



Blue Growth Pathway for Ports

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Pathway for
Sustainable
Development of
Ports and Shipping

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Executive Summary

International seaborne trade continues to increase, driven by continued growth in global demand. This has intensified the need for greater sustainability in ports and shipping. Our research seeks to examine how sustainable 'Blue Growth' in ports and shipping may be achieved through the application of a Transition Management approach. Using the case study of Belfast Harbour, we explored an innovative approach to future thinking and planning for sustainable blue growth. This work included identifying change drivers likely to impact the development of ports over the short-, medium-, and long-term until 2050 and assessing how the port could respond to them through three different future pathways. The drivers are best categorised using the Political, Economic, Social, Technological, Legal, and Environmental (PESTLE) framework.

Examples of pressures for each category include: changes following Brexit trade arrangements (P); coping with economic instability and uncertain flows of investment (E); civic unrest in response to social injustice & inequality (S); emerging digital & SMART technologies (T); new legislative and regulatory changes (L); and biodiversity loss (E). The future pathways represent 3 different responses to these drivers and were categorised as 'stable' future, disruption/ resilience, and managed innovation. The 'stable' future pathway reflected short-term change and is based on past experiences and predictions of the future to enhance economic stability. The disruption and resilience pathway fosters resilience, adaptability and a capacity to respond to unexpected shocks with a focus on the medium-term. The managed innovation pathway utilises innovation to flexibly steer towards managed, long-term change. The findings from the case study revealed that a 'managed innovation' approach is necessary to transition to greater sustainability over the longer term.



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Introduction

Due to increasing globalisation and containerisation, ports play a significant role in international logistics chains, handling over 80% of world trade. In 2017, seaborne trade volumes had reached 10.7 billion tonnes. Port activities, therefore, contribute significantly to international, as well as local and regional economies, with 14 out of the 20 economically strongest cities in the world being port cities. Ports, however, have potentially negative impacts on the environment. These impacts include emissions with global maritime transport accounting for 2.5% of global greenhouse gas (GHG) emissions. Additional environmental effects include water, soil, light and noise pollution, traffic congestion, the introduction of invasive species, effects on marine ecosystems and impacts of marine accidents and spills.

In this context, we examine how sustainable 'Blue Growth' in the ports and maritime shipping sectors can be achieved over the long-term. A case study approach involving Belfast Harbour is employed to explore innovative initiatives in technology, operations, and policy to overcome sustainability challenges. This study gives an overview of the current state of play in terms of sustainability for ports and shipping, the need for radical and transformative change in port operations and governance based on a case study of Belfast Harbour, and how a Transition Management approach can address the complexities and uncertainties in dealing with sustainable blue growth in the ports and shipping sector over the long-term. The study concludes with recommendations on how to develop a pathway towards sustainable Blue Growth in ports and shipping.

10.7 billion tonnes

**Seaborne trade
volumes in 2017**

3

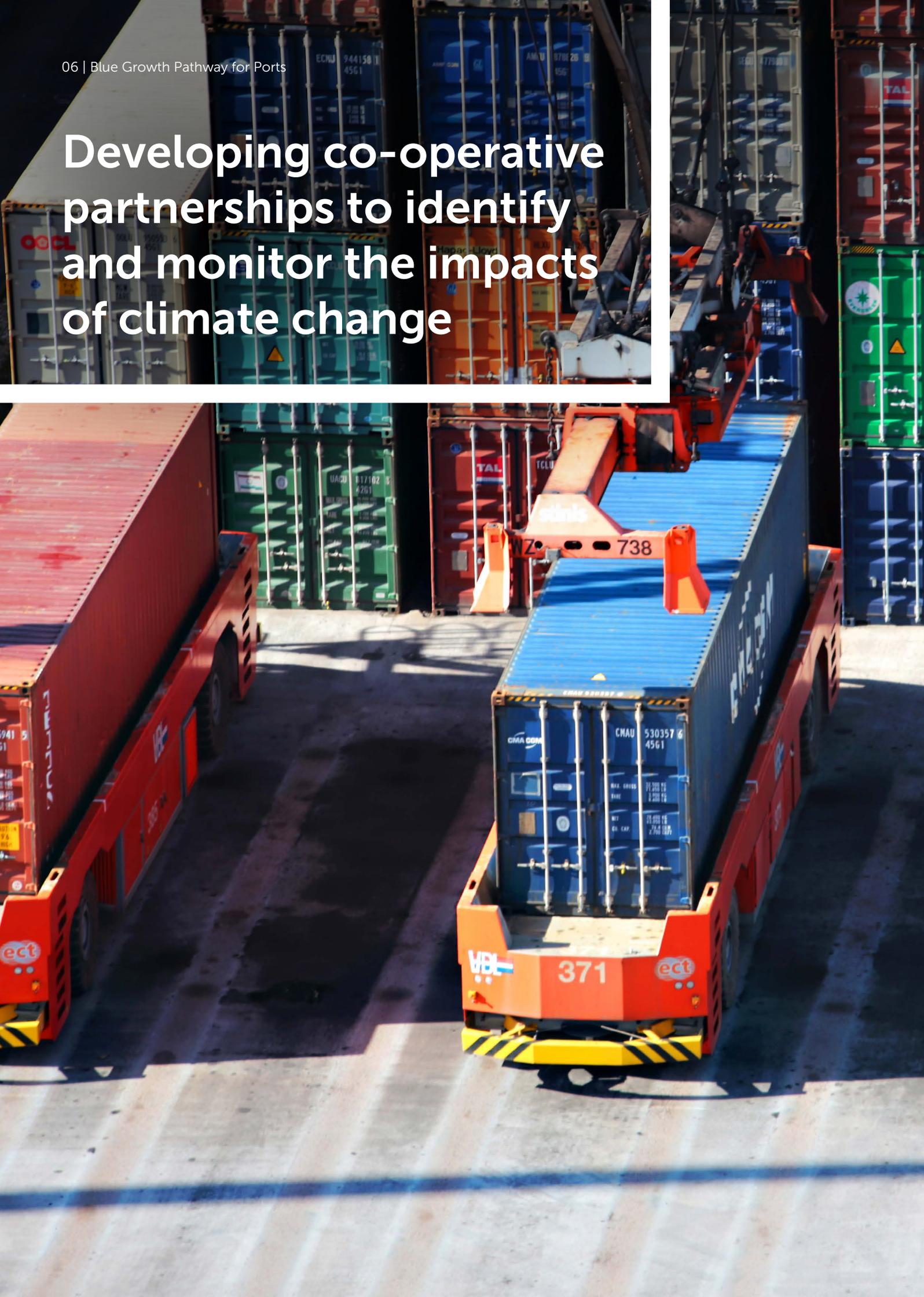
Ports and the Atlantic Action Plan

Our research findings will specifically assist ports in the development of a sustainable transition pathway over the long-term which contributes to 'Blue Growth', while at the same time, minimising environmental and social impacts. This research aligns with the priorities for research and investment set out in the Atlantic Action Plan by:

- (i) Illustrating how ports innovate through the sharing of knowledge between researchers and stakeholders including port industries, local businesses and NGOs;
- (ii) Highlighting the role of ports in protecting, securing and developing the potential of the Atlantic marine and coastal environment by contributing to the development of strategies to address global climate change issues, including mitigation and adaptation strategies by developing co-operative partnerships to identify and monitor the impacts of climate change;
- (iii) Improving accessibility and connectivity by promoting cooperation between ports and the use of best practice; and
- (iv) Creating a socially inclusive and sustainable model of regional development by fostering better links between ports and their hinterlands.

**Minimising
environmental
and social impacts**

Developing co-operative partnerships to identify and monitor the impacts of climate change



4

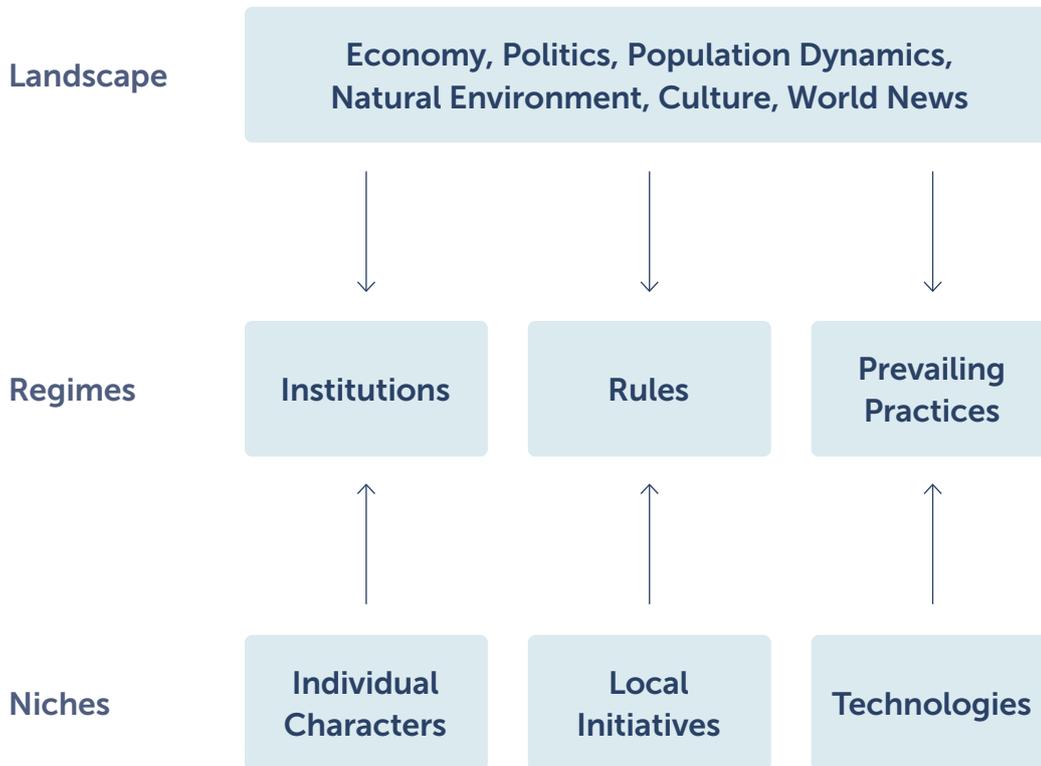
Transition Management

Transition management is a governance approach that aims to facilitate and accelerate sustainable transitions. Transition management focuses on coordinating a wide range of actors to achieve long-term sustainability. It seeks to coordinate these actors through the creation of a shared understanding of a problem and the development of a long-term vision and sustainable pathways through which the problem can be addressed. Sustainable transitions require actors to develop an understanding of the interconnections between the current management regime and the change pressures exerted on it (See Fig 1).

The management regime is the amalgamation of the dominant practices, rules, institutions, and norms that structure activity within a particular policy area. Change pressures can be characterized as landscape pressures and niche practices. Landscape pressures operate at the macro level and include issues such as economic, political, environmental, and demographic dynamics. These dynamics put pressure on the existing regime to change but cannot be directly controlled by the regime. For example, population growth will place pressure on food and energy regimes to scale up production. Niche pressures are micro-level innovations that exert pressure for regime change from below. Niches can be the actions of individual actors, the development of alternative technologies and local management practices that do not conform to established practices and put pressure on the regime to adapt to accommodate them. For example, the development of autonomous vessels will put pressure on port and shipping regimes to accommodate novel navigation systems. Landscape pressures and niches are, therefore, vital seeds for change and are crucial for path-breaking innovations.

The Multi-Level Concept in Transition Studies

Source: Adapted from Geels, 2002¹



Transition management focuses on the development of sustainable pathways that can overcome barriers and maximize opportunities and can steer innovations to become established within reformed and more sustainable regimes. MOSES has adopted transition management as a broad analytical framework through which to understand existing marine management regimes and to stimulate thinking about how more sustainable regimes may be realized in the future.

¹ Geels, F.W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy*, 31 (8-9), 1257-1274.

Amalgamation of the dominant practices, rules, institutions, and norms that structure activity within a particular policy area

Depending on the size and type of port, location, and organisational structure, the level of environmental impact from port activities may vary



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Port Management Regime

Ports are complex organisations with varying functions, roles, and assets that are affected by the economy, culture, policies, local communities, geographical locations and administrations. These characteristics make it difficult to govern and manage ports in an integrated manner. Often ports are managed under different forms of port administration and ownership. For example, some ports are controlled by municipal/ local government, encompassing all regulation and landlord functions, while others are operated under mixed public and private service provision. Regardless of port structure, sustainable economic growth is a common and critical agenda for port authorities. Depending on the size and type of port, location, and organisational structure, the level of environmental impact from port activities may vary.

Having regard to these divergences, the governance and management of ports tend to be fragmented and exacerbated by the complexities of international, regional, and national regulations. For instance, the IMO and EU are responsible for the safety, security, and environmental performance of international and European shipping. In the EU, policies are interpreted from the IMO and then adapted by EU member states by national legislation, which is then transposed through regional and local regulations. Different ports, however, may adopt different policies considering the local regulatory, geographical, economic, and political background. In terms of the Atlantic Area, how sustainable ports are largely depends on the various policies and tools adopted by port and public authorities. It is clear, therefore, that a coordinated strategy for the sustainable development of ports and shipping is lacking.

In terms of innovation occurring in the ports and shipping sector, to date, the sustainability of a port has largely depended on the various port policies and tools they have implemented. Examples of sustainability initiatives include environmental policy development, environmental management and monitoring, energy management, stakeholder engagement, sustainability incentives for port users, enhanced environmental reporting, marketing/communicating sustainability efforts, and on-going research and development.

Some ports have incorporated a range of initiatives such as 'eco-ports' and 'green ports' to address growing port sustainability concerns. Other managerial tools have included: pricing alteration, monitoring and measuring, market access control, as well as environmental standard regulation. These initiatives and tools can have a

positive effect on port activities including shipping traffic, cargo handling and storage operations, intermodal connection, industrial activities and port expansion. Port authorities need to adopt and implement appropriate incentives to ensure the necessary technological improvements and operational measures are taken to encourage and deliver sustainability. This requires a transformation of port governance that embraces innovation and technology but also ensures resilience to risk and disruption and adaptation to change. For instance, the UK government is in the process of creating new innovative 'Freeports' to accelerate post-Brexit trade.

Following a systematic review of the academic literature on sustainability in ports and shipping, decarbonisation, and technology, several constraints were identified which could make a transition to increased sustainability a challenging prospect. The high costs associated with sustainability actions such as high upfront investments and risks, economic pressures for ports, adverse policy incentives for port companies, a lack of sustainability competencies within port authorities and associated organisations, limited customer interest for more sustainable services, and difficulty in implementing sustainability practices are key constraints.

The complexities of international, regional, and national regulations were also highlighted as constraining factors in sustainability. Other constraints included a lack of data to monitor environmental impacts, the need to develop new governance arrangements, and a lack of standardisation across technological interventions. For example, the main challenge with cold ironing has been the lack of international standards for the technology. Other challenges identified included a relatively low level of project management maturity, lack of communication, and lack of knowledge and resources. In terms of shipping firms, the main constraint identified related to the challenge of integrating customer requirements into emerging sustainability approaches. Competition between ports, as well as competition between cities and ports for land-use development, were identified as challenges where there is a need for industrial and residential expansion to simultaneously develop sustainably.



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MOSES Belfast Harbour Case Study

Belfast Harbour, in Northern Ireland, was selected as a case study by QUB to critically evaluate the potential opportunities and challenges facing the port and shipping sector in transitioning towards a more sustainable growth path. The case study revealed that stakeholders found it difficult to comprehend or imagine how future conditions will shape port operations over the long-term. Given that Belfast Harbour had already developed its vision for the next 15 years, QUB focused their research around 'Future Thinking' with an emphasis on horizon scanning and the application of innovation and technology. A Future Pathways Analysis (FPA) approach was developed which is based on the concept of 'change' and the differing ways ports can respond to it. The FPA approach focused on: a) identified change drivers likely to impact the development of Belfast Harbour over the short, medium and long-term until 2050; and b) refining them as part of future pathways that chart consequences of certain decisions and actions. The drivers were categorised using the PESTLE framework. The future timeframes were 2025, 2035, and 2050. The pathways represented 3 different responses: a) 'stable' future; b) disruption/ resilience; and c) managed innovation.

In terms of imagining other pathways, an economy that is not dependent on growth but on social and planetary boundaries instead was considered as an alternative approach that should be considered over the longer term. A world that is 3 or 4 degrees warmer by 2100 as a result of climate change was also identified as a pathway to be considered in light of current global CO₂ emissions. Many stakeholders noted that there was a lack of urgency around managing the impacts of climate change and that adaptation was not at the forefront of future/ strategic plans. Despite climate change being considered a threat, many stakeholders felt that it presented an opportunity for ports and shipping to decarbonise and seek zero carbon emissions instead of a transition to a low carbon future. Fiscal incentives should be made available by port and local authorities to help with the transition to zero carbon emission.

Investment was considered necessary for training in new technologies, engineering, manufacturing and design. Belfast Harbour was considered an ideal location to maximise this technology revolution with its proximity to critical infrastructure i.e. third level institutions, R&D hubs, airports, multinational companies and businesses. It was also acknowledged that traditional port businesses are dependent on the port authority implementing innovative

changes, e.g. new infrastructure, cranes, greener processes and while technology advancements are being introduced, the capacity/drive to implement these improvements is uncertain. There is a need for greater collaboration between ports, city administrations, academia, businesses and local communities.

In terms of selecting the most suitable pathway for Belfast Harbour to follow, the majority of stakeholders felt that a 'managed innovation' approach is necessary to transition to greater sustainability over the longer term. It was emphasised that this approach should foster resilience and adaptability as well as embracing innovation and technology to flexibly steer long-term change. The approach will be informed by transition management and horizon scanning.



Any pathway should be evaluated as part of a participatory process that enables stakeholders to explore future development and desirable outcomes.

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Pathway for Sustainable Development of Ports and Shipping

The findings from the Belfast Harbour case study highlighted the need for ports to plan for change over the long-term to achieve sustainable blue growth. It is recommended that change drivers are categorised using the PESTLE framework, in consultation with key port stakeholders.

Identified **short-term** change drivers included:

- Implementation of trade arrangements post-Brexit (P);
- Maximising commercial capacity of port & supporting incumbent businesses (E);
- Realising waterfront potential and addressing community needs in city ports (S);
- Upgrading outdated port technologies (T);
- Responding to regulatory changes and compliance requirements (L);
- Addressing long-term data for global climate change (E).

Identified **medium-term** change drivers included:

- Evolving political & administrative changes (P);
- Growing global competition amongst maritime industries (E);
- Restructuring of employment sectors and expansion of new sectors (S);
- Advancements in autonomous/virtual management (T);
- International and national statutory energy targets (L);
- Addressing environmental and health crises (E).

Identified **long-term** change drivers included:

- Creation of new political realities, relationships & regulatory changes (P);
- Collapsing of new port industries and loss of employment (E);
- Widening disparities within society, leading to increased civic action and disruption (S);
- Rising utilisation of artificial intelligence, and augmented and virtual reality in port management (T);
- Fragmenting governance systems & restructuring of public services (L);
- Increasing occurrence of storm surges, flooding & extreme temperatures (E).

To assist other ports in planning for sustainability over the long-term we, therefore, recommend using an FPA approach similar to the one we applied in our case study. This proved to be a useful framework to critically examine, in collaboration with key

stakeholders, how a port conducts future planning and how a port can develop a future pathway that can achieve sustainability over the long-term. Any pathway should be evaluated as part of a participatory process that enables stakeholders to explore future development and desirable outcomes. By employing participatory methods, stakeholders can be directly involved in assessing possible futures, and thus be better placed to help shape the future or adapt to changing conditions. Regional authorities can contribute to this participatory process by: collaborating with key stakeholders at EU, national, regional and local level; promoting enhanced coordination and sustainability in their regional spatial and economic strategies; and optimising EU policy and funding instruments for regional/local development priorities including innovative port infrastructure.

The Belfast Harbour case study findings revealed that a future development pathway that embraces innovation and applies technology to advance managed, long-term change is the most advantageous resolution towards sustainable blue growth in ports and shipping. A 'managed innovation' pathway seeks to implement radical change through the utilisation of technology as well as novel management approaches, impacting local, national, and international arrangements. It is informed by transition management and horizon scanning and is based on a long-term perspective, to deal with future developments in a managed manner.



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