator.

It is therefore crucial that ports remain public critical infrastructure on top of their commercial activities. A perfect example of this is the actions certain ports undertook after the recent Suez crisis, by aligning with stakeholders in the value chain to remove congestions as swiftly as possible.

Diversity is key within- and amongst the ports

As mentioned multiple times throughout the document, ports are very diverse in their function and nature. This is of great benefit to the European transport system since **it allows for regional specialisation, well balanced and diverse connectivity and a spread of strategic industrial activities.**

Also internally, diversity in a port ecosystem reduces the risk **of economic shocks and can be beneficial in the set-up of circular economies.** Some ports achieve diversification by creating economies of scale, others through far going cooperation initiatives with other ports, or even mergers.

A final aspect of diversity which is important to note is the diversity of the port workforce. **First, ports have traditionally employed many blue collar workers. The increasing digitisation will attract more diverse profiles to work in the port and requires the respective employers to retrain the existing workforce.** Second, ports offer opportunities for the available multicultural workforce in the city by providing diverse employment options for their workforce.

Conclusion

Following the insights that port authorities are doing more and that their function needs to address the greater public good, it is important to note that the rising uncertainty also requires flexible solutions, certainly now ports are expected to do more activities with less (money and land). Traditional tools like master planning are insufficient to deal with the rapidly changing environment, creating a large risk of lock in. Due to the increasing pressure on land use (city growth, blue economy, re-shoring, etc.) and resources it is becoming increasingly difficult to benefit the entire port ecosystem.

The rising uncertainty requires flexible solutions

The traditional long-term perspective and planning of ports is under pressure because of short-term (overnight) changing environment, examples are included in the geopolitical segment of this study. While the European port industry has showed a remarkable resilience and adaptivity during the disruptions in 2020, it remains challenging for ports, being heavy assets to adapt or radically change in the short-term.

Going forward, there will be challenges to overcome to make sure that the flexibility and adaptive capacity of the port industry is not hindered. On the one hand agility of the port managers is needed (change direction when needed, adapt, diversify) whilst on the other hand there is a need for facilitation from the legislative and government environment. The public tendering rules, authorizations and funding mechanisms implies often long lead times for investments in ports.

When looking for supportive solutions in the future, it is important that flexibility in procedures & planning is guaranteed, and sufficient autonomy of ports is respected.

The recent global trade shock of the blockage of the Suez canal has made it once again clear that ports are an absolute necessity to provide buffer in the global supply chains. The backlog of containers was handled efficiently by European ports. Going forward it remains of the utmost importance that ports remain both in status and approach, resilient strategic infrastructure.

Doing more with less

The investment gap in IT and renewable infrastructure remains challenging for both larger and smaller ports. Especially since the investment frequency and the frequency of required IT maintenance is relatively high (5 years versus 20 for traditional port infrastructure). **Due to the high costs involved for developing and implementing large scale digital platforms, the “true smart ports”, using the maximum of innovative tools, will probably remain limited to the larger ports. The same gap is present for renewable infrastructure where the return on investment for the port authority is lower, slower and more uncertain, whereas the benefit for the wider society is larger than with traditional port infrastructure.**

In addition to the pressure on innovative and green investment (timelines), **some ports are faced with less direct resources due to for e.g. corporate taxation policies, declining public investments, higher dividend payments to shareholders, etc.**

Basic technological innovation (e.g. allowing for paperless trade, digitising back office operations) will be a must in all ports, no matter how small, but the large high tech IoT platforms are not expected to become the norm. In order to facilitate new entrants in the port ecosystem (blue economy, renewable energy generation, circular networks), ports will need to enable the availability of already scarce space. Other trends like re-shoring, increased need for resilient infrastructure considerations, environment compensation, and mixed urban use taking over older port areas only reinforces this scarcity of land. This puts increased pressure on the current (added) value generated by the port activities already in place. **Certain ports are using this to their advantage, rethinking existing and new port areas to optimise space and circular potential within the port.**

Conclusion

To counter the uncertainty and larger need for flexibility, certain ports are actively pursuing different forms of cooperation. As discussed in the chapter on “Building resilient port strategies for the future” there are many forms of cooperation which can benefit ports, from ad-hoc cooperations between ports or between ports and external stakeholders to far reaching mergers between port clusters. An important form of cooperation is the synergy between port and city. This has always been a co-dependent relationship between both but today an increased integration is visible through mixed use waterfront redevelopment, and alternative benefits generated by the port to the city (and the extended region).

Cooperation is central

The increased geopolitical, energy transition and technological complexity, combined with challenges such as consolidation in the shipping and logistics market enlarges the case for (port) cooperation.

Between port (authorities), cooperation is a key tool to either share knowledge or improve their respective competitive position, going from pure market position improvement to improvement of regional sustainability and innovation. **This cooperation can take many forms, from a simple cooperation agreement MoU to a full joint venture or merger.** The type of cooperation is dependent on the structure of both ports and the goal of the cooperation itself. A joint investment in PCS or CCS infrastructure can for example be structured under a joint venture whilst improved integration and sharing of resources can better be achieved by a full merger.

Cooperation occurs either between ports or between a port and an external stakeholder. Examples of port authorities cooperating with external stakeholders in the industry are ample. E.g. port authorities teaming up with digital service provider to develop technological use cases, joint investments to de-risk new renewable energy investments, intensive cooperation with hinterland connectivity providers, etc. The main goal of this external cooperation is often to leverage on external knowledge or de-risk certain events and investments.

Revitalisation of the port city relationship

Cooperation with cities is a prime example of (successful) external port cooperation. Ports and cities often have a co-dependent relationship. Urban nodes for example, are urban areas where the transport infrastructure of the trans-European transport network, such as ports including (cruise) passenger terminals, airports, railway stations, logistic platforms and freight terminals are located in and around an urban area. **Since many ports are part of urban nodes, communication, cooperation via joint events and the exchange of experience within and between nodes are crucial aspects of the further development.**

The relationship between ports and cities has become more complex over time. **The growing urbanization and the related expansion of cities has increased the pressure on port land.** In addition, the ongoing digitisation and need for more knowledge intensive profiles can be covered by the supply of highly trained profiles from an urban environment. In the other direction, ports generate (green) energy for the city, generate employment and added value, and provide sources for innovation.

Going forward it is expected that the port city integration will increase, and the port city relation could be seen in a new perspective. Ports have a possible role to play with regards to urban mobility e.g. maintenance and storage of shared mobility, urban logistics, generate green energy, provide different job profiles and mirror better the diversity in the city.

Conclusion

An important factor in cooperation and port city integration is transparency, here port authorities play an important role as neutral matchmaker in the value chain, but also need to increase transparency toward the surrounding communities on externalities and impacts. This is mirrored in the role port of the future can play in facilitating sustainable transport, either through solidifying the European ferry networks or promote sustainable (cruise) tourism.

Increased transparency towards the ecosystem and the value chain

Digitisation allows stakeholders to cooperate and integrate along the supply chain, and to optimise, manage and automate processes. Ports are actively becoming a digital hub, with port authorities as spiders in the web in which all stakeholders are connected and jointly collaborate. **This is a central role for port authorities as a neutral player to facilitate data exchange between more commercial players.**

A major challenge arising in these types of setups is the willingness of stakeholders to share data, and the way in which the data is shared. Port authorities are playing an important role in the underlying data orchestration, standardisation and exchange.

Transparency towards the wider ecosystem is of utmost importance for the sustainable growth of ports. Dissemination of the effect (both positive and negative) of port activities and the sharing of data and insights will increase the engagement of the surrounding communities.

Port authorities can generate a competitive edge by being more transparent towards local communities (including the business community) on financial and sustainable actions.

Reinventing maritime passenger transport

Maritime passenger traffic (both ferry and cruise) has been the most hit sector during the pandemic. While a safe and responsible resumption of passenger traffic will be a priority for Europe's ports, the sustainability issue remains equally important.

Ports are putting extra emphasis on facilitating passenger transport through improved ferry and roro connections. **Towards the future, ferry transport can take a more prominent leveraging on the sustainable tourist, commuter, and traveller, being an alternative to flights.**

In the wider cruise industry, the COVID-19 pandemic has brought an additional challenge to the forefront; health safety concerns will come on top of the sustainability concerns. The license to operate for future cruise business will depend on both sustainability and health safety concerns.

Eventual risk assessments for cruise have to be made in close dialogue with the local community and authorities. An infected ship can create important port of refuge issues, which can put pressure on the local community and local health authorities. Health safety infrastructure become an additional driver of investments.

Literature and photo credits

Literature

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