RESILIENCE4PORTS

MOVING THE NEEDLE ON PORT RESILIENCE

PROGRESS ON THE SHARM EL-SHEIKH ADAPTATION AGENDA'S MARITIME RESILIENCE BREAKTHROUGHS

ICSI International Coalition for Sustainable Infrastructure

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ABOUT RESILIENCE4PORTS

The Resilience4Ports (R4P) initiative, launched at COP27, is led by the International Coalition for Sustainable Infrastructure (ICSI) and supported by Arup, the UN Climate Change High-Level Champions and Lloyd's Register Foundation. The core focus of the R4P programme is to build a network of ports and communities that seeks to evaluate, co-create and test solutions across a variety of resilience issues. While the programme will focus initially on ports, given their pivotal role and acute climate risk exposures, it is intended to be scalable and encompass other elements of the maritime system.

ABOUT THE INTERNATIONAL COALITION FOR SUSTAINABLE INFRASTRUCTURE (ICSI)

The International Coalition for Sustainable Infrastructure (ICSI) is the global movement for engineering action on infrastructure sustainability, resilience, and climate change. ICSI brings together a global coalition of change agents from across the engineering, investment, city, and philanthropic communities committed to bold action to solve the systemic problems that exist at the intersection of climate change, ecosystem degradation, ageing infrastructure, and underinvestment. Built upon a commitment to tangible and collaborative action, ICSI continues to broaden participation across stakeholder communities to accelerate the innovation, adoption and scaling of people-centred, sustainable, and resilient infrastructure solutions that support sustainable development for all.

PROJECT PARTNERS

ARUP

ICSI International Coalition for Sustainable Infrastructure

LR Foundation

UN CLIMATE CHANGE HIGH-LEVEL CHAMPIONS

CONTRIBUTING ORGANISATIONS

aivp INSPIRING PEOPLE OF PORT CITIES

ARUP

CIP Inter-American Committee on Ports

Port of Antwerp Bruges

Bilbao PORT

Gambia Ports Authority

iaph international association of ports and harbors

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WPSP WORLD PORTS SUSTAINABILITY PROGRAM

FOREWORD

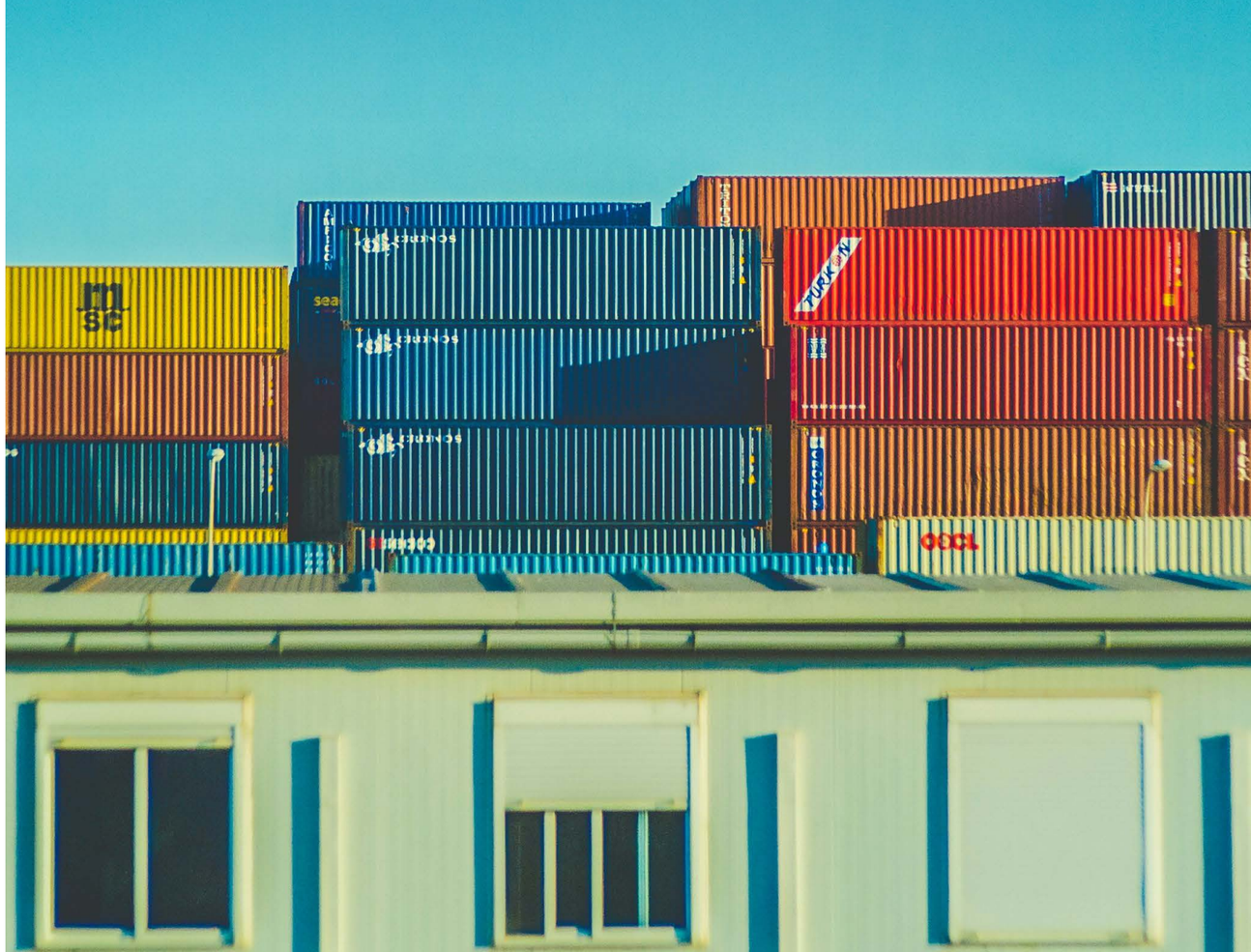
Ports are critical global systems that operate at the intersection of people, infrastructure, supply chains, shipping routes, the climate and the economy. This unique position makes them vulnerable to a host of environmental, technological, geopolitical and macroeconomic risks. In order to mitigate these systemic risks, keep people safe and ensure the efficient transport of vital goods and services around the world, we need to scale up efforts to adapt and build resilient port systems.

The Sharm El-Shiekh Adaptation Agenda (SAA), launched at COP27, provides a framework for organisations across a variety of sectors and disciplines to rally around a shared vision and drive action towards a sustainable and resilient world. To meet the SAA targets and achieve the Maritime Resilience Breakthrough goals, the port sector must have a means of measuring and evaluating its performance. The case studies detailed in this progress report highlight best practices in this area, providing examples of how ports can implement new technologies, sustainable practices and collaborative frameworks to withstand and recover from disruptions.

We are grateful for the leadership that Resilience4Ports is showing in this space, working with industry to ensure that safety, sustainability and resilience are central to future approaches to port management and operation.

Ruth Boumphrey
Chief Executive, Lloyd's Register Foundation

CONTENTS



INTRODUCTION

Port resilience is crucial for ensuring the uninterrupted functioning of global trade networks and safeguarding economic stability. There are 17,000 ports around the world and 30 million people are employed within port ecosystems, which is significant for local economies. As essential hubs for shipping and logistics, ports are increasingly vulnerable to various disruptions, including climate change, cyber threats, and geopolitical tensions. Enhancing port resilience allows facilities to effectively anticipate, withstand, and recover from such challenges, ensuring that supply chains remain operational and communities are protected.

The mission of climate adaptation and resilience is frequently disconnected from the net-zero agenda, but as global efforts leap towards green energy and decarbonisation, there is also a prospect to embed resilience within ports and ensure that adaptation and resilience are on an equal footing with mitigation.

The Sharm El-Sheikh Adaptation Agenda (SAA) and the Maritime Resilience Breakthroughs (see Box 1) aim to elevate resilience and adaptation and drive its implementation. Both initiatives emphasise the importance of protecting coastal ecosystems, enhancing disaster preparedness, and ensuring sustainable economic activities in maritime regions. Through this synergy, they aim to strengthen the ability of maritime systems to adapt to climate risks while promoting sustainable development in line with the global climate adaptation goals. The Resilience4Ports (R4P) Framework for Action (Box 2) was developed to enable the implementation of Maritime Resilience Breakthroughs.

This report highlights examples of scalable solutions, approaches and tangible actions being taken by port actors around the world to lower their carbon footprint and make their infrastructure and operations more resilient to climate change, while taking steps to enhance the resilience of communities and coastal and marine ecosystems.

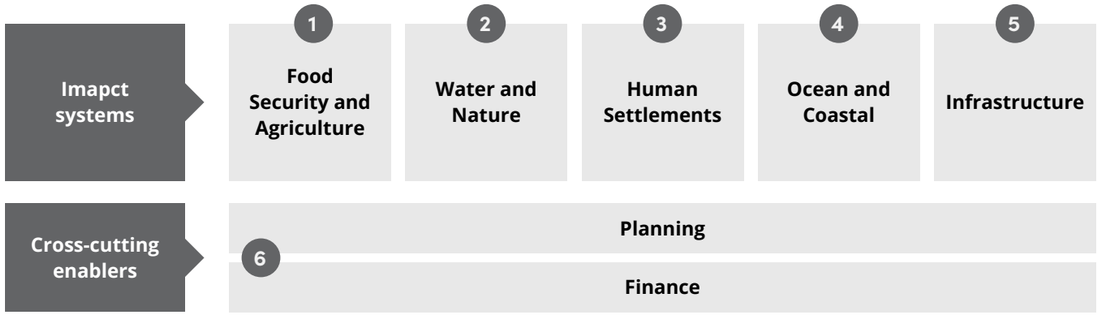
BOX 1 - THE SHARM EL-SHEIK ADAPTATION AGENDA AND THE MARITIME RESILIENCE BREAKTHROUGHS

The Sharm El-Sheikh Adaptation Agenda (SAA) is a comprehensive, shared agenda launched by the COP27 Presidency to rally global action around 30 adaptation outcomes that are needed to address the adaptation gap and achieve a resilient world by 2030.

Extreme weather events from heatwaves to floods and forest fires have become an everyday reality of our lives. Enhanced global action on adaptation and resilience is an utmost priority, even in a 1.5°C world.

In response to the devastating impacts of climate change affecting vulnerable people all over the world, the COP27 Presidency launched the SAA in partnership with the High-Level Champions and the Marrakech Partnership in November 2022. The SAA outlines 30 Adaptation Outcomes that are urgently needed to increase the resilience of 4 billion people to accelerate transformations across five impact systems/breakthroughs.

Read more



The Maritime Resilience Breakthroughs are in alignment with the key impact systems set forth in the Marrakesh Partnership to track initiatives globally as part of the Climate Action Pathways. The targets are meant to set out simple, measurable, and attainable milestones to guide progress toward resilience. They will serve to connect existing efforts and catalyse new ambition.

Read more

RESILIENT INFRASTRUCTURE SYSTEMS

By 2030, 30% of global maritime trade moves through climate-adapting ports, connecting people and supply chains, with a focus on benefitting the world's most vulnerable regions.

RESILIENT COASTAL AND OCEAN SYSTEMS

By 2030, across all regions, ports and their communities, protect and enhance local coastal and ocean systems through nature-based solutions, to build port resilience and support thriving natural habitats.

RESILIENT HUMAN SETTLEMENTS

By 2030, across all regions, ports and their communities, implement equity-focused social programmes including green jobs and community infrastructure that enable thriving ports and port communities.

BOX 2 - FROM GLOBAL AMBITION TO ACTION

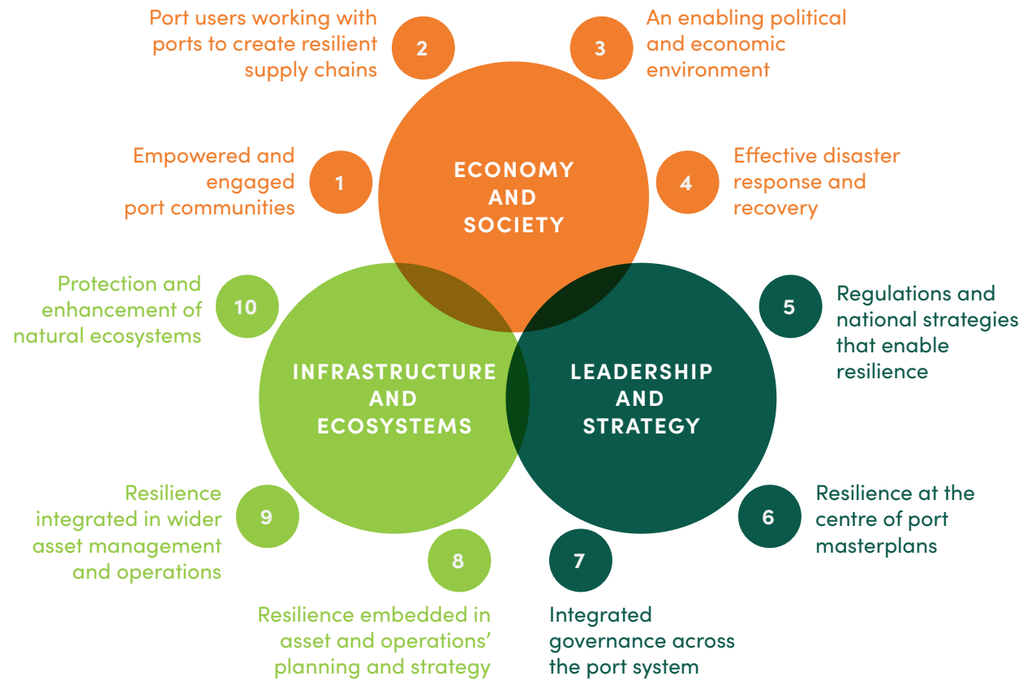
The R4P Framework for Action, launched at Singapore Maritime Week in May 2023, aligns with the ambitions of the Maritime Resilience Breakthroughs and supports their implementation

The Framework was developed to provide a line of sight for resilience from a policy level through to implementation at a port asset level across three dimensions: Economy and Society, Leadership and Strategy, and Infrastructure and Ecosystems. The framework is a useful tool that proposes a set of goals (enablers) that port stakeholders can use to build, measure and monitor resilience, alongside traditional and contemporary port indicators fostering an integrated approach linking action by different stakeholders towards a common aim.

The four goals within the Economy and Society dimension reflect that port resilience will require action not just by the port sector, but by governments, investors, civil society and port users/ customers. These goals create an enabling platform for port resilience, reaching beyond the port boundary.

Three goals relate to the Leadership and Strategy dimension. This area looks to align adaptation and resilience planning at a sector and port level, and between the range of actors involved in governing and operating a port. Port resilience requires a line of sight and consistency across government regulation, maritime sector strategies, port masterplans and port operators.

Finally, there are three goals related to the Infrastructure and Ecosystems dimension. Port infrastructure includes physical assets, but also people, energy, digital elements and the processes that link them all together. Ports are also embedded within and rely upon natural systems. These goals recognise resilience and progress against breakthrough targets.



Following the successful launch of the Framework for Action, the R4P knowledge library was developed to connect a wide range of practitioners with publicly accessible port resilience guidance, studies and tools. Launched at COP28, the Knowledge Library assesses a wide range of tools, guidance and reports, and maps these against the maritime resilience breakthroughs they support as well as the Framework for Action goals they help to achieve.

Read more about R4P Framework for action

Read more about R4P Knowledge library

SPOTLIGHT ON IMPLEMENTATION

In recent years, the importance of port resilience has garnered significant attention. Recognising that ports are vital lifelines for economies, stakeholders across the maritime industry have made progress in enhancing their resilience. This progress encompasses the adoption of innovative technologies, sustainable infrastructure practices, and collaborative frameworks that enable ports to better anticipate, withstand, and recover from disruptions. Case studies presented here demonstrate progress on the implementation of the SAA and Maritime Resilience Breakthroughs and use the R4P Framework for Action goals to highlight signals of change.

NO.	CASE STUDY	LOCATION(S)	SSA	R4P
1	Implementing the vision for a green, resilient Port of Baku	Baku, Azerbaijan	Resilient Infrastructure Systems Resilient Ocean and Coastal Systems Resilient Human Settlements	1 Empowered and engaged port communities 6 Resilience at the centre of port masterplans 10 Protection and enhancement of natural ecosystems
2	Climate Change Adaptation reporting, Port of London	London, United Kingdom	Resilient Infrastructure Systems	5 Regulations and national strategies that enable resilience 8 Resilience embedded in asset and operations' planning and strategy
3	Climate Risk Assessment in the Port of Banjul	Banjul, Gambia	Resilient Infrastructure Systems Resilient Ocean and Coastal Systems	6 Resilience at the centre of port masterplans 10 Protection and enhancement of natural ecosystems
4	Improved Disaster Risk Management for Ports in the Caribbean	Antigua and Barbuda, Bahamas, Barbados, Belize and more	Resilient Infrastructure Systems	4 Effective disaster response and recovery 6 Resilience at the centre of port masterplans
5	Enhancing Resilience of Natural Ecosystems and Energy Generation, Bilbao Port Authority	Bilbao, Spain	Resilient Human Settlements Resilient Infrastructure Systems Resilient Ocean and Coastal Systems	10 Protection and enhancement of natural ecosystems
6	Local and national regulations for scrubbers' washwater discharge at the Ports in the Americas	Belize, Bermuda, Brazil, United States, Panama, and Canada	Resilient Ocean and Coastal Systems	5 Regulations and national strategies that enable resilience 10 Protection and enhancement of natural ecosystems
7	Species Protection Programme, Port of Antwerp-Bruges	Antwerp, Belgium	Resilient Ocean and Coastal Systems	10 Protection and enhancement of natural ecosystems
8	Climate Adaptation and Coastal Resiliency Plan, Port of Long Beach	California, USA	Resilient Infrastructure Systems Resilient Ocean and Coastal Systems	4 Effective disaster response and recovery 6 Resilience at the centre of port masterplans
9	Community Awareness Programme, Sri Lanka Ports Authority	Colombo, Sri Lanka	Resilient Human Settlements	1 Empowered and engaged port communities
10	Artificial intelligence for environmental monitoring and prediction of the Port of Bari	Bari, Italy	Resilient Ocean and Coastal Systems	10 Protection and enhancement of natural ecosystems

CASE STUDY 1

IMPLEMENTING THE VISION FOR A GREEN, RESILIENT PORT OF BAKU

LOCATION

Baku, Azerbaijan

CASE STUDY PROVIDED BY

PORT OF BAKU

SAA MARITIME RESILIENCE BREAKTHROUGHS

- Resilient Infrastructure Systems
- Resilient Ocean and Coastal Systems
- Resilient Human Settlements

R4P FRAMEWORK GOALS

- 1 Empowered and engaged port communities
- 6 Resilience at the centre of port masterplans
- 10 Protection and enhancement of natural ecosystems

ABOUT THE PROJECT

The Port of Baku operates along the Middle Corridor, a modern trade route rooted in the ancient Silk Road, reaffirming its status as the most reliable route between Asia and Europe amid recent geopolitical developments. Committed to transforming this corridor into a Green Corridor, the Port has launched Green Port initiatives since 2016 in collaboration with the European Union and leading EcoPorts, solidifying its leadership in the Caspian region.

The Port has led in digitalisation, operational efficiency, and sustainability, becoming the first in the region to adopt a net-zero emission strategy. It received 'EcoPort' certification from The European Sea Ports Organisation (ESPO) in 2019 and became Azerbaijan's first public company to join the UN Global Compact in 2022. In 2024, it joined the UN Ocean Stewardship Coalition, aligning with principles of climate adaptation and resilience for ocean economy activities.

OUTCOMES

- Strengthened port operations and enhanced service excellence.
- Implemented green policies while exploring new business opportunities.
- Provided comprehensive training courses for Port of Baku staff on the Green Port Concept, Project Management, and Project Finance to build workforce resilience regarding green initiatives and climate change.
- Achieved certification for the Port of Baku under EcoPorts-PERS and various ISO standards.
- Enhanced local connections through outreach programmes promoting port-city relationships and fostering sustainability by transforming mindsets towards green practices.
- Launched programmes to protect biodiversity through habitat restoration and conservation partnerships.

The Port of Baku is committed to enhancing climate resilience through its 2035 Climate Action Plan, which focuses on mitigating climate risks, reducing emissions, and improving operational efficiency and resilience. By emphasising these efforts, the Port showcases its significant work in addressing climate change and achieving the Paris Agreement goals, reinforcing its status as the main port of the host country for COP29.

Situated in Alat, 70 km south of Baku, the Port of Baku integrates a strong Corporate Social Responsibility (CSR) agenda within its Environmental, Social, and Governance (ESG) strategy, actively engaging the local community, including children and youth. This strategy includes initiatives to strengthen the port-city relationship and promote sustainability. In 2023, the Port built the Alat Ecopark, featuring solar-powered lanterns, an eco-friendly playground, green spaces, and waste collection bins, all designed to enhance sustainability and resilience in the community.

Women's empowerment is a key priority in the Port's ESG strategy, focusing on gender equality in recruitment. Currently, female representation in management is 11%, with a goal of reaching 20% in five years. Initiatives like the RoboPort STEM lab, designed for children and youth, along with Women in STEM projects, aim to enhance opportunities for women and promote inclusive community growth.

Wildlife protection is integral to the Port's Climate Action Plan, which focuses on preserving food sources for over 40 bird species. In collaboration with the World Wildlife Fund (WWF), the Port has evaluated habitat needs to support these species year-round. The Port is also expanding green zones to enhance biodiversity, having already planted over 10,000 trees, with plans to increase this through offset mechanisms and additional projects.

In 2023, the Port of Baku conducted a carbon inventory assessment with EU Technical Assistance and Information Exchange (TAIEX) experts, evaluating emissions across all three scopes. To mitigate environmental impacts, the Port has implemented a cold ironing system to reduce vessel idling emissions and operates a biological wastewater treatment plant that recycles treated sewage for irrigation.

Finally, in a landmark move for Azerbaijan's renewable energy sector, during COP29, the Port of Baku will launch a 5.4 MW renewable energy project that combines solar power with an integrated Battery Energy Storage System (BESS). Once fully implemented, 100% of the port's annual electricity consumption will be sourced from green energy.

CASE STUDY 2

CLIMATE CHANGE ADAPTATION REPORTING, PORT OF LONDON

LOCATION

London, United Kingdom

CASE STUDY PROVIDED BY

ARUP

PORT OF LONDON AUTHORITY

SAA MARITIME RESILIENCE BREAKTHROUGHS

- Resilient Infrastructure Systems

R4P FRAMEWORK GOALS

- 5 Regulations and national strategies that enable resilience
- 8 Resilience embedded in asset and operations' planning and strategy

ABOUT THE PROJECT

The Port of London Authority (PLA) is a trust responsible for managing 95 miles of the tidal Thames, ensuring navigational safety and protecting the environment. In July 2024, the PLA – supported by Arup – embarked on its fourth round of the Climate Change Adaptation Report, part of the UK Government's voluntary climate adaptation reporting under the Climate Change Act of 2008. The updated Climate Change Adaptation Reports will provide valuable data and insights that will support the UK's Climate Change Risk Assessments and National Adaptation Programmes. The programme is designed to embed an all-encompassing approach to climate resilience across all sectors of the economy and infrastructure in line with the government's Resilience Framework.

The aim of the updated adaptation report is to enhance the PLA's resilience to climate change impacts in line with the latest climate science, operational changes, and best practices. The primary objective was to integrate climate adaptation into the PLA's internal strategies, operations, future budgets, and risk management practices.

The Climate Change Adaptation Report update focused on three main elements. The first focused on updating the Climate Change Risk Register by incorporating new information, interdependencies, and emerging risks to ensure that the PLA is well-prepared for future climate challenges. The second considered the economic aspects of climate change adaptation, providing a high-level review of the costs of inaction and the benefits of adaptation to support the internal case for climate adaptation actions and underscore the financial importance of a proactive approach. The third aimed to embed climate resilience into the PLA's decision-making processes, incorporating Arup's expert guidance and recommendations on integrating climate adaptation into strategic planning.

Continuous feedback and adjustments based on stakeholder inputs helped to enhance collaboration and knowledge sharing among and across PLA teams. This close collaboration was a key component to ensure that the updated adaptation report would not only meet the UK Government's requirements but also support PLA's long-term sustainability and resilience goals. Some of the key risks identified were increased safety incidents for staff and river users, disruption to river operations, increased flood risk, and the accelerated deterioration of assets.

This project represents a significant step forward in PLA's efforts to adapt to climate change, ensuring that its operations remain resilient and sustainable in the face of evolving environmental challenges.

OUTCOMES

- Adaptation Action Plan: The plan identified specific actions to mitigate risks, such as enhancing asset maintenance, and monitoring environmental changes. The plan ensures that PLA's operations remain resilient and sustainable in the face of a changing climate.
- Integration of Climate Resilience: The integration of climate resilience into PLA's strategic planning involved developing recommendations for embedding climate resilience into internal decision-making processes. This integration ensures that climate resilience is a core component of PLA's long-term planning and operations.
- Contribution to the UK's Climate Change Reporting: By integrating local adaptation strategies with national objectives, this project helps to build a comprehensive picture of the UK's preparedness for climate change, ensuring that both regional and national efforts are aligned and mutually reinforcing.

CASE STUDY 3

CLIMATE RISK ASSESSMENT IN THE PORT OF BANJUL

LOCATION

Banjul, Gambia

CASE STUDY PROVIDED BY

Gambia Ports Authority

SAA MARITIME RESILIENCE BREAKTHROUGHS

- Resilient Infrastructure Systems
- Resilient Ocean and Coastal Systems

R4P FRAMEWORK GOALS

- 6 Resilience at the centre of port masterplans
- 10 Protection and enhancement of natural ecosystems

ABOUT THE PROJECT

In 2022, the Global Centre on Adaptation (GCA) and the African Development Bank (AfDB) carried out a multi-stakeholder risk dialogue for the Port of Banjul in The Gambia to discuss the physical climate risks and the rationale for climate adaptation for the Port of Banjul 4th Expansion Project. The project was initiated to increase the cargo handling and storage capacity of the terminal in order to address the increasing demand on the port facility as the volume of cargo and trade continues to rise while the facility is not expanding commensurably.

Influenced by this, the port has been working extensively to enhance its climate adaptation efforts, driven by the necessity to safeguard its infrastructure and operations from climate change risks. As part of its fourth expansion project, the port is now implementing several resilience measures to address rising sea levels, extreme weather events, and other environmental hazards.

It was evident that climate hazards could lead to cumulative economic damages to the Port of Banjul estimated at $27 million over the next 30 years. The port could lose up to 3% of its revenue annually due to the impacts of physical climate risks.

The climate risk assessment (CRA) involved utilising cutting-edge climate analytics to identify and quantify the impacts of physical climate risk on the investment and to provide adaptation investment options to climate-proof the investment against the impacts of climate risks. To accomplish this, the Global Center on Adaptation (GCA) has assigned the delivery of a CRA and adaptation and resilience investment options to a consortium featuring Lobelia Earth, Royal Haskoning DHV, and Cityscape Associates Gambia.

In addition to structural adaptations, the port's efforts emphasise environmental conservation. One important initiative is the restoration of the adjacent Tanbi Wetland Complex, a vital mangrove ecosystem that provides crucial ecosystem services. The project seeks to harmonise port expansion with the management of this wetland, reducing the environmental impact of development while protecting natural buffers against flooding and coastal erosion. The Tanbi Wetlands play a key role in absorbing excess water during heavy rains and provide biodiversity benefits that enhance the region's ecological resilience.

OUTCOMES

- Agreed on the need to develop climate adaptation management plans to address the impacts of physical climate risks on the project.
- The Port of Banjul's infrastructure and operations will become more resilient to climate change impacts. This ensures the port's ability to handle increasing cargo volumes and maintain operational continuity, thereby supporting economic growth and trade in the region.
- The implementation of a CRA and the development of adaptation investment options provide a robust framework for managing climate risks. By identifying and prioritising vulnerabilities, the port can proactively implement targeted adaptation strategies, reducing potential damages and ensuring long-term resilience.

CASE STUDY 4

IMPROVED DISASTER RISK MANAGEMENT FOR PORTS IN THE CARIBBEAN

LOCATIONS

Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Guyana, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago

CASE STUDY PROVIDED BY

CIP Inter-American Committee on Ports

SAA MARITIME RESILIENCE BREAKTHROUGHS

- Resilient Infrastructure Systems

R4P FRAMEWORK GOALS

- 4 Effective disaster response and recovery
- 6 Resilience at the centre of port masterplans

ABOUT THE PROJECT

The Caribbean region, with its low-lying coastlines and proximity to tropical cyclone zones, is particularly vulnerable to climate-induced disasters such as hurricanes, floods, and rising sea levels. Ports in Caribbean nations such as Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Guyana, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago play crucial roles in the region's economies. Given their strategic importance for trade, tourism, and livelihoods, enhancing disaster risk management (DRM) at these ports is a pressing priority.

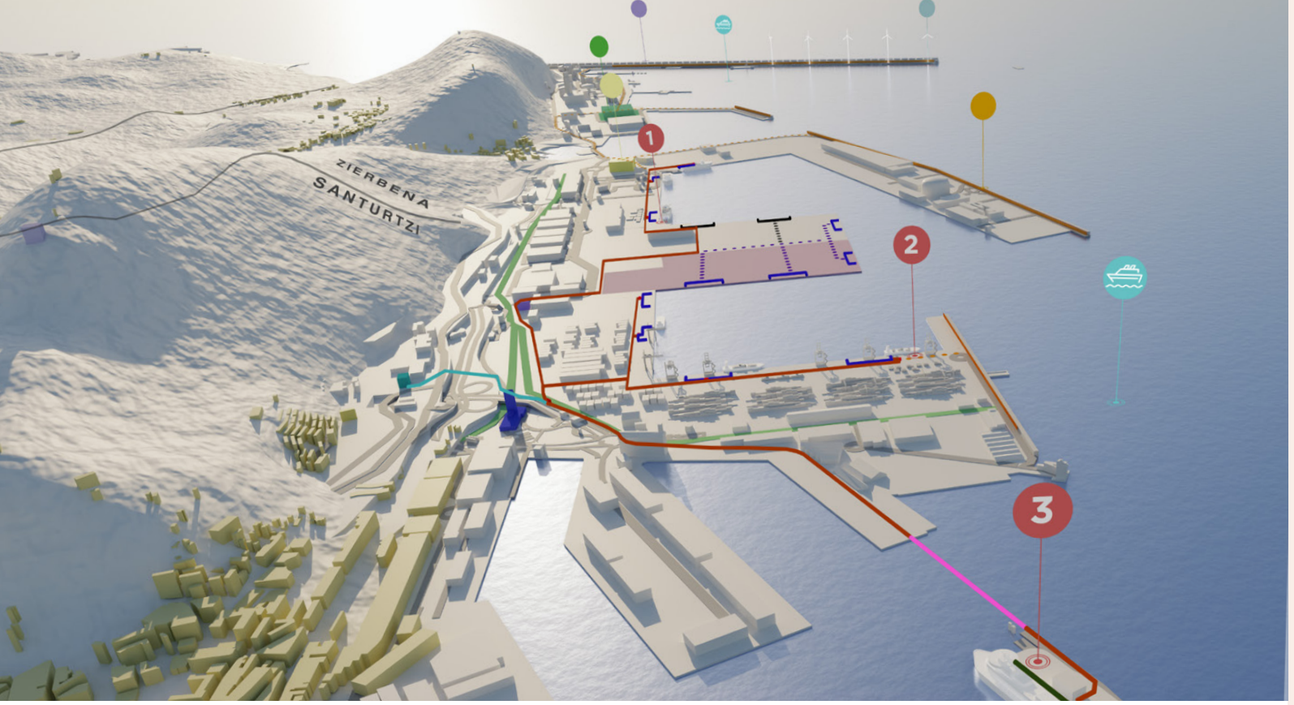
This project aimed to strengthen institutional DRM capabilities in Port and Maritime Authorities in the Caribbean and reduce the impact of natural hazards and anthropogenic disasters on port operations.

Implemented in four phases (DRM capabilities assessment; model emergency operations plan development; capacity building workshops; and table-top exercises), one of the key outputs of this initiative is the Model Emergency Operations Plan (MEOP) for Caribbean Ports. The MEOP, readily available in English, Spanish, French, and Portuguese, lays a comprehensive foundation for DRM and can be adapted based on a Port's individual characteristics and/or DRM requirements.

While covering preparedness, response, and recovery from disasters such as hurricanes, floods, and earthquakes, it also addresses anthropogenic hazards, including one of the most critical threats for modern port operations: cyber-attacks. In response to the project, the Port of Bridgetown in Barbados has implemented early warning systems to monitor weather patterns and water levels in real time. These systems help mitigate the impact of extreme weather events by allowing for better preparation and coordination during emergencies.

OUTCOMES

- Produced a DRM capabilities report with recommendations for enhanced DRM for Caribbean Ports.
- Developed a MEOP for ports.
- Developed a six-module training programme and DRM glossary for ports.
- Conducted three online workshops and one in-person workshop in Kingston, Jamaica, with a total of 90 participants from 14 Caribbean countries.
- Conducted three regional table-top exercises in Jamaica, Barbados and Trinidad and Tobago with a total of 92 participants from 13 Caribbean countries to formulate actionable strategies to plan, prepare, and respond to a disaster and better mitigate interruptions caused by natural hazards and anthropogenic disasters.



CASE STUDY 5

ENHANCING RESILIENCE OF NATURAL ECOSYSTEMS AND ENERGY GENERATION, BILBAO PORT AUTHORITY

LOCATION

Bilbao, Spain

CASE STUDY PROVIDED BY

Bilbao PORT

SAA MARITIME RESILIENCE BREAKTHROUGHS

- Resilient Human Settlements
- Resilient Infrastructure Systems
- Resilient Ocean and Coastal Systems

R4P FRAMEWORK GOALS

10 Protection and enhancement of natural ecosystems

ABOUT THE PROJECT

The Port of Bilbao has been actively working to enhance its resilience and adaptation to climate change, focusing on both environmental sustainability and biodiversity. In its 2023-2026 strategic plan, the port outlines a comprehensive approach to becoming a 'green, competitive, and responsible' port. This includes adapting its infrastructure to better handle the challenges posed by climate change and to ensure that its operations have a reduced environmental impact.

As part of this work, Bilbao Port is engaged in activities aimed at protecting and restoring the natural habitats in its surrounding areas. This includes partnerships with local conservation groups and governmental bodies to monitor and maintain the ecological health of the region's marine and coastal environments. Among these activities is the Biological Surveillance Plan of the Port of Bilbao, which stems from a collaboration agreement between Bilbao Port and the University of the Basque Country, with the purpose of assessing the ecological status of port waters.

Another activity in this area is developing different innovative pilots to increase the resilience and biodiversity of the Port of Bilbao, in collaboration with universities and start-ups. These pilots aim to measure the biodiversity that can be produced in different places in the port, for instance:

- Biomimetic Micro Reefs are extremely efficient and versatile with advanced monitoring through robotic technology and a reporting system; six panels are already installed.
- Bio-enhancing concrete composition and moulded modifying agents create texturised surfaces on which marine life is developed. These concrete blocks have been installed in Bilbao Port.
- Artificial underwater reefs improve underwater flora and fauna.

Another key aspect is the port's investment in green energy and emission reduction technologies. The port is actively implementing cold ironing (onshore power supply), which allows ships to turn off their engines and plug into onshore power sources while docked.

Bilbao Port initiated this strategic investment project (BilbOPS Project) for the electrification of wharves by deploying Onshore Power Supply (OPS) technology, with 11 connection points. The technology intends vessels with the right equipment to connect to the onshore power supply while they are berthed, disconnecting their diesel motors, and reducing port greenhouse gases by up to 40%.

To guarantee that the energy provided by the OPS services to the shipping lines is green and resilient, the BilbOPS project includes the production of renewable energy in the port as a synergetic element. Initially, four photovoltaic plants will be installed at the ferry and cruise terminals, along with two wind turbines and a battery-based energy storage system. This green energy production hub, which is also open to wave projects, will be integrated into the OPS electrical network for ships and the port's own use. This project, co-funded by the European Commission's CEF Transport programme, is part of a wider range of alternative fuel services to be offered at the Port of Bilbao, together with the LGN filling station, the Basque Hydrogen Corridor (BH2C) or e-fuels and biofuels to be produced at the port.

OUTCOMES

- Diversifying power generation enhances the resilience of port operations.
- Lower levels of emissions, noise, and vibrations.
- Direct improvements in living conditions for 125,000 residents in neighbouring towns and 10,000 workers at the port.
- OPS services 900 stopovers per year on the container, ferry and cruise liner wharves.
- Improved biodiversity around the Port of Bilbao ocean areas.

CASE STUDY 6

LOCAL AND NATIONAL REGULATIONS FOR SCRUBBERS' WASHWATER DISCHARGE AT THE PORTS IN THE AMERICAS

LOCATIONS

Belize, Bermuda, Brazil, United States, Panama, and Canada

CASE STUDY PROVIDED BY

INSTITUTE OF THE AMERICAS

SAA MARITIME RESILIENCE BREAKTHROUGHS

Resilient Ocean and Coastal Systems

R4P FRAMEWORK GOALS

5 Regulations and national strategies that enable resilience

10 Protection and enhancement of natural ecosystems

ABOUT THE PROJECT

In an effort to reduce the maritime industry's air pollution, the International Maritime Organization (IMO) issued a regulation as part of MARPOL Annex VI lowering the limit of allowable sulphur content in ships' fuel that came into effect in January 2020. While IMO-2020 intended ship owners to transition to cleaner fuels, such as Low Sulphur Fuel Oil (LSFO), it allowed an alternative compliance mechanism through the use of Exhaust Gas Cleaning Systems, also known as scrubbers.

Scrubbers, which most often use seawater to neutralise ship's exhaust gases before releasing them into the atmosphere, produce an enormous amount of 'washwater' – effluents that are discharged into the ocean and generally untreated, resulting in environmental damages. Per a recent study by the International Council for Clean Transportation (ICCT), shipping is responsible for more than 10 gigatons of scrubber effluents per year.

There are several countries that ban scrubber washwater at the national level, for example, Belize provides protection to key marine ecosystems that include animal migration routes. When pollution is heavily localised in certain areas or ports, or when there is no political support to pursue a nation-wide ban, ports can actively ban discharges in their own waters and terminals. Such is the case at the Port of Vancouver and the Port of Seattle, where cruise ships are not allowed to discharge at berth. There are also state-level bans, for example in California, where vessels must use cleaner fuels, and Connecticut, which provides infrastructure for vessels to plug into onshore power.

Nations can also ban scrubber discharge from certain zones, called 'Special Areas', such as in the Panama Canal. As a major logistical hub and international route for maritime trade, the authority heavily regulates all vessel effluents. Lastly, a jurisdiction can implement more stringent water quality requirements, as well as require special permits to discharge or even use scrubbers. The following are intended outcomes of banning scrubbers.

OUTCOMES

- Increased resilience of ocean ecosystems: Allowing highly acidic scrubbers' discharges into the ocean increases ocean acidification, thus inhibiting the ocean's capacity to absorb CO_2 and enabling climate change. In addition, they contain polluting components, such as toxic heavy metals, endangering multiple species, including marine mammals. Banning these effluents would enhance the resilience of marine ecosystems.
- Improved resilience of food systems and food security: Heavy metals present in these effluents include vanadium, nickel, copper, cadmium, mercury and lead – toxic substances that are ingested and absorbed by living organisms and accumulated through the food chain. If not controlled, this can potentially have negative consequences, either directly or indirectly, on fisheries and other target species that humans ingest and many coastal communities depend on.
- Enhanced quality of coastal spaces for recreation: Scrubbers' effluents, through the scrubbed toxic substances they contain, greatly diminish the quality of the body of water where they are discharged. Those substances are then spread through marine currents. It is proven that they increase the temperature, toxicity, turbidity and acidity of the water. Regulating this could ensure that the water quality of public beaches near ports does not decrease.

CASE STUDY 7

SPECIES PROTECTION PROGRAMME IN THE PORT OF ANTWERP-BRUGES

LOCATION

Antwerp, Belgium

CASE STUDY PROVIDED BY

Port of Antwerp Bruges

iaph international association of ports and harbors

WPSP WORLD PORTS SUSTAINABILITY PROGRAM

SAA MARITIME RESILIENCE BREAKTHROUGHS

Resilient Ocean and Coastal Systems

R4P FRAMEWORK GOALS

10 Protection and enhancement of natural ecosystems

ABOUT THE PROJECT

The Port of Antwerp-Bruges is home to approximately 90 protected plant and animal species. In partnership with Natuurpunt (a nature conservation NGO), a dedicated species protection programme has been developed to preserve these populations while allowing industrial growth. This programme, established in 2022, focuses on ten of the protected species every five years, ensuring that by 2027, targeted conservation efforts have been applied to a rotating group of species.

Historically, obtaining permits for new infrastructure in areas inhabited by protected species was challenging, often leading to delays or rejections by nature preservation organisations. To address this, the Port Authority has established ecological corridors between nature reserves. Measures in both ecological corridors and core areas ensure that while companies can proceed with necessary developments, the protected species have sufficient habitats to thrive.

The Port Management of Antwerp showcases a visionary and proactive approach to environmental conservation and sustainable development. Acknowledging the ecological importance of the Scheldt Estuary and the variety of species within the port area, the management has adopted a comprehensive strategy that merges conservation with economic activities. By partnering with organisations like Natuurpunt and launching innovative initiatives such as the Species Protection Program, the port management demonstrates a commitment to protecting biodiversity utilising nature-positive approaches to enhance coastal and ocean resilience to tackle climate change while promoting growth. Through strategic collaborations, open communication, and forward-thinking policies, the management exemplifies responsible stewardship, aiming to maintain the port as a vibrant economic centre while preserving its natural heritage for future generations.

OUTCOMES

- Creation of a network of ecological infrastructure that functions as green corridors, connecting natural areas within the port. This network helps facilitate the movement and survival of species such as the Argus butterfly, Bluethroat, and various bats, ensuring they have the space and resources they need. Examples of measures are: habitat creation for the natterjack toad, establishment of fish spawning areas, and provision of nesting sites for sand martins, among other species-specific actions.
- Demonstration of commitment to balancing industrial activity with the preservation of its unique biodiversity.
- Safeguards the environment and supports sustainable development within the port area; improves resilience and biodiversity of ocean and coastal systems.

Photo by Sfoskett

CASE STUDY 8

CLIMATE ADAPTATION AND COASTAL RESILIENCY PLAN, PORT OF LONG BEACH

LOCATION

California, USA

CASE STUDY PROVIDED BY

Port of LONG BEACH
THE PORT OF CHOICE

SAA MARITIME RESILIENCE BREAKTHROUGHS

- Resilient Ocean and Coastal Systems
- Resilient Infrastructure Systems

R4P FRAMEWORK GOALS

- 4 Effective disaster response and recovery
- 6 Resilience at the centre of port masterplans

ABOUT THE PROJECT

The Port of Long Beach has created a Climate Adaptation and Coastal Resiliency Plan (CRP) to address the direct and indirect risks posed by climate change and coastal hazards. This plan provides a framework for integrating adaptive measures related to anticipated climate change impacts into the Port's policymaking, planning, construction practices, infrastructure design, and environmental documentation.

The project has the following goals:

- Manage risks associated with climate change
- Identify Port assets that are most vulnerable
- Identify potential adaptation strategies to protect the Port
- Ensure resilience and business continuity

As a vital economic engine for Southern California and the United States, as well as a key gateway for global trade, the Port recognises the importance of protecting its operations and serving its tenants and stakeholders. The CRP outlines immediate solutions to safeguard the Port's most vulnerable areas and assets, as well as long-term strategies to ensure business continuity across its infrastructure and operations for the future.

The CRP incorporates a review of the latest climate science, an inventory of Port assets, and a comprehensive mapping of sea-level rise and storm surge inundation. These data sets helped develop vulnerability and risk profiles for the Port's terminal infrastructure, transportation systems, essential buildings, and utilities. A wide range of potential adaptation strategies was identified to mitigate the Port's vulnerabilities, and a collaborative approach was employed to select a subset of these strategies for further refinement.

The Port's vulnerabilities became evident in August 2014 when storm surge and wave hazards from Hurricane Marie impacted the Southern California coast. The Port experienced flooding and damage at the Navy Mole (Nimitz Road) and Pier F, leading to a suspension of fueling operations and restricting terminal access in several locations for several days. Access to multiple critical facilities was affected for several months. While Hurricane Marie was regarded as an unusual storm event due to its approach angle relative to the coastline, changing climate and ocean conditions may heighten the risk of storm events that differ from historical patterns.

Based on best management practices and insights from technical experts – including coastal and electrical engineers, port and transportation planners, and environmental policy specialists – a preliminary list of potential adaptation strategies was developed. More than 20 strategies were identified and prioritised ranging from existing and new governance, short- and long-term initiatives, and physical infrastructural enhancements. The Port continues to update its CRP based on the best available science sanctioned by the state of California.

OUTCOMES

- The Port's critical infrastructure, including terminal facilities, transportation systems, and utilities, is resilient to climate change impacts. This will ensure the continuity of operations and minimise disruptions, safeguarding the Port's role as a vital economic engine and global trade gateway.
- The Port has a comprehensive risk management framework that identifies and prioritises the most vulnerable assets and implements targeted adaptation strategies. By proactively addressing vulnerabilities, the Port can reduce potential damages and operational downtimes, enhancing overall resilience and business continuity.

CASE STUDY 9

COMMUNITY AWARENESS PROGRAMME, SRI LANKA PORTS AUTHORITY

LOCATION

Colombo, Sri Lanka

CASE STUDY PROVIDED BY

iaph international association of ports and harbors

WPSP WORLD PORTS SUSTAINABILITY PROGRAM

SAA MARITIME RESILIENCE BREAKTHROUGHS

Resilient Human Settlements

R4P FRAMEWORK GOALS

1 Empowered and engaged port communities

ABOUT THE PROJECT

The Sri Lanka Ports Authority recognised the importance of engaging with the local community and improving communication regarding port projects and their goals. Beyond addressing public perception and understanding, there was a notable gap between the theoretical knowledge from academic institutions and the practical realities of port operations and marine environmental protection. To enhance community involvement in port development and foster public support for transforming the Port of Colombo into a green port, efforts were necessary.

Consequently, an awareness-building project was launched, which has been highly successful. This initiative has increased resilience through green initiatives, community engagement and fostering a sense of ownership toward the port. Additionally, it has encouraged academics and scientists to conduct research related to the port, ultimately benefiting its overall development.

OUTCOMES

- Create a more knowledgeable and resilient workforce and community engaged in port development and sustainability initiatives by enhancing communication.
- Improve the links between academic research and port and maritime management and practice by increasing practical awareness of university and vocational students.

The port authority is actively working to integrate sustainability and resilience into the next generation through various port visitor programmes and by promoting a mindset centred on sustainability and resilience. As educators of future leaders and decision-makers, these initiatives emphasise the significance of lifecycle thinking, which considers the environmental impact of a product or activity throughout its entire life span. The port authority has successfully implemented lifecycle thinking strategies to minimise environmental effects, showcasing its commitment to sustainability.

In addition to these educational efforts, the port authority has effectively addressed community needs across social, environmental, and economic dimensions. The awareness programmes have fostered a stronger connection between the port and the local community, enhancing resilience in both the workforce and the community itself regarding green initiatives and the challenges posed by climate change. By prioritising these aspects, the port authority is not only promoting sustainable practices but also ensuring that the community is prepared to navigate future environmental challenges by being resilient.

CASE STUDY 10

ARTIFICIAL INTELLIGENCE FOR ENVIRONMENTAL MONITORING AND PREDICTION OF THE PORT OF BARI

LOCATION

Bari, Italy

CASE STUDY PROVIDED BY

iaph international association of ports and harbors

WPSP WORLD PORTS SUSTAINABILITY PROGRAM

SAA MARITIME RESILIENCE BREAKTHROUGHS

Resilient Ocean and Coastal Systems

R4P FRAMEWORK GOALS

10 Protection and enhancement of natural ecosystems

ABOUT THE PROJECT

Conceived jointly by the Port Authority of Bari and DBALab, the ISMAEL Platform is an innovative monitoring and Decision Support System. The platform aims at monitoring environmental pollutants generated by traffic within the port area (ships, ferries, cargos, vehicles) and evaluating the impact on the port itself and its urban surroundings (city of Bari). It targets the predictive assessment of environmental indicators related to air, water quality and carbon footprint, and the assessment of impacts on the supply chain.

ISMAEL is based on the Internet of Things and it consists of the following main elements:

1. The collection of environmental data (such as pollutants in air and water), weather condition data and trucks' and ships' traffic data through a network of sensors.
2. The collection of 'big data' related to the operational port processes (e.g. ship schedules, AIS surveys, tourist bus transits) through connection with the Port Community System 'Gaia' of the Port System Authority of the Southern Adriatic Sea.
3. The transmission and aggregation of data in one central system.
4. The analysis and presentation of the above data in a user-friendly tool in order to promptly support decision-making.

The goal of the environmental model is to simulate the port area by looking at parameters, such as pollutants in the air or movement of sediments in the water. The model can predict the impacts of port activities on the air and water quality, due to, for example, the arrival and departure of cargo and passenger vessels. The simulation allows the Port of Bari and the local Environmental Protection Agency (ARPA) to evaluate the impact of existing port operations and to examine and consider alternative scenarios for organising these operations. The virtual reconstruction of the port, creating a dynamic digital twin which is constantly up to date, is a remarkable added value of ISMAEL.

OUTCOMES

- Data Collection: The project would involve gathering data from various sources, including sensors for air and water quality, weather conditions, and traffic patterns within the port.
- AI and Machine Learning: AI algorithms analyse the collected data to identify patterns, predict environmental impacts, and optimise operations. This can help in forecasting pollution levels, managing waste, and assessing the ecological footprint of port activities.
- Decision Support Systems: By integrating AI insights, port authorities can make informed decisions regarding cargo handling, vessel traffic management, and resource allocation, reducing environmental impacts.
- Real-Time Monitoring: Continuous monitoring helps in tracking changes in environmental parameters, allowing for immediate responses to any issues, such as spills or emissions. In turn, this can enhance the resilience of port operations.
- Sustainability Goals: The project aligns with broader sustainability objectives, such as reducing carbon emissions, protecting marine ecosystems, and promoting eco-friendly practices in port operations.

The use of AI and decision support systems can be powerful enablers of climate resilience and adaptation.

PORTWATCH

PortWatch provides advanced analytical tools designed to help users evaluate the domestic and international trade impacts of both current and future disasters, including extreme weather events. By leveraging satellite-based vessel data and big data analytics, PortWatch generates actionable insights for a range of stakeholders, including policymakers, international organisations, and the general public.

A standout feature of PortWatch is its comprehensive disaster alert system. Following significant disasters, the platform delivers email alerts detailing the actual and anticipated trade disruptions in the affected regions. This timely information is crucial for helping policymakers, development partners, and the public respond swiftly and effectively to emergencies, ensuring that vital trade routes and economic activities can be managed and supported during challenging times.

In addition to disaster alerts, PortWatch also provides climate scenario analysis that aids in identifying vulnerabilities within the maritime trade network. This vulnerability analysis captures the potential impacts of increasingly frequent and intense climate extremes, allowing stakeholders to prepare for future challenges. The platform uses modelled risk estimates from 1,400 ports around the globe to assess the potential effects of various disasters, such as cyclones, floods, and earthquakes. These data-driven insights empower international dialogue on climate resilience and help policymakers prioritise investments aimed at bolstering the resilience of essential economic infrastructure.

PortWatch is a collaborative initiative between the International Monetary Fund (IMF) and the Environmental Change Institute at the University of Oxford. This partnership brings together expertise in economics and environmental science, enhancing the analytical capabilities of the platform. By combining these strengths, PortWatch not only addresses immediate disaster-related concerns but also contributes to long-term strategies for sustainable trade and infrastructure resilience. Ultimately, PortWatch serves as a vital resource for understanding and mitigating the impacts of disasters on global trade networks, promoting informed decision-making in the face of an increasingly unpredictable climate.

UNIVERSITY OF OXFORD

FOR MORE INFORMATION

portwatch.imf.org

SAFARI

The SAFARI project aims to create a versatile digital platform designed to bolster the resilience of port infrastructure in the face of extreme weather events. As climate change continues to intensify in frequency and severity of these extreme weather events, enhancing the resilience of port facilities is becoming increasingly critical for maintaining trade and economic stability. Port cities, both on the coast and inland, face more of these challenges than hinterland cities and are uniquely positioned to safekeep the logistics network.

This innovative platform will serve as a comprehensive communication hub that connects diverse port communities, fostering strong communication channels among various stakeholders, including port authorities, shipping companies, local governments, and emergency response teams. By facilitating real-time information sharing, the SAFARI platform will ensure that all parties are informed and prepared to act swiftly in the event of an emergency. This will not only have benefits for port efficiency but also for human capital safety and infrastructure resilience.

Equipped with advanced emergency management modules, the platform will provide tools and resources for effective disaster response and recovery. These modules will enable stakeholders to develop and implement robust emergency plans, conduct risk assessments, and simulate potential scenarios to better understand vulnerabilities and devise appropriate strategies.

In addition to emergency management, the platform will incorporate operational and maintenance components to enhance day-to-day functions within port operations. This includes tracking infrastructure conditions, scheduling maintenance activities, and analysing data to identify trends or issues that could affect resilience.

Overall, the SAFARI project represents a proactive approach to safeguarding port infrastructure against the challenges posed by extreme weather events, ensuring that ports remain functional and resilient in the face of adversity. By fostering collaboration and enhancing preparedness, this platform will play a vital role in sustaining economic activity and supporting communities reliant on port operations.

The SAFARI project was launched in June 2024 and involves the following ports: the Port of Dunkirk, the Port of Seville, the Port of Lisbon, the Port of Livorno, and the Port of Tripoli.

aivp INSPIRING PEOPLE OF PORT CITIES

FOR MORE INFORMATION

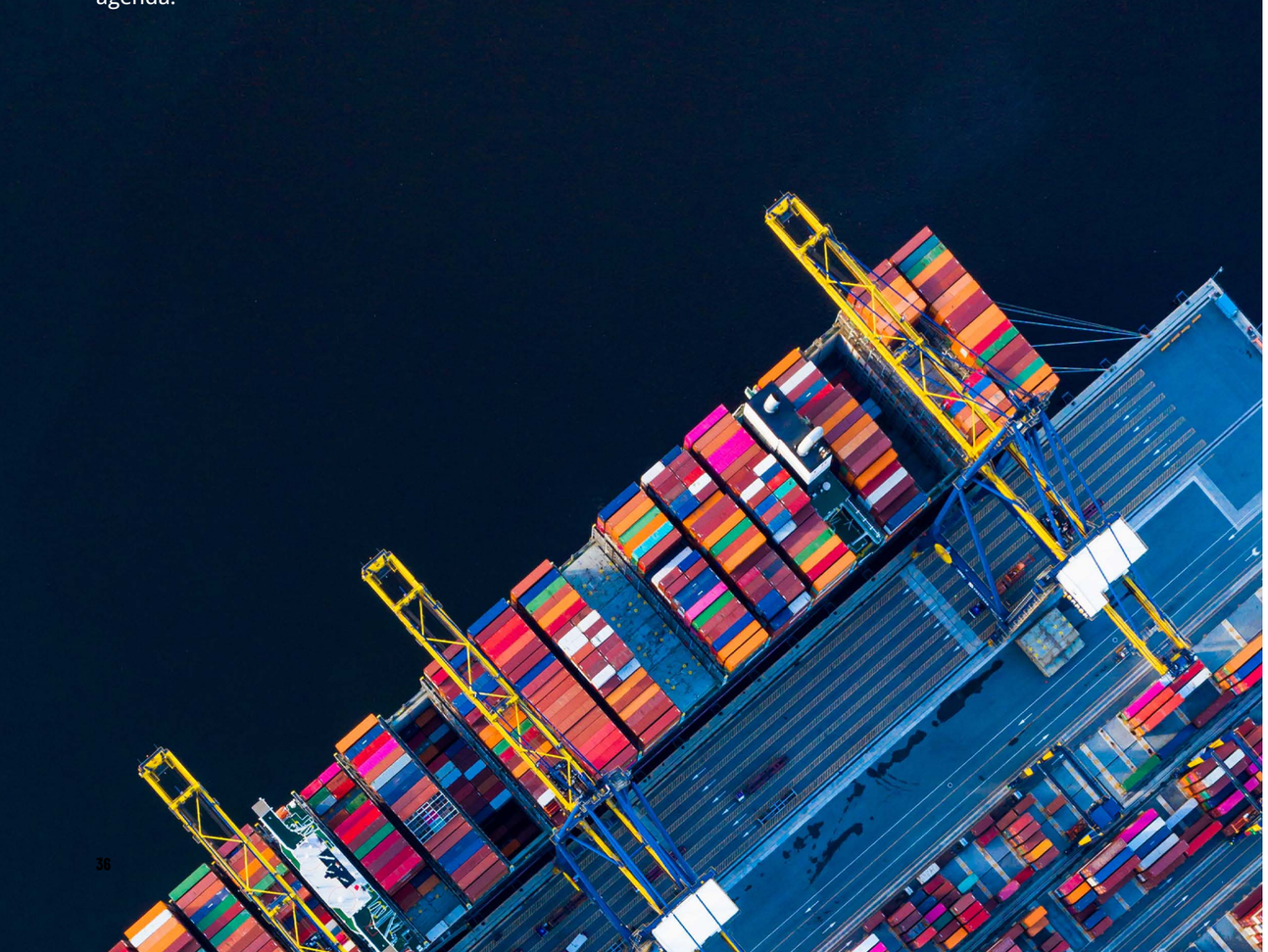
www.safariports.eu/

CLOSING REMARKS

Embedding resilience within port systems is essential to successfully navigate the energy transition, decarbonisation and digitalisation, ensuring that adaptation and resilience are prioritised alongside mitigation efforts. This can be achieved through deep and open cooperation among a network of ports, key stakeholders and communities. Knowledge-sharing, technology transfer, and climate and disaster finance are just some mechanisms that will lead to the development of holistic, scalable solutions.

This publication presents just a small portion of examples from ports around the world that are centring sustainability and resilience in their approach and achieving positive outcomes for people and planet. These case studies exemplify the salience of sustainability and resilience in port systems and serve as a beacon of hope that stakeholders are steadily and collectively steering the industry in the right direction.

Further work needs to be carried out with port actors to systematically utilise the R4P Framework to accelerate port resilience and track progress against the Maritime Resilience Breakthroughs defined in the Sharm El-Sheik agenda.



30 x COP 30 - A CALL TO ACTION

Catalysing the momentum for the emerging implementation of climate resilience and adaptation in the maritime sector, the International Coalition for Sustainable Infrastructure (ICSI), through R4P, has launched a Call to Action (pledge) to bring port actors together to support accelerating port resilience.

This acts as the first sectoral approach to the Sharm-El-Sheikh Adaptation Agenda (SAA) and has three main objectives (see Section 1) to support the achievement of the Maritime Resilience Breakthrough outcome targets in the UN High-Level Climate Champions and Marrakech Partnership for Global Climate Action 2030 Climate Solutions for Resilient Shipping.

The pledge aims to attract at least 30 signatories by COP30. At the time of this publication launch at COP29, the following port actors have signed up to the pledge: Port of Baku, Namibian Ports Authority, Port of Ghana, Port of Namibia, Port of Acu, Solomon Islands Ports Authority, Port of Bilbao, Port of Long Beach and Port of Seattle. The following orgnisations are also supporting this pledge: International Association of Ports and Harbors (IAPH), AIVP and Institute of the Americas.

R4P aims to champion the following action points for port actors to enhance and accelerate port resilience:

1.UNDERSTAND AND MANAGE CLIMATE RISKS

Identify, understand, prioritise, and manage climate risks to port operations, developing concrete action plans for positive outcomes for people and nature in accordance with the Maritime Resilience Breakthroughs.

2.INTEGRATE CLIMATE RESILIENCE INTO BUSINESS MODELS AND PROCESSES

Foster partnerships between government agencies, industry players, research institutions, and international financial institutions (IFIs) to scale climate finance, explore joint initiatives, knowledge-sharing mechanisms, and funding opportunities.

3.FOSTER COMMUNITY FOCUS IN BUSINESS CONTINUITY

Engage with local communities to understand their vulnerabilities and create mutually beneficial relationships, supporting sustainable economies and promoting social capital.

4.SHARE KNOWLEDGE AND EXPERIENCES

Collaborate with governments, industry leaders, and international organisations to share best practices, pool resources, and develop coordinated responses to common threats.

International Coalition for Sustainable Infrastructure

www.sustainability-coalition.org