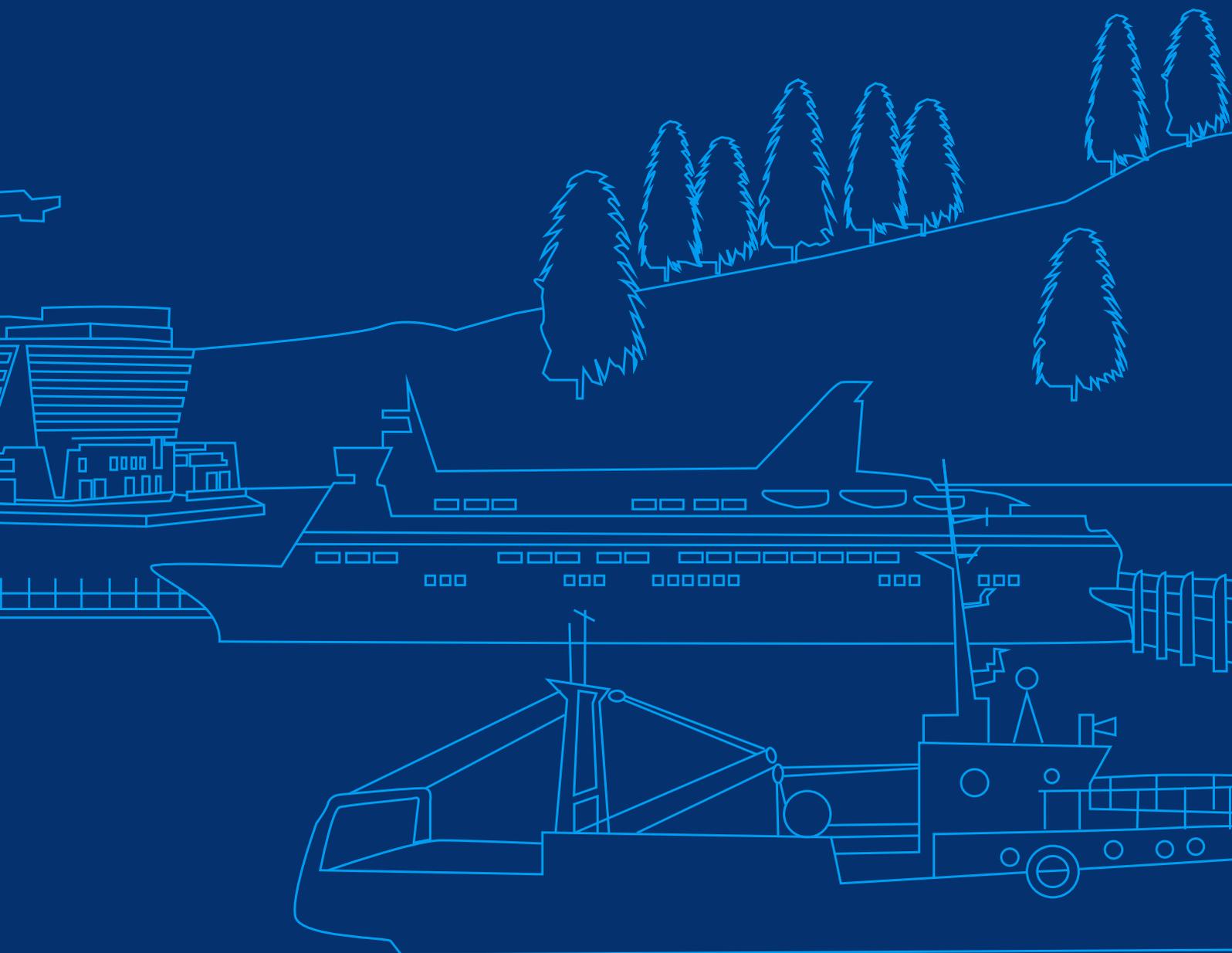
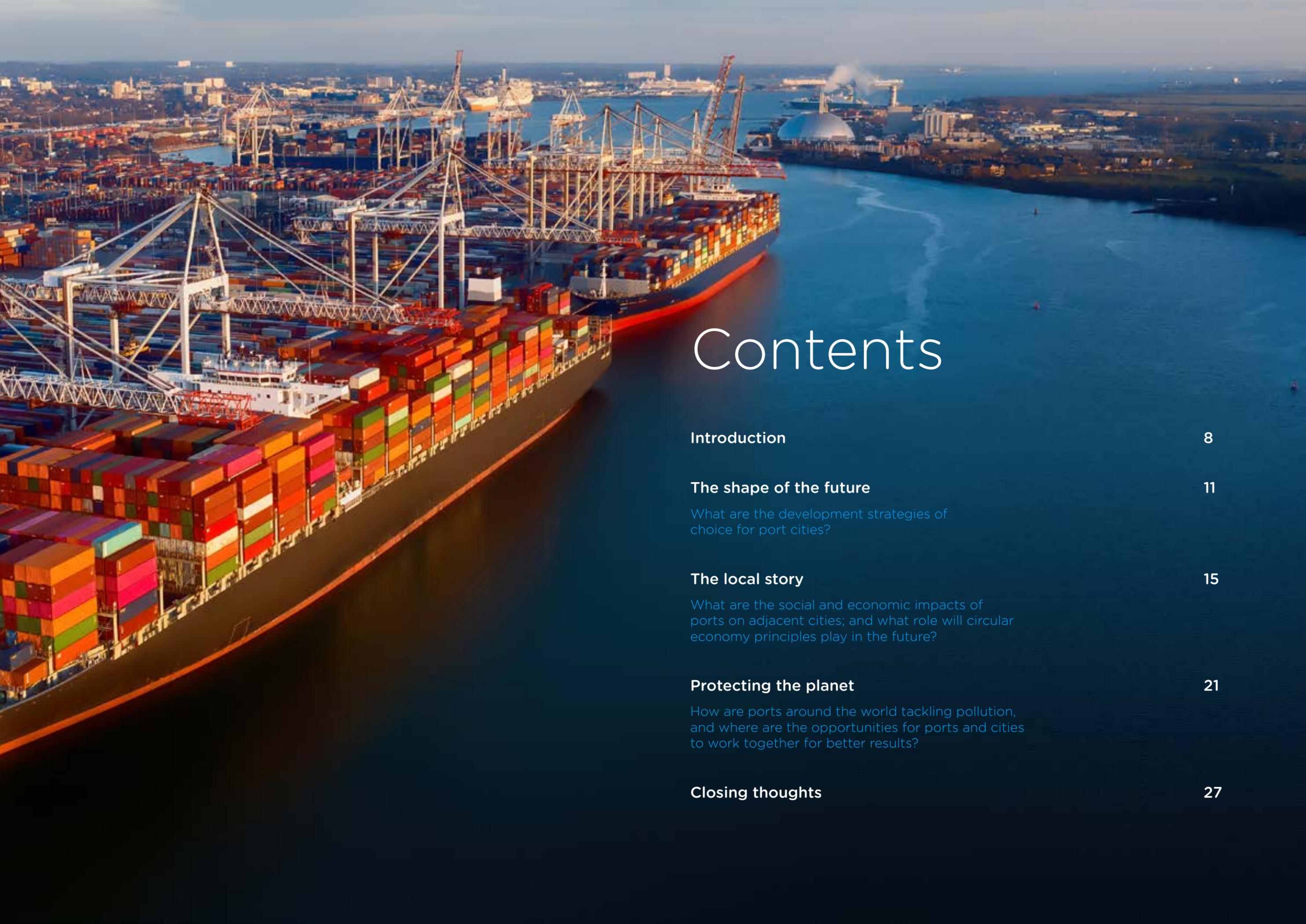


Port cities of the future

Summary research paper





Contents

Introduction	8
The shape of the future What are the development strategies of choice for port cities?	11
The local story What are the social and economic impacts of ports on adjacent cities; and what role will circular economy principles play in the future?	15
Protecting the planet How are ports around the world tackling pollution, and where are the opportunities for ports and cities to work together for better results?	21
Closing thoughts	27

Introduction

How will the world's port cities continue to be commercially successful, create positive synergies amongst local stakeholders, and manage their impact on the environment responsibly?

These are the questions we posed to academics at the University of Southampton as they embarked on a major new research project examining the current activities and future plans of port cities around the world

In planning for the future, port cities are confronted by the same issues as all other cities, but they also operate with a range of challenges and opportunities that are unique to their particular context.

These are shaped by the complex role that the port plays in a city's history and culture, as well as ports' industrial development and their impact on local communities, the economy and environment.

Ramboll and the University of Southampton's four-year research programme has gathered insights from professionals employed by port authorities in **26** countries around the world. The sample includes **16%** of the world's top 100 container ports and **10%** of the world's largest cruise ports.

Our ambition is that this programme of work will support ports and adjacent cities to form more harmonious relationships, to finding synergies in their objectives for future development and overcome barriers where they exist.

The findings point to the potential for a triple win for port cities in the future - in sustainable diversification which can deliver growth for ports whilst increasing benefits for the local economy and reducing environmental impacts.

As we publish in the wake of the UN's IPCC Sixth Report, billed as a 'code red for humanity', and COP26, we welcome this new intelligence, which charts the path towards a bold green future for port cities.

Research participation from port authority professionals representing:

26

Countries

16%

of the world's top 100 container ports

10%

of the world's largest cruise ports



The shape of the future

What are the development strategies of choice for port cities?

Around the globe, ports are key drivers of economic development, handling over 80% of world trade, facilitating the movement of people, creating infrastructure development, supporting direct and indirect job provision, attracting investment and lowering costs for producers and consumers.

Understanding the drivers of and barriers to future port development is essential for improving the way key stakeholders and ports engage. City authorities need better foresight around the development strategies ports are likely to pursue, in order to align interests and planning decisions, and find opportunities for port strategies to build in benefits for local stakeholders.

In this way, port cities will then be able to achieve more sustainable development and ports will become more resilient businesses.

Strategies for growth

Over the centuries, ports have always adapted to remain competitive and suit the needs of those who use them. The processes of specialisation, diversification, expansion and relocation are the key strategies deployed in both historical and current port development. The range of pros and cons for each of these approaches have been studied, but there is currently little consensus as to which option ports are currently engaged in pursuing, and a lack of a truly global perspective on this issue – a gap this research seeks to fill.

Specialisation as a development strategy, which sees a port become a centre for lift on/lift off containers, roll-on/roll-off wheeled cargo, or dry bulk for example, offers increased efficiency, lower costs and economies of scale that benefit ports.

Diversification, in contrast offers dependency reduction, risk reduction minimisation of loss and economies of scope. Diversification can range from using existing infrastructure or technology to provide a new service; deploying new infrastructure for the same customer-base; or developing new infrastructure for a new target market.

A strategy of **expansion** allows a port to draw on the benefits of both specialisation and diversification but has challenges, in particular around

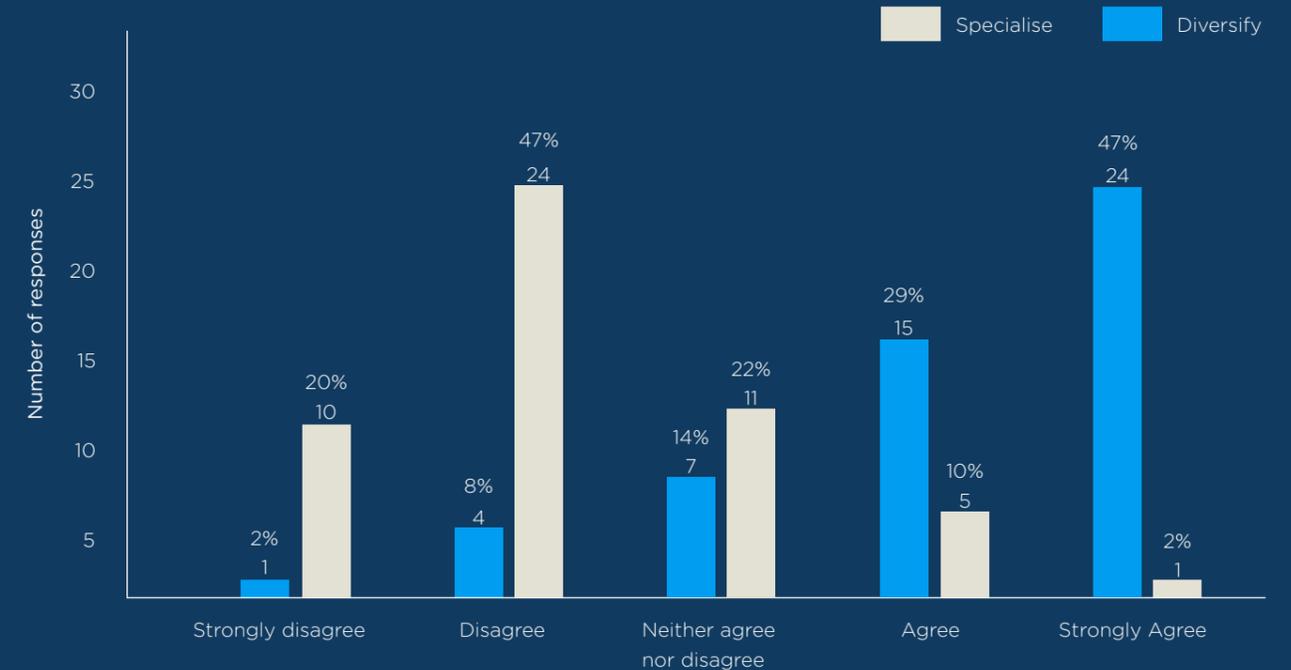
land use and potential conflict with city authorities and local stakeholders. Some ports choose **relocation** to help manage these conflicts – for example Helsinki, Busan and Shanghai. This can reduce the negative impacts of port activities by removing some or all of the port-city interface but comes with a financial cost. There is also a knock on economic and social impact when a port relocates, as it is decoupled from its immediate neighbours, breaking cultural bonds, as well as reducing opportunities for local employment.

Diversification: ports' strategy of choice

Though there is no clear consensus on which approach is more effective at securing a port's long-term future, much of the recent literature has suggested that ports should specialise in order to remain competitive and to better weather economic downturns. But what is the reality on the ground? What strategies do ports around the world actually have in place for their long-term development?

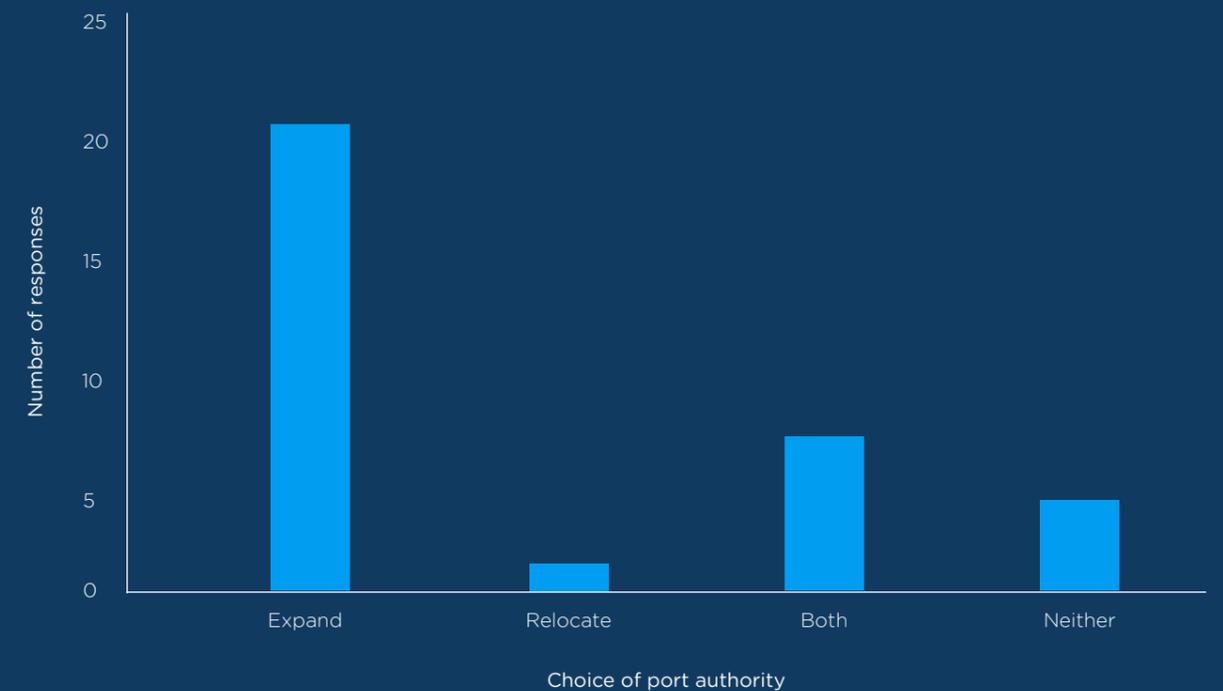
In fact, our research uncovered a strong preference for diversification as a strategy, with the **majority** of ports agreeing or strongly agreeing that diversification is beneficial. In contrast, the majority of respondents disagreed or strongly disagreed that specialisation is beneficial (fig 1).

Figure 1. Views on diversification and specialisation being beneficial among port authorities



The data suggests that ports of all sizes, in all countries, and at all levels of economic development prefer diversification: clearly viewing diversification as a more strategic path to growth than specialisation.

Figure 2. Desire to expand and/or relocate among port authorities



Further, the research shows that relocation is not a desirable option for port authorities and that the vast majority would prefer to expand their current location (fig 2).

Barriers and opportunities for port city development

We explored some of the barriers ports face to their development strategies. The data reveals that high costs were cited at the biggest obstacle to both expansion and relocation for ports. Co-operation with city and municipal authorities is also a concern for both

expansion and relocation, as are local interest groups – illustrating the growing role of stakeholders outside the traditional group of decision-makers.

The data indicates that close proximity between port and city leads to increased tension around land use. Given ports' preference for expansion over relocation, this is likely to be a flash point in future.

The results suggest that the aims and objectives of ports and cities are not currently in alignment. Improving relations is vital to alleviate barriers to development. The will for this already exists. The data suggests that ports are strongly in favour of joint working, with 84% of the sample agreeing that closer co-operation between port and city would be mutually beneficial.



What might the future look like?

Debunking the assumption that ports around the world are likely to want to specialise rather than diversify is useful for setting expectations for city authorities. This insight gives them foresight that ports are likely to want to expand in their current location and pursue diversification.

Expansion, of course, causes friction with local stakeholders, but alongside diversification it can offer opportunities for ports and cities to re-engage with each other to introduce port services that support sustainable development and greater localised benefits, for example renewable energy or circular economy. The OECD has stated that a diversified port could drive economic diversification of a wider city-region and vice versa. Specialisation in contrast offers fewer additional benefits for cities.

We know that currently there is an absence of joint planning, with port and city master plans usually drawn up separately, featuring few areas of overlap.

The data makes clear that there is a strong case for pursuing joint master planning and Local Area Plans between cities and ports. This approach could open up, for example, joint thinking on transport infrastructure to allow for the construction of freight corridors to manage port traffic. It could facilitate more effective land use and make it possible to introduce new technologies, such as renewable energy and circular economy approaches.

If ports and cities work together, the potential is there for benefits not only to port and city authorities, but across local communities and stakeholders.

The local story

What are social and economic impacts of ports on adjacent cities; and what role will circular economy principles play in the future?

What do ports contribute?

From both a social and economic perspective there has been a considerable shift in the role of the port over recent decades, and indeed centuries.

In the social context, historically, where a city adjoins a port, the port is at the heart of that city's identity, shaping its fabric and its people. In the port city of Liverpool in the UK for example, the city's most iconic buildings relate to its maritime heritage. Over the centuries, the availability of casual labour as a result of port development attracted waves of migrants including groups from China, Wales and Ireland, in turn influencing Liverpoolian food and political views. It's clear the impact of the port goes far beyond the simple movement of goods and people.

In the economic context, historically port-cities have seen a high level of integration of infrastructure between port and city, and plentiful local employment. Today however, ports are more cut off from their local area.

There is less local employment, as a result of mechanisation and automation of port functions, there is less public access, and increased security around ports.

How are ports around the world seeking to improve relationships with their local communities and build on the social benefits they can deliver? What is the economic impact of ports at the local level? How can they achieve sustainable development and what role could circular economy principles play in the future of port cities?

Port cities: the social context

Today though the connection of a port to the lives of local people has often dwindled, those same local communities continue to feel the negative effects of their neighbour's activities which can span potential or perceived visual blight, harmful air emissions, noise and water pollution, and increased traffic congestion.

If port city development is to be sustainable in future, the relationship between port and city must be restored. Local people must once again derive genuine benefits from the presence of a port. Ports must find ways to better relate to their communities and communicate what they have to offer, encompassing history, art and culture.

To date there has been a gap in the research examining how motivated ports are to engage with the social pillar of

sustainable development, and if they are, how they can best do so. This new data allows us to begin to fill this gap.

Does social impact matter to ports?

The research responses underscore that the answer is a resounding yes. This has been described as ports' quest to achieve a 'societal licence to operate'.

There is a high degree of consensus around the idea that ports should create local benefit, and that local people should be aware of those benefits. The research reveals an understanding by ports that they have to reduce the negative impacts of their activities.

96% of respondents agree that a port should create benefits for the local population / 96% agree that the local population should be knowledgeable about the port / 89% want to improve local attitudes to the port / 67% feel under pressure to reduce negative impacts

These figures reflect ESPO's findings that improving relations with local communities is a top priority for ports, and demonstrate that this is a global phenomenon, not one restricted to Europe. The lack of consensus around whether local people are aware of any benefits the port brings, or have positive views, illustrates that there is much progress to be made, but our research and understanding can help illustrate these benefits for wider stakeholder understanding and gaining support.

Of our research respondents...

96%

agree that a port should create benefits for the local population

96%

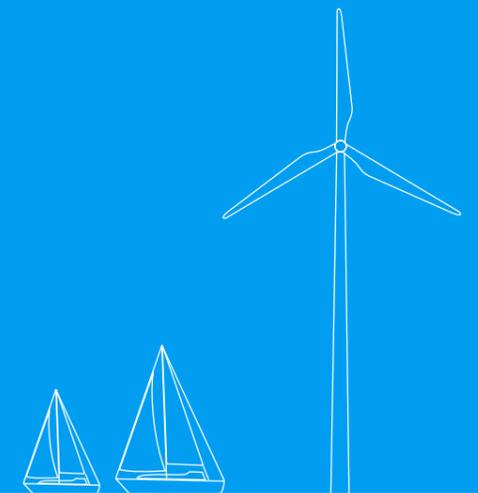
agree that the local population should be knowledgeable about the port

89%

want to improve local attitudes to the port

67%

feel under pressure to reduce negative impacts



How do ports connect with their communities?

Ports around the world endeavour to make a positive social impact using a range of methods: port centres offering information and a venue for in person visits, social media, education projects, maritime museums, port events, public access and donations of time or funds to local causes.

The research reveals that the majority of ports are already using one or more of these measures, most often turning to social media, port events and education as means to reach out to their city neighbours (table 1). These may be ports' preferred options because they are relatively low cost.

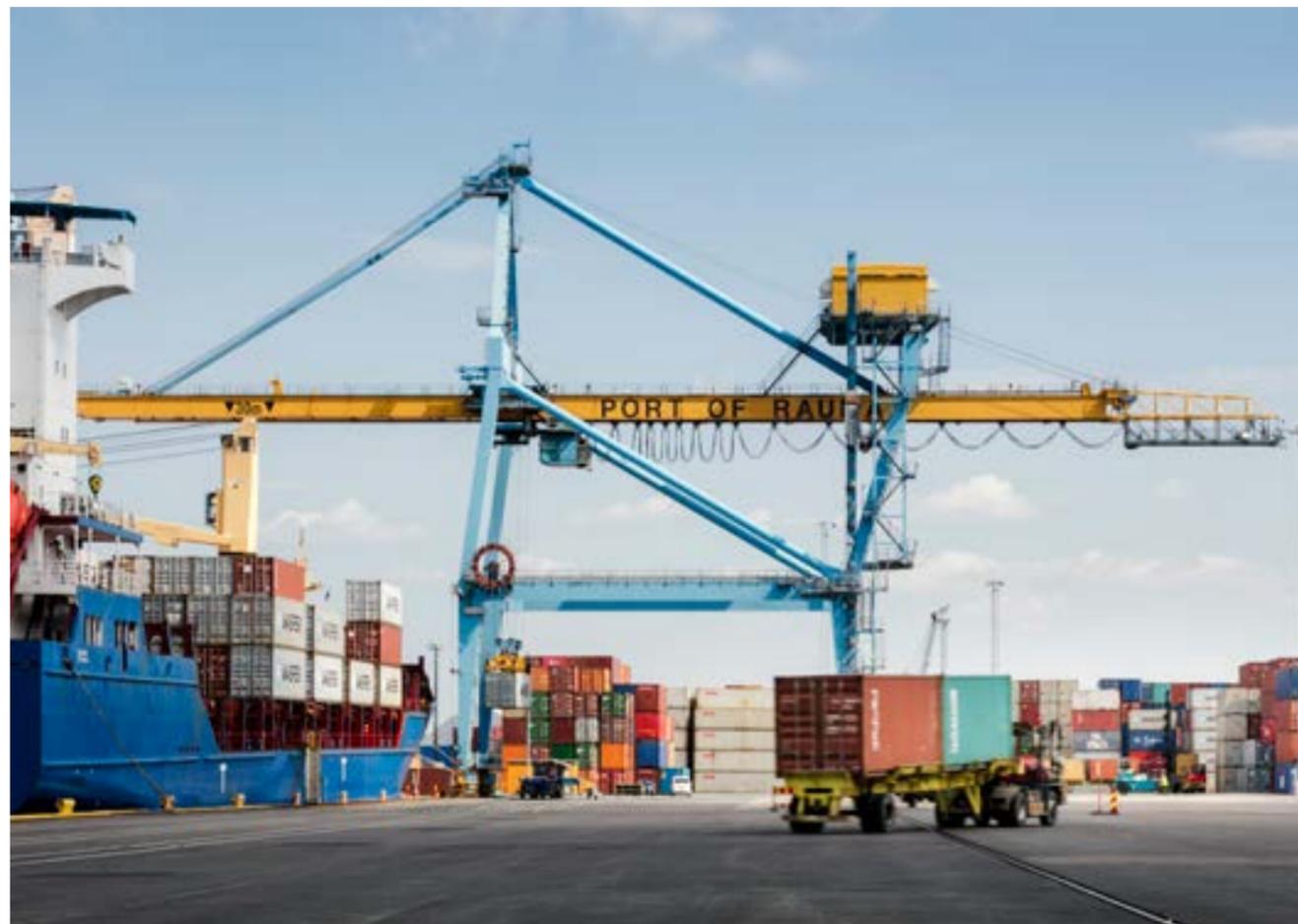


Table 1. Views on diversification and specialisation being beneficial among port authorities

Method	Current adoption levels %	Future levels of interest %
Port information and social media	81	84
Port Events	67	68
Education	63	77
Maritime Museum	46	55
Public Access	46	56
Port Centres	29	45

But, though widely adopted, responses suggest that ports may feel that the methods they are currently using are not working, and other methods may be more effective.

What can the data tell us about methods where ports have seen the greatest social impact? The measures highlighted as improving local attitudes are maritime museums and increased public access – this is despite the fact that they are also rated as being among the most undesirable for ports. The figures suggest that port centres are the option adopted least by ports – but they are the one with the most potential for growth, with a 16-percentage point increase between

current and future levels of adoption.

On the basis of this research, globally we would expect to see an increase in the creation of port centres in the future. Ports and adjoining cities should work together to maximise the benefits that port centres can provide, using them as focal points for other activities including providing education, port events, public access and maritime museums.

How do ports prefer to support these activities? The data tells us that providing financial support is the least popular option for most measures. The most popular means of providing support is information provision – which underpins

measures including social media and education.

We know then that ports are willing to adopt measures that will bring social benefits to the port city more widely, but may as yet not be making an impact with the measures they have chosen. For port cities to capitalise on the interest ports have in these measures, they may need to collaborate more closely on, for example, museums or education initiatives, and to offer support to overcome financial barriers to allow port interest in these measures to translate into action. By working together, ports and cities can both benefit.

Port cities: the economic context

Traditionally, ports have brought a range of benefits to port cities, from direct and indirect employment, to attracting investment and generating a knowledge spill-over created by the pooling of people and industries.

Today though, ports face a drag on their relationships with the cities where they operate. On the one hand there is a growing awareness of the environmental impact of their activities, yet on the other there has been a drop in local employment created by ports, and a decline in the integration of port/city infrastructure. The OECD found that 90% of the economic benefits of ports occur outside the port city area, giving rise to the real possibility that local economies may no longer significantly benefit from the existence of nearby ports.

If ports are to operate more sustainably and in greater harmony with local city authorities and communities, this issue has to be addressed. Revitalising social benefits – discussed above – is one part of the picture, but the economic challenge must be resolved too.

Ports' ability to add economic value through waterfront development,

maritime clusters or port-industrial development is established and well-studied in individual port cities, but there is a lack of research that takes a worldwide perspective. Building a circular economy is a newer approach for which far less global research exists. Are ports around the world interested in and ready to adopt circular economy principles? What are the barriers that could hold them back?

A circular economy paradigm shift?

What do we mean when we talk about a circular economy, and how does that look in the port context? The circular economy is a no-waste approach where materials and resources are kept in use within a closed cycle of extended use, reuse and recycling.

Achieving a circular economy is possible through focusing on every stage of a product's life cycle and creating opportunities and benefits. Done right, it reduces environmental impact, improves supply security for raw materials, stimulates growth, innovation, competition and the job market.

There are examples of ports already adopting circular economy approaches, such as Gavle in Sweden, where dredged

material was used to create new land for port expansion and Rotterdam in the Netherlands, which captures CO2 from industrial processes in the port area, for use in local greenhouses to improve crop growth. For the future it may be possible to apply circular economy thinking to issues completely unique to ports, for example to recycle end of life fishing gear, or find uses for sludge from closed-loop scrubbers.

We explored current levels of adoption of maritime clusters (incorporating for example ship building, coastal tourism, maritime services and fisheries), port industrial development, waterfront development and circular economy around the world, as well as interest levels in developing them further.

The research reveals that most ports have already adopted one or more measures, with waterfront economy and port industrial development currently the most widely taken up. Industrial development is the most adopted option, and the most desired for the future.

The research shows that ports regularly have a mix of all methods, and suggests that some are complimentary, for example industrial development providing components of a maritime cluster, or waste for circular economy. The data also suggests that active ports

engage in multiple approaches, and inactive ports engage in none, prompting the question of how inactive ports can be motivated to increase local economic benefits.

The research points to high levels of association between interest in waterfront development and industrial development. In the future this could be used as a way to balance the competing needs of ports and cities, freeing up access to the waterfront while allowing industrial development to take place elsewhere.

Looking to the balance between current activity and future interest in activity, in the future, interest in waterfront economy falls off, while it remains high for industrial development. Looking ahead then, port cities must find a way to link industrial development to the circular economy as it is a route to enabling industrial development, while reducing the negative impacts it creates.

A circular economy is the method with the lowest reported current levels of adoption – but also the only option where there is a large increase between current levels and future interest. With this data, for the first time, we identify the potential and willingness of ports to be on the frontline of the transition to a

circular economy globally. Making this change requires a paradigm shift in port cities, but if barriers to implementation can be overcome, then we can expect to see a considerable growth in the adoption of circular economy approaches among world ports.

What barriers hamper ports' development?

The research indicates that ports consider high costs and land use to be the largest barriers to industrial and waterfront development, and take up of circular economy approaches.

High costs are also the largest barrier to maritime clusters.

Industrial development – identified in the research as both the most widely adopted measure currently, and most desired for the future – attracts greater opposition and scrutiny from wider society than other approaches. The data reflects this, with considerable barriers in the form of city authorities and pressure groups, in addition to the primary obstacles of land use and cost.

We know that typically the main barriers to any city adopting a circular economy are the cultural obstacles: from lack of interest and awareness to

lack of knowledge and collaboration among major stakeholders. Often this is coupled with lack of policy support and technological limitations, as well as question marks over financial viability.

The research indicates that the appetite for circular economy already exists among ports and the barriers as they see them are for the most part no different from those for industrial or waterfront development, namely high costs and land use. They do not perceive city authorities or private stakeholders as major obstacles, so if these groups can work together, it should be possible to remove the barriers, making the circular economy viable.

Building in a circular economy has the potential to deliver a triple win scenario by benefitting ports and cities, as well as wider society. City authorities, regional and national governments and supranational bodies such as the European Union should all engage to assist ports in implementing circular economy principles.



Protecting the planet



How are ports around the world tackling pollution, and where are the opportunities for port and cities to work together for better results?

When a port experiences economic growth, there are usually negative environmental impacts which are a challenge for port cities to manage.

Around the world, city authorities need a thorough understanding of ports' views on pollution, their appetite for the solutions available, and any barriers they perceive to putting those solutions in place.

With this information, ports and cities can better align their objectives and work together to use resources more efficiently,

Here, we scope the range of pollution associated with ports, and identify what causes most concern to their city-neighbours. We ask how ports feel about the pollution that occurs as a result of their activities, and find out what measures they are adopting to reduce it.

The research allows us to contrast results drawn from a global sample, with the European data that already exists – giving us a broader picture of ports' views around the world.

Scoping ports' environmental impact

Ports' activities create air, water, soil, waste, noise, light and biological pollution. This occurs as a result of shipping within the port, the use of port land and the impact of transport to and from ports. Some of this pollution is global in impact, for example greenhouse gas emissions, and some has strong localised effects such as nitrogen oxide and sulphur oxide emissions, noise and light pollution.

In the context of air pollution, for port cities, emissions created by the port can

form a large percentage of total city emissions, as for example in Hong Kong, where port activities were estimated to contribute 54% of SO₂ and 33% of nitrogen oxide emissions annually.

What kind of pollution is causing ports' communities most concern? We analysed the number of complaints about pollution received by ports around the world, finding that they are most likely to receive complaints about water, noise, air and waste pollution, with water and noise topping the scale.

What pollution is most important from ports' perspective? Ports around the world consider nearly all forms of pollution important, with air, water, noise and waste topping the chart. Each of these is considered important or very important by over 80% of this global sample. The survey identifies water quality as the number one issue, which suggests that globally the order of priority for ports contrasts slightly with ESPO's data, which places air quality first. Light pollution is considered important by less than half the sample (table 2).

Table 2. Ports perspective on importance of dealing with specific types of pollution and which have measures in place and those with further measures planned

Type of Pollution	Percentage reporting important or very important	Percentage of ports with measures in place	Percentage of ports with plans for further measures
Waste	92	90	74
Water	90	90	81
Air	85	68	71
Noise	82	68	66
Invasive species	80	67	62
Soil	78	72	58
Light	45	44	41

What types of pollution are ports most engaged in tackling?

Water and waste are the forms of pollution ports are most engaged in tackling – with 90% of ports surveyed having measures in place in this area. The majority of ports also have measures in place to tackle air, soil, noise and invasive species. In contrast, less than half of ports have measures in place to tackle light pollution.

How are ports tackling air emissions?

The most widely adopted measures that ports are currently employing to manage air emissions include renewable energy, electric port equipment, building efficiency improvements, vessel speed reduction, low sulphur fuel, shore-to-ship power and increased use of rail transport. Ports also report that though less widely adopted today, Liquefied

Natural Gas (LNG) sees the biggest jump between current use, and plans for future adoption. This technology is popular with ports as a short-term solution to air quality issues due to the lower costs involved, compared to, for example, shore-to-ship power.

What are the levels of interest in measures for reducing port pollution in future?

For the future, renewable energy is the most popular option with ports, with 88% of the sample expressing interest. Electric port equipment (86% interest), building efficiency improvements (82%) and electric port vehicles or harbour vessels (80%) also enjoy high levels of support from port authorities globally. The majority of respondents are not prioritising emissions control areas, road freight traffic control and designated freight corridors.

What about waste?

Though ports clearly regard waste as an important issue, the data reveals that the majority of ports have no recycling plan in place and this is a key area where they could work more closely with the cities to form a wider strategy.

How big an issue is traffic congestion?

The majority of ports regard traffic congestion as being detrimental to their operations, but the data shows ports are not interested in moving activity away from the main port area, using dry ports or extended gates. Gate appointment systems are the most popular option for trying to reduce traffic congestion. Regularising port traffic by using technology also appears to be something which would work alongside cities' other traffic systems.

Barriers and opportunities

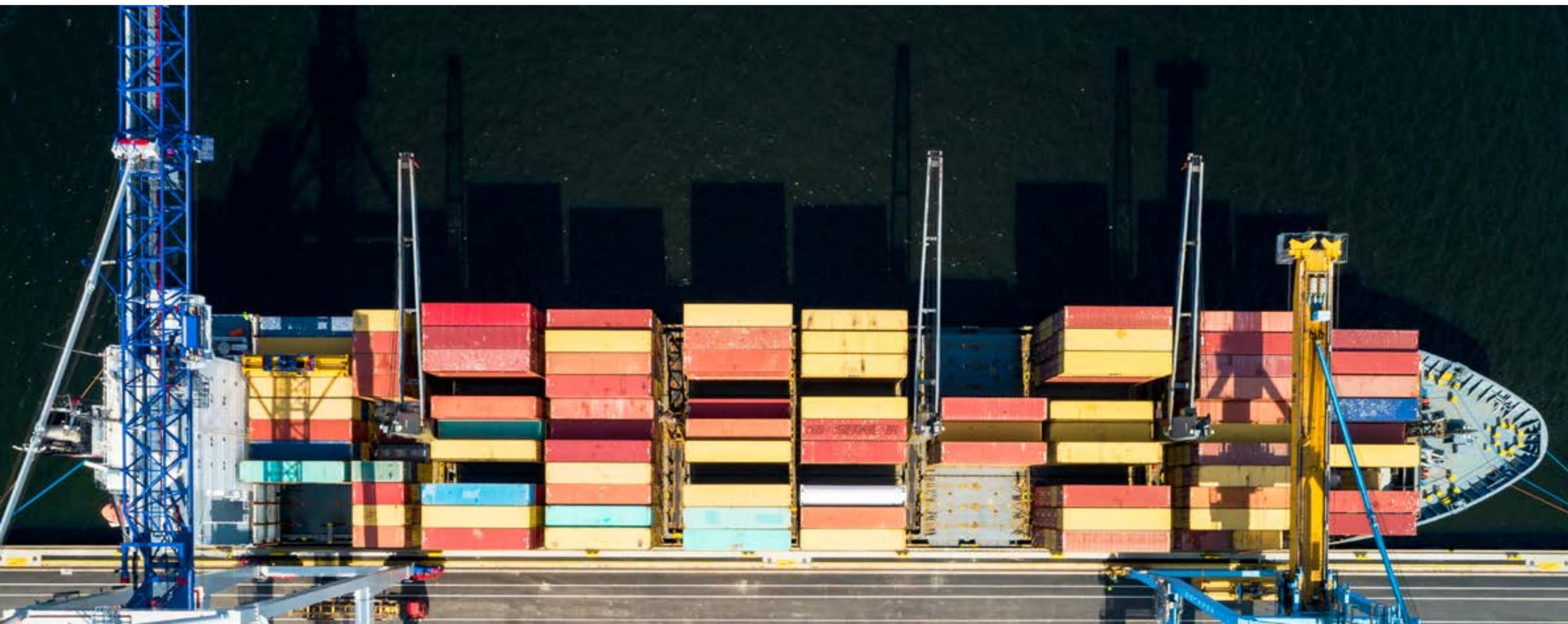
Our research responses highlight the global importance of pollution to port authorities, and high levels of interest in addressing it. What factors prevent them taking action? We found that high costs are the largest barrier hampering ports implementing solutions to address

pollution, listed as an important or very important barrier by over 60% of the sample for all measures.

Taking one example, shore-to-ship power, where ports have adopted this measure, we found that they are likely to have funded it themselves, and nearly all those yet to adopt it considered high costs an important or very important barrier. This

underscores the lack of financial support from other stakeholders in port-cities – and highlights that finding ways around this barrier will be key if port-cities are to plan for mutually beneficial development.

Private stakeholders are also considered an important or very important barrier for almost all measures.



What are the opportunities?

The adoption of **renewable energy** enjoys high levels of interest from ports, with 88% expressing an interest. It could be particularly appealing to ports wishing to diversify and it is a measure that would bring benefits to the wider city. Ports and cities should focus on how they can move forward on this together to achieve symbiotic development.

Ports are interested in **recycling and re-use**, but have no fixed plans in place to do so more efficiently. They are willing to make progress so must be encouraged to adopt procedures that make the most of their existing facilities. There is a real opportunity for port cities to be at the forefront of a paradigm shift towards the circular economy. If this can happen, waste will be transformed from pollution to opportunity. With greater co-operation between ports and cities this could be the shape of the future.

Ports express high levels of interest in adopting **freight transport** by rail – a measure that would reduce pollution and traffic congestion. The data shows the majority of ports currently transport less than 20% of freight by rail, so there is an opportunity to move forward here – if barriers including high costs and the need for co-operation with city authorities and private stakeholders can be overcome. Around the world, freight corridors have proved successful in easing congestion, again if costs, pressure on land use, and the need for cooperation between a wide range of stakeholders are effectively addressed.

Though light pollution is not a high priority for ports or their neighbours, it is a serious issue that affects the environment and human health. Responses show that measures for combating light pollution, such as **LED lighting systems** face low barriers for adoption, which means with greater awareness of the harmful effects

of light pollution it should be possible to encourage more ports to make beneficial changes.

Port and city authorities working in tandem

There are many effective options for reducing pollution that enjoy high levels of support from port authorities, and the research shows that the majority of ports do not consider economic viability a prerequisite for adopting measures to combat pollution. There is huge appetite to adopt new, more environmentally friendly measures and approaches such as circular economy principles. Given the potential benefits for port-cities as a whole, city authorities should consider engaging with ports on this, in particular to help them overcome financial barriers.





Closing thoughts

The work by the University of Southampton presented in this report provides valuable insights that will help port cities move towards a successful and sustainable future.

As the findings make clear, there is much to be optimistic about:

the opportunities for joint master planning to support development that benefits both port and city, including intelligent approaches to transport infrastructure. The appetite for embracing a paradigm shift to a circular economy in ports. And, the high levels of interest amongst ports in addressing pollution and adopting more environmentally friendly technologies.

A collaborative relationship between city and port authorities can therefore help build long term success, founded in sustainable development, without negative impacts on local communities or the environment.

