



SEA OF HOPE

THE BLUE ECONOMY IMPERATIVES FOR
THE GLOBAL SOUTH WITH REFERENCE TO INDIA

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Acknowledgement

This report spotlights the blue economy from the lens of the Global South, with India, a key emerging economy and maritime nation, serving as a focal point.

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Foreword

Oceans are vital living ecosystems on which human life depends. Yet only 8.3 percent of ocean areas are designated for conservation, and just 2.8 percent are effectively managed despite the global commitment to protect 30 percent by 2030. The consequences are stark: collapsing fisheries, degraded coral reefs, and vanishing coastal protections.

How do we safeguard the world's oceans amid the current, unprecedented threats? In June 2025, the UN Ocean Conference gave us reason to hope. With 18 more countries ratifying the High Seas Treaty, the world is getting closer to a global legal framework that would protect biodiversity beyond national jurisdictions. Additional pledges for marine conservation, coastal resilience, and pollution reduction signal that the oceans are no longer viewed as too vast to govern, or too remote to matter.

This report—*Sea of Hope: The Blue Economy Imperatives for the Global South with Reference to India*—builds on this momentum. It brings together perspectives from the Observer

Research Foundation, along with case studies and insights from DP World, to examine how the blue economy can support inclusive and sustainable development. The focus is on India and the Global South, where the links between ocean health, infrastructure, and livelihoods are deeply felt.

Swati Prabhu lays out the structural challenges and opportunities of ocean-led development; Gopalika Arora focuses on nature-based resilience; Mannat Jaspal and Abhishree Pandey examine financing models; Anusha Kesarkar Gavankar highlights the role of ports in supporting communities; and Nilanjan Ghosh closes with a call to align infrastructure with ecological systems.

With almost 90 percent of global trade moving by sea, the maritime sector carries both influence and responsibility. Shipping may be the most carbon-efficient form of long-distance freight—large container vessels emit 3 grams of CO₂ per tonne-kilometre compared to 435 grams for air transport—yet its scale makes it a growing challenge. The sector accounts for 2.9 percent of global CO₂ emissions, a figure that could rise considerably with increasing trade volumes, potentially reaching 10 percent by 2050.

This report underscores that the blue economy is not just a future ambition but an urgent development imperative for the Global South. Unlocking its full potential will require coordinated efforts across the domains of policy, governance, regulation, financing, and innovation. It sets out practical pathways, from fostering inclusive development and sustainable finance to enhancing North-South cooperation and harnessing technology.

DP World's dedicated Ocean Strategy provides a framework for how businesses can drive change. It focuses on four areas: diverse and resilient ecosystems, healthy waters, blue science and innovation, and blue finance. These priorities are already shaping operations and investments, from coral restoration in the Eastern Mediterranean to mangrove regeneration in Kochi, and the issuance of a US\$100-million corporate blue bond—the first of its kind in the Middle East and North Africa. Together, these efforts aim to embed ecological resilience and social benefit into global trade systems so they serve all.

I thank the Observer Research Foundation for bringing focus to this vital issue, and I am proud that DP World's efforts to safeguard oceans are recognised within this report's pages.

-Ayla Bajwa

Group Senior Vice President for Sustainability
DP World

Glossary of Key Concepts

Benefit-sharing Mechanisms: Systems designed and applied to distribute direct and indirect benefits of project activities.

Blended Finance: The use of development finance to mobilise private capital flows towards sustainable development in developing countries.

Blue Bonds: Debt instruments issued to raise finance for marine and ocean-based projects that have long-term sustainability objectives and benefits.

Blue Carbon: Carbon that is captured from the atmosphere and stored in marine and coastal ecosystems like seagrass meadows, mangroves and tidal marshes.

Blue Carbon Credits: Carbon offsets generated from conservation or restoration of coastal and marine ecosystem such as mangroves, salt marshes, and seagrasses.

Blue Economy: The sustainable use of ocean resources for economic growth, improved livelihoods and jobs, while preserving the health of ocean ecosystems.

Blue Tech: The innovative use of emerging technologies to scale up the positive impacts of, and manage risks associated with the blue economy.



Bridge Capital: Short-term financing that helps bridge the gap between a project's initial funding needs and its long-term financing, often involving private sector capital mobilisation.

Catastrophe Bonds: Insurance-linked securities that transfer the risk of catastrophic events from insurers to investors.

Circular Economy: A system where resources are kept in use for as long as possible by reducing waste, reusing, repairing, and recycling products.

Debt Swaps: The exchange of existing debt, typically in the form of loans or non-equity securities, for either a new debt agreement (debt-for-debt swap) or for equity shares in a company (debt-for-equity swap).

Ecosystem Services: Goods and services provided by nature that are fundamental to human life and livelihoods. Examples include food, water, fisheries, air and water purification, soil formation, plant pollination, and climate regulation.

ESG (Environmental, Social, and Governance): Standards used to evaluate a company's performance on sustainability, social responsibility, and ethical management.

Global South: Countries in Africa, Asia, Latin America, and the Caribbean that are generally less economically developed and face ongoing social, political, and environmental challenges.

GDP of the Poor: Contribution of natural resources and ecosystem services to livelihoods and well-being should be estimated and recognised through a "GDP of the poor", which would encompass the various natural sources that contribute to a livelihood of the poor in the developing world, including land, freshwater, soil, biodiversity, and marine resources. This definition was given by Pavan Sukhdev in a paper published in 2009.

Green Bonds: Fixed-income securities designed to raise funds exclusively for climate and environmental projects.

Inclusive Development: An approach to growth that ensures all people, especially marginalised and disadvantaged groups, participate in and benefit from economic, social, and environmental progress.

Just Energy Transition Partnership (JETP): Multilateral agreement between a developed and a developing country, in which the developed country provides financial and technical assistance to support a socially inclusive energy transition in the developing country.

Nationally Determined Contributions (NDCs): A country's climate action plans towards reducing national emissions and adapting to the impacts of climate change. Actions that use and restore natural ecosystems to address challenges like climate change and disaster risk, while benefiting people and biodiversity.

Natural Capital: Resources offered by nature's supply of invaluable assets, such as water, soil, air, and trees.

Parametric Insurance: Type of insurance that covers the probability (or likelihood) of a loss-causing event happening (also known as index-based insurance).

Public-Private Partnerships (PPPs): Collaborative agreements between governments and private companies to finance, build, and operate projects like infrastructure, services, or utilities, sharing risks and responsibilities.

Risk-pooling Arrangements: Collaborative insurance schemes where multiple entities share risks across regions or sectors to reduce the overall financial impact of unexpected events.

Sustainability-Linked Loans: A loan whereby an economic outcome is linked to the sustainability performance of the borrower.

Urban Local Bodies (ULBs): Local government institutions responsible for governing and managing urban areas, including cities and towns, by providing essential services like water supply, waste management, and urban planning.

Executive Summary

The Blue Economy

Oceans cover over 70 percent of the Earth's surface and contain 97 percent of its water, underpinning food security, climate regulation, and oxygen production. The Blue Economy refers to the sustainable use and regeneration of marine resources, spanning fisheries, aquaculture, maritime trade, coastal management, and tourism.

The scale of oceanic influence underscores the importance of the Blue Economy: 80 percent of global trade is sea-based, 40 percent of the global population live in coastal regions, and over 3 billion people depend on the oceans for their livelihoods.



The estimated natural capital of the Blue Economy is valued at US\$25 trillion, with an annual output of goods and services estimated at US\$2.5 trillion, placing it on a par with the seventh-largest global economy in GDP terms. Yet these figures are only the tip of the iceberg.

The Blue Economy intersects with maritime trade and port infrastructure. Although maritime shipping underpins 80 percent of global goods movement, it accounts for 3 percent of global greenhouse gas emissions and contributes to a large part of oceanic degradation. Sustainable seaport practices—through cleaner technologies, waste management, and ecosystem conservation—are therefore essential. These practices not only minimise ecological footprints but also enhance the resilience of marine ecosystems.

Another critical frontier is blue carbon. Coastal ecosystems such as mangroves, seagrasses, and salt marshes are carbon sinks. Tapping into blue carbon markets—where Global South nations act as net sellers—offers innovative pathways for climate financing and ecosystem restoration. India can lead this shift by pioneering nature-based solutions and institutional frameworks to mobilise blue carbon as a developmental asset.

This Report

This report, *Sea of Hope: The Blue Economy Imperatives for the Global South with Reference to India*, published by the Observer Research Foundation (ORF) and DP World, explores ways to advance the Blue Economy from a Global South lens, with specific reference to India. It examines thematic areas including sustainable maritime practices, port development, nature-based climate solutions, and innovative financing tools.

The Blue Economy offers both opportunities and challenges; overcoming the challenges will enhance the opportunities further. This necessitates a strategic realignment of policy, institutional, regulatory, and financing frameworks. This volume calls for a renewed Global South agenda for the Blue Economy, with India as its focus. Combining academic insights with strategic pathways for policymakers, practitioners, and industry regulators, it underscores the need for policy development in the Global South to enable a sustainable Blue Economy.



India, a vital voice of the Global South, leverages its vast maritime infrastructure to handle over 1,000 million tons of cargo annually – 95 percent of its trade by volume. With the blue economy contributing roughly 4 percent to GDP, its importance is clear. As coastal development accelerates in the country, it is crucial to safeguard the resilience of our shorelines and the livelihoods of local communities around them. Guided by our sustainability strategy, DP World is committed to leading by example with concrete actions that support a sustainable blue economy.

-Rizwan Soomar,
CEO & Managing Director,
Middle East, North Africa and India Subcontinent, DP World

Recommendations

1. Making a Business Case for the Blue Economy

To mobilise private-sector engagement, it is essential to present the Blue Economy as a viable business opportunity. Historically, companies have been hesitant to invest in environmental and social infrastructure due to perceived low financial returns. However, this narrow focus on economic rate of return (return on investment, or RoI) should give way to a broader recognition of the social rate of return, especially as sustainability increasingly influences consumer preferences, investor sentiments, and regulatory frameworks.

2. Promoting Innovation and Green Finance

It is critical to fund research in low-emission shipping technologies, carbon capture onboard vessels, and AI-driven logistics for route optimisation. Leveraging blue bonds and sustainability-linked loans can help raise capital for port upgrades, emission-reducing technologies, and ecosystem restoration.

3. Establishing Market-Based Instruments: Payments for Ecosystem Services (PES)

Innovative financing mechanisms such as Payments for Ecosystem Services (PES) can monetise and incentivise the preservation of marine and coastal ecosystems. Downstream beneficiaries—tourism operators, fisheries, and coastal developers—can be encouraged to compensate those who maintain or restore these services upstream.

4. Rebalancing Climate Finance: Adaptation vs. Mitigation

Given the acute climate risks faced by coastal populations in the Global South, equitable climate finance must redress this imbalance. Adaptation finance is not merely a technical requirement but a justice imperative—ensuring that all nations, especially those that are historically marginalised, can access the resources necessary for resilient ocean-based development.

5. Greening Maritime Infrastructure

Decarbonising shipping fleets requires transitioning from heavy fuel oil to low-emission alternatives such as LNG, green hydrogen, ammonia, and electric propulsion. By retrofitting existing ships with energy-saving technologies, such as air lubrication systems, hull coatings, and waste heat recovery, fuel consumption and emissions can be reduced. Further, aligning operations with IMO 2023 and 2050 GHG reduction strategies enhances compliance and reduces the environmental footprint of the shipping industry.

6. Developing Sustainable Ports

Incorporating green building principles, shore power (cold ironing) facilities for ships at berth, and LED-based lighting systems can reduce operational carbon footprints and can facilitate designing eco-ports. By deploying advanced waste reception and treatment systems to handle ship-borne and port-generated waste, including oil residues, ballast water, and plastics, challenges of waste management can be handled. Automating and digitising port logistics to improve efficiency and reduce congestion can help in minimising emissions from idling vessels and trucks.

7. Enhancing Multimodal Connectivity and Hinterland Integration

Developing multimodal logistics corridors (rail-road-sea integration) to shift freight away from carbon-intensive road transport and reducing emissions across the supply chain can build seamless logistics corridors. Ports can also anchor marine industrial clusters, including green shipbuilding, aquaculture hubs, coastal tourism, and clean energy zones.

8. Supporting Coastal Resilience and Ecosystem Services

Investing in Nature-Based Solutions (NbS) or green buffers such as mangrove belts, salt marshes, or dune systems around port perimeters can help enhance natural coastal protection and biodiversity. Further, working with governments, industry practitioners and scientists on marine spatial planning can ensure that port expansions and shipping routes minimise habitat disruption and avoid sensitive ecological zones.

9. Community Engagement and Inclusive Development

For livelihoods integration, it is critical to ensure that port expansion projects take into consideration the needs of local fishing communities and small-scale traders, including provisions for alternative livelihoods and inclusive stakeholder consultations. Investing in skills building for training local youth and workers in marine logistics, ship repair, and renewable energy operations can help build human capital for the Blue Economy.

10. Partnerships for Bolstering Regional and Global Initiatives

Alliances like the Getting to Zero Coalition, Clean Cargo Working Group, and World Ports Sustainability Program (WPSP) enable co-development of solutions and sharing of best practices. Regional Blue Economy platforms can bolster collaborations between governments and multilateral institutions on initiatives such as IMO's Blue Solutions, UNCTAD's Port Management Programme, and Africa's Integrated Maritime Strategy 2050. Public-Private Partnerships (PPPs) can diversify investment risk, foster technological innovation and operational efficiency, and increase the total factor productivity. Their success, however, depends on clear regulations and well-designed contracts. In this context, cross-sector coordination and alignment in regulatory and governance architecture become important to reduce the transaction costs of business and diminish, if not eliminate, any opportunity for regulatory arbitrage.

Introducing Blue Economy in the Global South

Swati Prabhu

The world finds itself at a critical juncture on its sustainability journey. Biodiversity loss has visibly weakened the resilience of ecosystems, negatively impacting economies and public health. The systemic and historical undervaluation of ecosystem services increases the relevance of developing the blue economy—an economy which has the potential to restore and sustain natural systems that have enabled economic activities for centuries.

Greenhouse gas emissions are rising. This, along with growing climate risks, is affecting both built environments and natural ecosystems. Vulnerable and susceptible to climate change on these two fronts, the world needs a two-pronged approach.

It must equip itself with both mitigation and adaptation strategies that will help develop a long-term, practicable sustainability agenda: mitigation to curb GHG emissions that contribute to accelerating the impacts of climate change, and adaptation which builds resilience by preserving ecosystem integrity and humankind's ability to respond to frequent and extreme weather events.¹

This symbiotic relationship between humans and nature is perhaps most prominent across marine and coastal ecosystems. Not only have these environments long stood as gateways for trade and economic progress; they have also provided critical services, acting as water filtration systems, shoreline protection, carbon sequesters, and custodians of fauna and flora species.² Considering this wide range of economic, environmental, and social benefits, humanity's relationship with the oceans has also evolved in significant ways.³ Covering almost two-thirds of the Earth's surface, the oceans enable almost 80 percent of global trade.⁴ This percentage is even higher for most developing countries.

The health of the planet and economy is underpinned by the oceans⁵ by stabilising global temperatures, connecting people, and sustaining life on Earth.⁶ As a critical driver of the economy, the oceans can contribute towards furthering a two-pronged approach that leverages climate mitigation and adaptation initiatives to promote inclusive growth and long-term sustainability.⁷

'Blue Economy', Defined

There is no universal definition of 'blue economy'. However, there is a general consensus that oceans contribute not only to the economy but also towards ensuring the overall well-being of humanity.

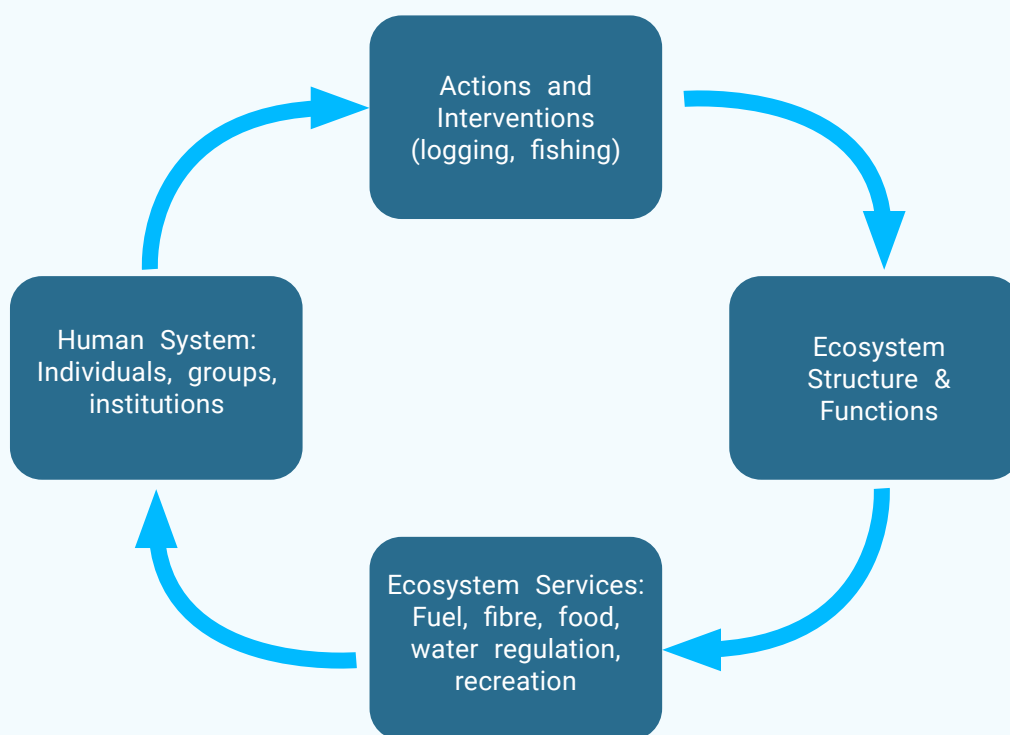
The World Bank defines 'blue economy' as "the sustainable use of ocean resources for economic growth, improved livelihoods and jobs, while preserving the health of ocean ecosystems."⁸ The European Commission identifies it as "all economic activities related to oceans, seas and coasts, covering a wide range of interlinked established and emerging sectors." Further, the Conservation International says, "blue economy also includes economic benefits that may not be marketed, such as carbon storage, coastal protection, cultural values and biodiversity." According to the World Wide Fund (WWF), blue economy ensures that the economic development of the ocean contributes to the true prosperity of the future.⁹ As a marine-based economy, it provides social and economic benefits; restores, protects, and maintains the diversity, productivity and resilience of marine ecosystems; and is based on clean technologies, renewable energy, and circular material flows.

These definitions speak of sustainability in its strong form, i.e., underlining that natural resources and ecosystem services are irreplaceable and must be preserved.^{a,10} In this sense, the uptake and relevance of ‘sustainability’ in the blue economy is crucial to understand. To better understand its practical implications, the following section explores how ecosystem services directly support human livelihoods.

Exploring Ecosystem-Livelihoods Linkages

The tangible value of environmental and natural resources emerges from the ecosystem services they provide to human communities. Ecosystem services highlight the importance of preserving natural habitats and biodiversity for human well-being. These services and goods provided by nature are inextricably linked to human lives and livelihoods. Indeed, biodiversity conservation underscores the bi-directional causality that exists between ecosystems and economies (Figure 1).

Figure 1. Ecosystem-Economy Synergies



Source: Resilience Alliance

^a There are two types of sustainability: weak sustainability is characterised by a non-declining combined stock of capital and assumes that man-made capital can be replaced with natural capital; strong sustainability means that natural capital cannot be replaced by any other capital.

Economic forces and actions that comprise the human social system act as interventions in the ecosystem to fulfil their economic needs.¹¹ These economic activities also play a pivotal role in forming ecosystem structures and functions.

For example, coral reefs are one of the most biodiverse ecosystems on the planet. About 25 percent of the oceans' fishes thrive on healthy coral reefs.¹² Over half a billion people worldwide depend directly on coral reefs for food, income, and natural protection from climatic risks. However, these coral reefs are being threatened by exploitation and misuse, resulting in long-term environmental degradation. Further, there is a lack of a clearly defined market framework for the services provided by the coral reefs, making them undervalued and unacknowledged. The valuation of ecosystem services can facilitate the optimal investments towards biodiversity and harness the blue economy.¹³

For example, as per estimates of the World Economic Forum (WEF), about US\$44 trillion of economic value generation, or over half of global GDP, is moderately or highly dependent on services from nature,¹⁴ with construction (US\$4 trillion), agriculture (US\$2.5 trillion), and food and beverages (US\$1.4 trillion) being the three largest industries that rely on nature.¹⁵ These industries rely on either the direct extraction of resources from forests and the ocean or the provision of ecosystem services such as healthy soil, clean water, pollination, and a stable climate.

While the valuation of ecosystem services is highly contextual, it has several benefits:

- › Offers a basis for understanding the role of the ecosystem in the livelihood and sustenance of the human community at various scales. For example, DP World Yarimca has taken steps to restore the underwater coral bridge between the Mediterranean and Marmara Seas through its Yellow Coral Conservation Project. Recognising the coral's role in the ecosystem and the threats posed by human activity, temperature shifts, and mucilage outbreaks, the company collaborated with Istanbul University and the Marine Life Conservation Society to reverse the damage. Their efforts include close monitoring, cleaning mucilage, and replanting corals. Through these actions, DP World is ensuring both immediate recovery and long-term sustainability.¹⁶

- › The ability to guide legal proceedings for determining damages when a party is held liable for the loss to another party. For example, though loss and damage (L&D) has become a policy issue under the 2015 Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC), it is not legally binding.
- › Helps revise investment (infrastructure development) decisions. For example, about US\$2.5 billion has been committed by DP World towards infrastructure development across India, Africa, South America, and Europe for an integrated supply chain solution.¹⁷
- › Reduces market failures and enhances the scope for market creation. For example, Payment for Ecosystem Services (PES) is an incentive mechanism encouraging sustainable financing for conservation and natural resource management.
- › Helps in improved appreciation of conservation programmes that are implemented for safeguarding various components of the ecosystem. For example, in 2022, a special committee appointed by the Supreme Court of India recommended a considerable revision of the Net Present Value (NPV) of forests by fixing compensatory afforestation practices.¹⁸

Empowering People and Livelihoods in the Blue Economy

Given the deep ecosystems-livelihoods linkage, the Global South must find a way to further integrate the blue economy as part of its sustainable development ambitions. With its vast coastline and strategic maritime position, India exemplifies the potential of this economic model. As a prominent actor from the Global South, India's growth strongly depends on a vibrant blue economy manifested through several economic opportunities in generating and sustaining livelihoods. India's 2025 Union Budget set up the Maritime Development Fund (MDF) INR 25,000 crores (US\$290 million) to propel India's maritime sector for economic expansion, capacity building, and solution-driven holistic development of society and economic growth.¹⁹

Vulnerable communities residing in the Global South are dependent on the ocean resources. India ranks third in global fish production, second in aquaculture, and is the leading producer of shrimp. It contributes towards domestic food security and the international seafood market.²⁰ With a vast coastline of 11,098 km,²¹ India's fishing sector supports the livelihoods of about 30 million people. At the same

time, it also offers possibilities for empowering communities, growing industries in shipping and shipbuilding, job creation, and sustainable rural development. Indeed, Blue Food and Blue Jobs are gaining significant traction. Blue Food—fish, seafood, and seaweed—from artisanal fishery to large-scale aquaculture, is integral to the improved nutrition and food security of millions. Similarly, the creation of jobs in fishery, aquaculture, shipping, marine conservation, sustainable tourism, and renewable energy, known as Blue Jobs, could ensure sustainable livelihoods.²²

Moreover, fisheries and aquaculture play a role in sustaining livelihoods and providing nutritious food and economic opportunities. South Asia is a major contributor to the global food basket through its fisheries sector. Further, the oceans have a vast untapped potential for harnessing renewable energy, which is essential against the backdrop of increasing global energy demand. India should aim to be at the forefront in harnessing offshore wind, tidal, and wave energy. For instance, offshore wind potential of 71 GW has already been identified by the Indian government along the Gujarat and Tamil Nadu coasts.

Global trade architecture is undergoing a change with the emergence and expansion of the blue economy. With 80 percent of global trade in goods carried out by sea, the Organisation for Economic Co-operation and Development (OECD) projects that the industries belonging to the traditional ocean economy will double in size to US\$3 trillion by 2030.²³

India's *Maritime Amrit Kaal Vision 2047* is a flagship initiative aiming to modernise ports, improve shipping infrastructure, and promote renewable marine energy, with an investment target of INR35,000 crore by 2047.²⁴ Other notable programmes such as *Sagarmala*, Integrated Coastal Zone Management, and the Deep Ocean Mission further support the sustainable development of the ocean economy. *Maritime India Vision 2030* outlines 150 initiatives aimed at propelling India to global maritime leadership. Businesses like DP World are recognising the importance of healthy oceans. DP World has released its Ocean strategy and vision for a thriving ocean and stable climate supporting an equitable trade system that allows both nature and people to flourish²⁵ (see Figure 2). Comprising four pillars—diverse and resilient ecosystems; healthy waters; blue science, innovation and leadership; and blue finance—DP World's Ocean Strategy emphasises locally adapted solutions, especially ports and terminals, to implement tailored strategies that address specific local challenges and opportunities.

However, geopolitical constraints and sea-borne globalisation in the maritime domain impact the free flow of trade, supply chains, climate resilience strategies,

and the larger ambit of blue economy. Challenges to maritime security are blurring the line between the security and sustainability dynamics of the ocean economy. These include traditional threats, such as strategic port development; continuous and consistent supply of capital; risks posed by coast-guard services and maritime militia; and non-traditional threats like climate change, anthropogenic interventions in the form of piracy, maritime terrorism, drug and human trafficking, Illegal Unreported, and Unregulated (IUU) fishing, oil spills, plastic waste, and marine pollution.

DP World's Ocean Strategy for 2024-2030 redefines the nexus between global trade and environmental stewardship underpinning the importance of a Sustainable Blue Economy through four strategic areas of action.

Diverse and Resilient Ecosystems:

Aiming to combat the degradation of over 60 percent of marine ecosystems, DP World's strategy uses a science-driven and nature-based solutions approach to regenerative projects focusing on blue carbon ecosystems. Key targets include the development of a Blue Carbon Ecosystems Strategy by 2025 and the restoration of 280 hectares of mangroves by 2030, alongside initiatives to preserve biodiversity through living shorelines, seawalls, and biogenic reefs.

Healthy Waters:

Preventing, reducing, and mitigating pollution from the ocean by driving decarbonisation and sustainable business practices for waste management. This will be achieved by deploying holistic practices, smart technologies, sustainable design and adoption of circular economy principles by 2030. DP World has a Net-Zero by 2050 target, with sub-targets called Science-Based Target Initiatives (SBTI) to be achieved through concerted efforts across our marine services, ports, and terminals.

Blue Science, Innovation & Leadership:

Accelerating change through innovative, science-driven solutions and blue behaviours. Key targets include enabling and supporting the development and scaling up of ocean solutions and innovations relevant to the shipping sector by 2026 and supporting partners, using our space, logistics and marine services to enable the development and application of high-impact ocean solutions.

Blue Finance:

To enable finance mechanisms to help close the financial resources gap for protecting our natural capital, with a key target that includes the development of a finance mechanism to enable and increase blue investments with impact on ocean health by 2025.

Source: DP World

Blue Economy in the Global South

For the Global South, the standard method of evaluating GDP may not be an accurate measure of economic growth or overall societal well-being. The real economy includes natural capital assets—i.e., natural resources that do not have to be produced—and the valuable but non-marketed, ecosystem services that these assets provide. Here, the “GDP of the poor” is relevant as a measure of the value of ecosystem services, since the poor are more dependent on ecosystem services than the wealthy. The “GDP of the poor” comprises the composite values of ecosystem services, which are sources of livelihoods for the poor and are overlooked by standard GDP figures. Given the high degree of dependence of the poor on ecosystem services, they are also the most affected by the depletion of the natural resource base that provides these services. The contribution of natural resources and ecosystem services to livelihoods and well-being should be estimated and recognised through a “GDP of the poor” that encompasses various natural sources, including land, freshwater, soil, biodiversity, and marine resources.

Blue Tech: Technological Proliferation, Blue Economy, and Port Development

To address the growing range of threats, integration of cutting-edge technologies in marine management is a critical component of ensuring sustainable ocean governance.²⁶ Technological proliferation and its pivotal role in realising blue economy is making waves on the sustainable ocean front. As per the World Bank, ‘Blue Tech’ refers to the innovative use of emerging technologies to scale up the positive impact and manage risks associated with the blue economy. These can range from the use of earth observation and sensors to improve sustainable fisheries, drones to help plant mangroves, forecasting and early warning systems for coastal storms, robots to clean beaches and floating trash, to floating energy production, autonomous ships, and even undersea agriculture.²⁷

Furthermore, marine information and communication technology (ICT) sector covering satellite monitoring, analysis of big data for biodiversity, pollution, weather patterns, ecosystem evolution, fishing zone advisory services, ocean state forecast, storm surges, cyclones, monsoon variability, tsunamis, R&D services including validation of satellite sensors, parameterisation of key processes for models and verification of model simulations is an emerging sector of blue economy.²⁹ Several frontier technologies and emerging research areas, such as Artificial Intelligence (AI) and Machine Learning (ML) pilots; digital twins technology; Internet of things (IoT); video analytics; and Augmented Reality (AR) and Virtual Reality (VR) are shaping the future of the maritime and logistics sectors.

Moreover, port development moving beyond the economic infrastructure also involves the digital transformations and innovations to enhance efficiency, improve decision-making, and optimise the overall functioning of various sectors across the spectrum of the blue economy. Experts posit that efficient movement of goods and materials is highly dependent on innovative port operations and logistics technologies. Supply chain resilience and securing end-to-end logistics are gaining significance in contemporary times, with seismic shifts occurring at every stretch of the ocean. Global business enterprises are viewing port operations as a critical aspect determining the future of blue economy. International trade is also being shaped by technology such as automation, blockchain, and sustainable infrastructure.

This report, *Sea of Hope: The Blue Economy Imperatives for the Global South with Reference to India*, is published by the Observer Research Foundation (ORF) and DP World. It aims to examine avenues for enhancing and promoting the cause of the blue economy through a Global South lens, with specific reference to India. Covering thematic areas related to the ocean economy, the report focuses on sustainable maritime practices, sustainable infrastructure like port development, nature-based climate solutions, and innovative financing tools.

Following this Introduction is Chapter 2, where *Swati Prabhu* highlights the challenges to nurturing the blue economy. These include global warming and climate change, anthropogenic interventions, port development, marine pollution, losses in fisheries, and IUU fishing. With its robust policy interventions towards port-led industrialisation, infrastructure modernisation, enhancing connectivity

for easing supply chain bottlenecks, and technological research, India is positioned in the driver's seat by pushing blue economy in its development narrative.

In Chapter 3, *Gopalika Arora* focuses on how nature-based solutions, such as restoring mangroves and coral reefs, can address climate challenges and enhance resilience in coastal and marine environments. At the same time, the article argues, it is imperative for the port sector to maintain its critical economic role while contributing towards sustainability.

In Chapter 4, *Mannat Jaspal and Abhishree Pandey* discuss innovative tools like blue bonds, blue carbon credits, debt-for-nature and debt-for-ocean swaps, blended finance, and risk insurance schemes for funding sustainable maritime projects.

In Chapter 5, *Anusha Kesarkar-Gavankar* explores how port development can be harnessed to promote equitable growth and strengthen community resilience in the Global South, where the consequences of environmental degradation and exclusionary development are most deeply felt.

In Chapter 6, *Nilanjan Ghosh* concludes the report by highlighting the uniqueness of this volume by concerning itself with the blue economy challenge of the Global South that is distinguishable from the Global North. The article outlines the important recommendations emerging from the volume, especially for blue economy financing, and the role of logistics and infrastructure organisations; and the alignment of the blue economy principles with Indian PM Modi's call for LiFE (Lifestyle for Environment).

Endnotes

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Building the Blue Economy: Challenges and Prospects in the Global South

Swati Prabhu

As the world rapidly approaches the 2030 deadline for realising the Sustainable Development Goals (SDGs), ocean governance has emerged as a critical action area for fostering a sustainable future. The Global South, despite attempting multiple strategies for inclusive development for over half a century, continues to battle underdevelopment. There is an urgent need for a holistic development strategy that couples growth with the sustainable use of resources, facilitating rounded economic development opportunities.

Conceptually, the Blue Economy has the capacity to fulfill these objectives by combining care for ocean health with the wider proliferation of resources generated from it. In this sense, the oceans can unleash opportunities, but sustainability norms need to be adhered to in order to maximise these possibilities for the long term. As global attention shifts toward more climate-resilient and inclusive development models, the blue economy offers immense potential in sectors such as fisheries, aquaculture, marine transport, coastal tourism, and renewable ocean energy.

For countries in the Global South, where large populations depend directly on the ocean for food, employment, and trade, the blue economy presents a strategic opportunity to diversify economies, reduce poverty, and enhance resilience to climate change. However, realising these benefits is not without challenges. Issues such as overfishing, pollution, weak maritime governance, and limited technological and financial capacity hinder the sustainable development of ocean-based sectors. Balancing economic ambitions with environmental protection and social equity remains a complex task.

Opportunities and Challenges for the Blue Economy

Ocean governance, and thus the blue economy, is not a new concept but only a new moniker. Popularised by economist Gunter Pauli in 1994 at the United Nations University (UNU),¹ the idea of 'blue economy' stems from the concerns of achieving sustainable development for the oceans, thereby striving to balance social equity, economic growth, and environmental conservation.² Moreover, there is increasing recognition that the blue economy is an inter-sectoral concept, having multidimensional aspects and is transboundary in nature.³ A host of challenges and potentials exist in the ambit of blue economy.

The impacts of climate change are partly personified by heightened global warming that impacts marine and coastal ecosystems. This poses a threat to vulnerable communities located particularly in the small island developing states (SIDS). The United Nations Convention on the Law of the Sea (UNCLOS) 1994 highlighted a plethora of challenges for the ocean and marine resources of diverse origins.⁴ After the UNCLOS 1994, it was increasingly being acknowledged that such challenges in many cases were detached from the idea of territory and sovereignty. Though UNCLOS provides ways to respond to some of the critical problems arising within marine ecosystems

through its depletion and degradation, new challenges are appearing in various parts of the world, especially in the Global South. Examples include ocean acidification, marine pollution, depletion of fish stocks, and degradation of marine ecosystems. Further, intricate and transboundary issues include Illegal, Unreported and Unregulated (IUU) fishing, habitat destruction, chemical pollution, marine plastic pollution, and deoxygenation through excessive nutrient supply.

Having historically contributed only 1.5 percent of global GHG emissions, SIDS and the wider Global South is disproportionately bearing the brunt of the climate crisis.⁵ Industries like tourism and fisheries contribute up to half of the GDP of the SIDS, like Maldives, Seychelles, and Antigua and Barbuda. Between 1970-2020, the more frequent hurricanes and extreme weather events resulted in economic losses of approximately US\$153 billion for SIDS alone.⁶ This resulted in the displacement of large populations and massive damages to lives, livelihoods, property, and infrastructure. For example, in February 2013, an earthquake and tsunami in the Solomon Islands displaced an estimated 2,400 people. In 2009, a tsunami hit Samoa, displacing some 5,000 people. In 2009, volcanic eruptions forced some 400 people to flee Gaua Island, Vanuatu. In Papua New Guinea, the 2004 volcanic eruption on Manam Island displaced 10,000 people.⁷

Mass migration is often triggered by inadequate weather forecasting, rising sea levels, flood risks, and vulnerable infrastructure. Here, the rise of digital technologies and tech-led development has emerged as a prominent factor in the climate landscape. Technological advancements are certainly an asset for enhancing ocean governance, but accessibility to these mediums is limited, especially for the Global South. The imperatives are technology transfer, capacity building, knowledge sharing, and skill distribution. Lack of efficient and equipped businesses or entrepreneurial settings in the blue economy marketplace is a complex issue.⁸ Additionally, fiscal constraints to fund the maritime sector is commonplace. For example, research institutions, non-government organisations (NGOs), and start-ups often struggle to access the bridge capital that can turn their business ideas into practical products. The absence of a formal tech-transfer capacity to secure capital from either the private or public sector can impact the long-term commercial prospects of the blue economy.

As a result, many of the countries from the Global South are pursuing blue economy as a model or a framework for driving sustainability.⁹ Indeed, this model depends on a pledge towards the ecologically-sensitive use of ocean resources, such as sustainable fisheries (for example, a reduction of bycatch and increased science-based fisheries management) and responsible aquaculture (preserving marine biodiversity while ensuring a continuous food supply).¹⁰ Experts believe that the blue economy model can facilitate prosperity and inclusive growth and help chart a development pathway for a resilient and prosperous future for the Global South based on principles of conservation and social equity. As such, it aligns with most of the Sustainable Development Goals (SDGs), particularly those related to poverty (SDG-1), food security (SDG-2), gender equality (SDG-5), energy (SDG-7), decent work (SDG-8), climate action (SDG-13), and life below water (SDG-14).¹¹

Globally, a number of countries, including Australia, India, Indonesia, France, Brazil, Papua New Guinea, Seychelles, Namibia, Mozambique, Japan, and the Philippines, have incorporated the tenets of blue economy into their broader development agendas. India, for instance, explicitly recognises the importance of the ocean with Prime Minister Modi stating: “The *blue chakra* or the wheel in India’s national flag represents the potential of Blue Revolution or the Ocean Economy.”¹² India is currently drafting the National Policy on Blue Economy to envisage optimal utilisation of all sectors of the maritime domain for sustainable development of the coastal communities.¹³

Policy Interventions: The Case of India

Though blue economy as a concept involving the sustainable utilisation of ocean resources has gained currency in both the Global North and the Global South, there is a difference in approaches. For the Global North, blue economy is primarily linked with issues of oil spills, ocean health, maritime security, and the marine ecosystem in general. Whereas, in the Global South, it is rooted in building resilience in communities that rely on the oceans for not only their livelihoods but also for basic sustenance. For example, the WWF Vision 2050 case study conducted by Ghost et al.¹⁴ underlined the ecosystem service valuation of mangroves in the Indian Sundarbans Delta (ISD). By conducting a comprehensive cost-benefit analysis, they showed that under a business-as-usual (BAU) scenario where vulnerable communities are not relocated by 2050, the total value yielded by the regional economy of the ISD would reach INR 172.31 trillion.¹⁵ On the other hand, if a strategic

retreat or organic outmigration of the population takes place to a stable and developed region with simultaneous regeneration of mangroves in the vacated area, the current value of the net benefits from the Vision 2050 scenario (INR 2202.7 trillion) will be 12.8 times that of the BAU scenario (INR 172.31 trillion) for the period 2050-2100.

The linkages between ecosystems and economies are more pronounced for the Global South, where a large portion of the population resides in the marine and coastal regions. Experts posit that blue economy is not just “an altruistic intent but a development imperative” for the Global South.¹⁶

As a prominent development partner from the Global South, India enjoys a unique maritime position.¹⁷ Nine of its 29 states are coastal, and the nation’s geography includes 1,382 islands. There are nearly 199 ports, including 12 major ports that handle approximately 1,400 million tons of cargo each year. Out of these 12, DP World operates terminals at Cochin, Nhava Sheva, Chennai and Mundra. Moreover, India’s Exclusive Economic Zone of over 2 million sq km has a bounty of living and non-living resources with significant recoverable resources such as crude oil and natural gas. The Government of India’s Vision of New India by 2030, enunciated in February 2019, highlighted the blue economy as one of the 10 core dimensions of growth.

Some of its ocean governance schemes include the following:

› **PRITHVI (Prithvi Vigyan)**

An umbrella scheme merging five schemes—“Atmosphere & Climate Research-Modelling Observing Systems & Services (ACROSS)”, “Ocean Services, Modelling Application, Resources and Technology (O-SMART)”, “Polar Science and Cryosphere Research (PACER)”, “Seismology and Geosciences (SAGE)” and “Research, Education, Training and Outreach (REACHOUT)”.¹⁸

› **DOM (Deep Ocean Mission)**

There are six components of DOM that aim to explore the deep oceans for resources and develop sea technologies for the sustainable use of ocean resources.¹⁹

- a) Development of technologies for deep-sea mining and manned submersibles
- b) Development of ocean climate change advisory services
- c) Creating public awareness about earth system sciences and its allied fields
- d) Technological innovations for the exploration and conservation of deep-sea biodiversity
- e) Deep ocean survey and exploration
- f) Energy and freshwater from the ocean
- g) Advanced marine station for ocean biology

› **Mission Mausam**

Implemented by the India Meteorological Department (IMD), the National Centre for Medium Range Weather Forecasting (NCMRWF), and the Indian Institute of Tropical Meteorology (IITM), this scheme aims to provide accurate weather and climate forecasting information to combat extreme weather, climate change, water scarcity, and other environmental risks.²⁰

- a) Develop cutting-edge weather surveillance technologies and systems.
- b) Implement higher-resolution atmospheric observations with better temporal and spatial sampling/coverage.
- c) Implement next-generation radars and satellites with advanced instrument payloads.
- d) Deploy high-performance computers (HPC).
- e) Improve understanding of weather and climate processes and prediction capabilities.
- f) Develop improved Earth system models and data-driven methods (with the use of AI/ML).
- g) Develop technologies for weather management.
- h) Develop a state-of-the-art decision support system (DSS) and dissemination system for last-mile connectivity.
- i) Strengthen capacity building and research collaborations.

During its G20 Presidency in 2023, India attempted to mainstream blue economy in the global discourse.²¹ The adoption of the 'Chennai High-Level Principles for a Sustainable and Resilient Blue/Ocean-based Economy' during the meeting of G20 Environment and Climate Ministers in July 2023 is an illustration of this effort.²²

In this sense, PM Modi's call for LiFE (Lifestyle for the Environment) at COP26 in Glasgow on 1 November 2021, which was also emphasised in its G20 Presidency, is another pertinent example.

› **SAGARMALA**

Officially launched in 2015, Sagarmala aims to unlock the untapped potential of India's extensive coastline, navigable waterways, and strategic maritime trade routes for port-led development and coastal community upliftment.²³

Partnering for Innovation, Sustainable Ports, and the Blue Economy

There is a strong need, especially in the developing world, to learn from emerging global good practices and risk management measures in a rapidly changing technological environment. Building robust partnerships to leverage blue growth is key. For instance, India's Ministry of Ports, Shipping, and Waterways (MoPSW) has established a Blue Economy coordination committee to enhance collaboration among stakeholders, ensuring a unified approach to sustainable practices and policy formulation within the blue economy framework.²⁴ Development partnerships with the broader stakeholder network at both regional and international levels are essential for the Global South, including in India.

As one of the fastest-growing economies in the world, India's position as a development partner is significant. For instance, the Indian Technical and Economic Cooperation institutionalised in 1964 signifies its global vision of fostering partnerships in pertinent areas of development.²⁵ Led by demand-driven projects without attached conditionalities, Indian capacity-building projects have brought benefits to developing economies, including the SIDS, in areas of climate change, disaster relief, and renewable energy. At the global stage, India set the tone with a renewed vigour towards sustainability by establishing initiatives like the International Solar Alliance (ISA) and the Coalition for Disaster Resilient Infrastructure (CDRI) in 2015.

Further, making digital forays through 'India Stack', New Delhi has also upended the global narrative on innovation and development. With its novel approach towards digitalisation of large-scale systems, its vision of digital public infrastructure (DPI) has visibly gained traction. Port-led industrialisation,

infrastructure modernisation, enhancing connectivity for easing supply chain bottlenecks, driving research, and promoting entrepreneurship and startups, are some of the prominent steps being taken by India to power its maritime revolution.

For example, under Vision@2047, the Government of India aims to invest US\$1.2 trillion (INR 100 lakh cr.) in building a holistic infrastructure through GATI Shakti. This is directed towards leveraging local manufacturing, pushing exports, and bringing new possibilities for futuristic economic zones. Here, in August 2025, DP World launched two new domestic rail services linking Bhimasar and Hazira in Gujarat to Kolkata in West Bengal to accelerate cargo movements between India's western manufacturing clusters and key eastern trade hubs.

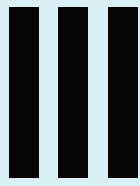
This also relates closely to coastal community development by livelihood generation, increasing inland waterways transportation, and aligning the larger goal of sustainable development. However, challenges of limited capacity in terms of advanced technologies, limited investments from the private sector, and inadequate regulatory mechanisms and their associated environmental degradation also persist.

Thus, it becomes imperative to examine and assess India's position as a key factor in the blue economy framework towards pushing the development and connectivity narrative.

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Leveraging Nature-Based Solutions (NbS) for Sustainable Port Development

Gopalika Arora

The maritime sector is the backbone of international trade, facilitating over 90 percent of global cargo movement across the oceans and seas.¹ Port infrastructure and services play a key role in maintaining the smooth operation of the global supply chains. As ports continue to be developed and expanded across the globe, they serve not only as critical nodes in international trade but also as drivers of economic growth and employment. Over 30 million people are employed by the port sector directly, with over 90 million jobs dependent on the broader port-related ecosystem.²

While the port infrastructure is vital to global trade and has a big socio-economic impact, its development and operations can pose challenges for marine ecosystems.

While vital to the global economy, ports are also responsible for approximately 3 percent of global greenhouse gas emissions.³ Poorly planned port development can cause stress to the marine ecosystems, while operations may contribute to pollution, GHG emissions and the proliferation of invasive species. As global trade continues to expand, these challenges are only likely to grow. It is therefore essential for the port sector to contribute towards sustainability while maintaining its economic role.

Port Development and Environmental Sustainability: The Double Materiality Perspective

The concept of 'double materiality' has emerged as an important framework in the sustainability discourse, recognising that materiality operates along two dimensions: impact materiality and financial materiality. Impact materiality considers how a company or a sector impacts the environment and society, whereas financial materiality underscores how environmental and social factors impact a company or sector's economic performance.⁴ This dual perspective is especially relevant for the port sector, which both depends on and affects natural ecosystems.

The Dependence of Ports on Natural Resources and Vulnerability to Climate-Induced Hazards

Ports can play a key role in advancing a nature-positive transition by developing a clear understanding of how their operations both depend on and affect natural resources and ecosystems. The port sector is dependent on natural resources and certain regulating, provisioning, and supporting ecosystem services to support its operations and infrastructure. This makes them more vulnerable to extreme weather events and climate-induced natural hazards. Approximately 86 percent of ports globally face exposure to at least three natural hazards, such as cyclones, storm surges, and flooding.⁶ According to an OECD report, under a high-emissions scenario, the share of port operations facing massive risk from coastal flooding and storm surges is expected to rise sharply from 4 percent in 2023 to nearly 14 percent by the end of the 21st century.⁷ Additionally, they are also threatened by rising sea levels caused by climate change.

The Impact of Port Development on Natural Resources

Ports rely on nature for their operations and also impact nature. They are typically located near coastal communities and ecologically sensitive habitats. Port operations and their associated supply chain activities can generate various environmental and socio-economic impacts. Port development and operations can lead to substantial changes in the land and marine ecosystems, primarily through activities such as land reclamation, dredging and the diversion or modification of natural waterways. These interventions often result in removal and degradation of critical marine habitats like mangroves and coral reefs.⁸ In the absence of effective environmental safeguards, such disruptions can have a detrimental effect on the coastal ecosystems and the services provided by them. These include intensification of the coastal erosion process, increased vulnerability to flooding, deterioration of water quality, and exacerbation of climate change-induced impacts such as the 'urban heat island' effect.⁹

Port operations can also contribute large volumes of greenhouse gas (GHG) emissions throughout their value chain.¹⁰ Emissions are generated at each phase, from upstream activities such as energy supply and manufacturing to mid-stream operations including port construction and terminal operations, and certain downstream activities involving transportation.¹¹ Downstream activities like shipping accounts for most of the emissions in the value chain.¹²

In response to this challenge, the International Maritime Organization (IMO) has adopted an ambitious strategy aimed at reducing annual GHG emissions from international shipping by 70 percent to 80 percent by 2040, relative to 2008 levels, with a long-term objective of achieving net-zero emissions by approximately 2050.¹³ In April 2025, the IMO adopted measures to include a new fuel standard for ships and a global pricing mechanism for emissions. These will be formally adopted in October 2025 and entered into force in 2027. Additionally, in alignment with the global decarbonisation agenda, the International Association of Ports and Harbors (IAPH) has called on port authorities worldwide to actively support and implement measures that contribute to GHG emission reductions across port operations and maritime value chains.¹⁴ Despite global initiatives, achieving required reductions in GHG emissions from ports remains a complex challenge. The difficulties stem from the multifaceted nature of port operations and the wide range of emission sources embedded across various activities and logistical processes within the port ecosystem.¹⁵

Given their critical function in facilitating global cargo and passenger transport, ports may also contribute to the proliferation of invasive species.¹⁶ The introduction of such species into new environments, where they compete with native species for resources and habitat, leads to a further decline in the surrounding biodiversity. Current estimates suggest that over 80 percent of the world's marine ecosystems have been impacted by at least one harmful invasive species.¹⁷ A 2020 study on global maritime trade and biological invasions projected that, over the next 30 years, the risk of marine species invasions could increase by a factor of 3 to 20, highlighting the urgent need for stricter biosecurity and management measures.¹⁸

Given the dual dynamic of the port sector's impacts and reliance on natural ecosystems, transitioning towards a nature-positive future is essential for long-term resilience and sustainability. It is necessary to climate-proof investments by identifying ecological and climate risks, transitioning towards green infrastructure, and developing nature-positive business models. This is where nature-based solutions can play a transformative role. By embedding natural systems in the planning and design of ports, they can offer an opportunity to mitigate climate impacts, strengthen climate resilience, and generate co-benefits for both ecosystems and communities.

Integrating Blue Carbon Ecosystems into Port Planning and Operations

Blue carbon ecosystems such as mangroves, tidal marshes, and seagrass are gaining increasing recognition as cost-effective nature-based solutions for climate mitigation and adaptation.¹⁹ These ecosystems have the unique ability to absorb and store large volumes of carbon over long timescales, effectively functioning as carbon sinks.²⁰ In addition to their climate benefits, these ecosystems also provide a wide range of co-benefits for biodiversity as well as human well-being. Spanning over 51 million hectares globally, they collectively store around 11.5 billion tons of carbon. Seagrasses account for 63 percent of this area, followed by mangroves at 27 percent and salt marshes at 10 percent, with mangroves alone holding the largest share of carbon reserves (around 6.5 billion tons).²¹ Seagrasses are particularly valuable for their long-term carbon storage in sediments, their role as nursery habitats for marine life, and their capacity to improve water quality. Salt marshes, on the other hand, offer a high rate of soil carbon accumulation, act as natural buffers against coastal flooding, and support diverse bird and fish populations.

Mangroves are among the most productive coastal habitats, contributing to global blue carbon storage. Although they cover only about 1 percent of the world's coastal ecosystems and represent the sole forest-based blue carbon ecosystem, mangroves are responsible for storing approximately 15 percent of the organic carbon found in marine sediments.²² Additionally, they are also a great example of green infrastructure, providing US\$250 million worth of flood protection in the regions where they grow.²³ Seagrass also plays a vital role and can remove around 0.5 pounds of carbon annually, more than three times the rate of a tropical forest and seven times the range of a temperate forest.²⁴

Therefore, targeted investments in protecting and restoring these ecosystems could capture nearly 4 gigatons of carbon per year by 2030, increasing to over 11 gigatons annually by 2050.²⁵ However, when degraded, these ecosystems can release significant amounts of carbon, further aggravating climate risks.

To ensure the long-term sustainability of port operations, it is essential to adopt initiatives that safeguard biodiversity, contribute to the restoration of natural habitats, and strengthen blue carbon ecosystems. The overarching objective must be to transition toward a 'nature-positive' port model—one that integrates economic growth with ecological stewardship. In doing so, port activities can shift from being agents of environmental disruption to becoming catalysts for the preservation and enhancement of natural resources, ensuring that their operations leave a legacy of both prosperity and ecological balance.

Towards a Nature-Positive Port Sector: Key Recommendations

1. Embedding Natural Capital and Strategic Environmental Assessments in Infrastructure Planning

(a) Valuing Natural Capital

The rapid urbanisation of coastal areas, expansion of global trade, and the continued depletion of natural resources collectively underscore the imperative for the port sector to move beyond the conventional economic paradigms. Port development and operations must be informed by a holistic approach that incorporates both environmental and social

considerations into development planning.²⁶ A key aspect often overlooked in this process is the value of natural capital, which provides essential services such as flood protection, carbon sequestration, and biodiversity support.²⁷

Natural capital refers to the “stock of renewable and non-renewable resources that combine to yield a flow of benefits to people.”²⁸ In the context of ports, natural capital includes coastal and marine ecosystems like mangroves, seagrasses, and salt marshes that provide essential services like flood protection and carbon sequestration while maintaining ecological balance and supporting economic activities. Despite their importance, these ecosystem services have historically been undervalued and neglected due to a lack of well-structured markets for natural capital accounting.²⁹ As a result, the value of these services is unaccounted for in the development planning process, which often prioritises short-term economic gains over long-term sustainability.

The prevailing economic orientation of port planning or any other infrastructure development projects often results in natural capital being perceived as a constraint rather than an asset.³⁰ Traditional models of economics often overlook the contributions of these ecosystems to sustainable development. Assigning a monetary value to nature in quantitative and comparable economic terms enhances its visibility in the decision-making processes. This will allow the private sector to efficiently assess the trade-offs and benefits associated with conserving or degrading natural capital. Integrating the economic valuation of ecosystem services into infrastructure planning supports more informed evaluations of both conventional development investments and those aimed at protecting or restoring natural systems.³¹

South Africa's National Ports Authority has taken a notable step by incorporating natural capital into its strategic priorities, positioning it alongside financial and human capital as a pillar of value creation.³² However, the challenge persists in recognising the link between natural capital and economic development. Once valued appropriately, coordinated action between public and private sectors is needed to align policies that protect it.

(b) Integrating Environmental Impact Assessments in the Early Stages

The global recognition of the need to incorporate environmental assessments and social assessments in the early stages of any infrastructure planning is growing steadily. Strategic Environmental Assessments (SEAs) is one of the popular tools to identify any potential environmental challenges at the beginning of a development project.³³ By integrating these assessments in the planning phase, port developers will be better equipped to design infrastructure that minimises ecological damage. Additionally, Environmental and Social Impact Assessments (ESIAs)³⁴ must be initiated during the pre-construction stage.³⁵ This approach will ensure that potential environmental and social risks and impacts are identified and addressed, also allowing businesses to integrate sustainable practices into their design choices. It can also provide an opportunity to steer clear of risky projects, develop nature-positive and climate proofing measures, and mobilise finance for the same.

While many designated countries have robust environmental and social requirements essential for the construction of port facilities and other large industrial projects that interfere with environmentally and socially sensitive areas, non-designated countries can often have nascent and less mature equivalents. This is where good international industry practices, such as the IFC Performance Standards or Equator Principles, can play a critical role in ensuring global port development meets consistent permitting and compliance standards that protect ecosystems integrity, preserve access to pastoral livelihoods and facilitate sustainable industrialisation en masse.

As ports transition into operational phases, the implementation of robust Environmental Management Systems (EMSs) and Social Management Systems (ESMSs) is also important. These systems are essential not only for maintaining compliance with environmental regulations but also for ensuring improvement in sustainable practices.³⁶ These environmental and social impact assessments and management systems often require an array of environmental data at a granular level. Ensuring open access to tools and input datasets is important for streamlining the assessment process and enhancing the credibility, transparency, and

reliability of the outcomes of these assessments. There is a pressing need to establish robust data and information management systems to facilitate transparent reporting of environmental and ecological information. Additionally, a centralised platform is essential for sharing the data and future projections, with regular updates to ensure accuracy and relevance at appropriate spatial and temporal scales.

Case Study: DP World's Approach to Environmental Risk Management

DP World has institutionalised a robust framework for managing environmental risks (such as biodiversity loss) and social risks (such as involuntary resettlement) across its global operations. When undertaking new developments, particularly in previously undeveloped areas, the company conducts Environmental and Social Impact Assessments (ESIAs) in accordance with national legal requirements and its internal standards. These internal protocols are informed by international best practices, most notably the IFC Performance Standards, specifically IFC Performance Standard 5 on Land Acquisition and Involuntary Resettlement and Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources. The company is also making more efforts to identify financial mechanisms and opportunities to action NbS programmes and science-based solutions at earlier stages that could help enhance ports' environmental performance over time.³⁷

2. Advancing Sustainability through Circular Economy Practices in Port Operations

Port-related development, management and operations involve the extensive use and production of materials across terrestrial and marine environments. Without effective management, these processes can result in environmental externalities.³⁸ The port sector should embrace circular economy practices by adopting strategies that prioritise the reduction, recycling, and reuse of waste. In doing so, they can help shift supply chains from a linear model to a more sustainable, circular framework.³⁹

By prioritising material recirculation, resource efficiency, and integrated supply chains, ports can reduce dependency on raw materials, mitigate environmental impacts, and lower carbon emissions. Adopting circular practices may also improve any supply chain disruptions and lead to resilience building. To support this transition, ports must align their strategies with the circular economy principles and frameworks, ensuring that circularity drives long-term, nature-positive growth across the sector.

3. Strengthening Transparency and Accountability through Nature-Related Disclosures

Port developers and operators should prioritise the disclosure of critical nature-related information to ensure greater transparency and accountability in their sustainability performance. Given their reliance on coastal ecosystems, it is important that port authorities and operators systematically disclose environmental risks, dependencies, and impacts throughout their operations and value chains.

This includes seeking third-party verification and independent validation of nature-positive initiatives to enhance credibility and build stakeholder trust. Alignment with emerging global disclosure frameworks such as the Taskforce on Nature-related Financial Disclosures (TNFD)⁴⁰ and International Sustainability Standards Board (ISSB)⁴¹ will be crucial as regulatory expectations around environmental and biodiversity-related performance become more stringent.

Voluntary frameworks such as the TNFD have already gained traction globally, with over 500 organisations, including major financial institutions, signaling support.⁴² Early adoption of such frameworks by ports will not only enable compliance with upcoming regulatory shifts but also position port authorities and terminal operators as leaders in sustainable maritime infrastructure, contributing meaningfully to the global transition towards a nature-positive and climate-resilient blue economy.

While a preliminary assessment of Fortune Global 500 companies suggests that corporate action on nature remains limited, climate considerations have already seen mainstream uptake as 83 percent of these companies have set climate-related targets.⁴³ For the port sector, this signals an opportunity to lead by expanding disclosure practices beyond climate to encompass

nature-related risks, dependencies, and impacts, especially around land-use change, coastal resilience, biodiversity loss, and marine pollution.

4. **Scaling Investments in Nature-Based Solutions**

A strategic and coordinated approach is essential to restore, enhance, and protect marine ecosystems and biodiversity, particularly in the coastal communities where ports and associated industries operate. This can be advanced through targeted investments in nature-based initiatives, with an emphasis on blue carbon ecosystems, including the protection of marine species, mangrove restoration, and the conservation of seagrass beds. To mitigate emissions in hard-to-abate sectors, stakeholders are also encouraged to support carbon offset projects, particularly blue carbon solutions, as part of broader decarbonisation strategies. Furthermore, companies should extend their efforts beyond operational boundaries by contributing to systems-level conservation and restoration. This includes investing in credible and effective nature-based solutions through localised approaches, and collaborating with environmental NGOs, local governments, indigenous and local communities to ensure legitimacy, inclusivity, and long-term sustainability of these initiatives.

Case Study: DP World's Mangrove Restoration Initiative in Kochi

As part of its commitment to ocean health and communities resilience, DP World focuses on the regeneration of blue carbon ecosystems, and has recently launched a mangrove conservation initiative in Ernakulam, Kochi, in partnership with Plan@Earth, a local non-profit dedicated to environmental conservation. The project aims to restore 50 acres of mangrove ecosystems across four coastal panchayats—Pallipuram, Kuzhipilly, Kadamakudy, and Njarakkal—in the Vypeen region while creating new livelihood opportunities for local communities. Over a three-year period, the initiative will see the planting of approximately 100,000 mangrove saplings, repurposing some of the areas for ecological integration. Additionally, more than 1000 community members will be engaged in various livelihood initiatives linked with the mangrove ecosystem.⁴⁴

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IV Financial Pathways to Scale the Blue Economy

Mannat Jaspal and Abhishree Pandey

According to a UNDP report, the estimated value of blue carbon ecosystems is over US\$190 billion per year, and their ability to reduce the costs of climate change impacts is over US\$65 billion annually.¹ Despite the growing recognition of their potential in supporting climate goals, protecting biodiversity, and promoting economic development, the financing landscape for the blue economy remains persistently scarce and fragmented. By 2030, achieving Sustainable Development Goal 14 (SDG14)—which focuses on managing and protecting marine and coastal ecosystems—will require an estimated US\$175 billion annually.² However, between 2015 and 2019, actual investments fell far short, totaling less than US\$10 billion.³

Table 1: Finance Gap by Region (Asia and the Pacific): Investments Needed by 2030 to Meet the Blue Economy-Related SDGs (million \$)

Themes	Segments	Pacific	SE Asia	South Asia	Totals	Blue Economy Score
Ecosystem and Natural Resource Management	Marine & River Ecosystems	121	44	51	216	23
	Fishing	22	200	2,001	1,427	15
	Fisheries	14	-27	28	15	15
	Seafood Processing & Distributions	930	4,775	3,429	9,134	19
	Aquaculture & Algalculture	1,001	9,782	9,843	20,626	23
Pollution Control	Solid Waste Management	80,500	145,000	47,400	272,900	17
	Resource Efficiency And Circular Economy	9,000	58,600	69,900	137,500	20
	Non-point Source Pollution Management	26,300	87,100	463,800	577,200	21
	Wastewater Management	13,900	97,000	150,400	261,300	23
Sustainable Coastal and Marine Development	Coastal and Marine Tourism	1,776	1,396	773	3,945	14
	Coastal Resilience	1,700	3,600	6,340	11,640	23
	Resilient Ports	881,000	1,510,000	1,280,000	3,671,000	22
	Green Ports	8,858	63,641	22,086	94,585	22
	Green Shipping	2,171	5,649	5,532	13,352	22
	Marine Offshore Wind Renewable Energy	25,200	151,800	235,900	412,900	22
	Marine Tidal, Wave, Geothermal Renewable Energy	100	500	800	1,400	22
Total		1,052,593	2,139,060	2,298,283	5,489,140	

Source: Asian Development Bank⁴

Public funding dominates investments in the blue economy, especially in nature-based solutions (NbS) where it makes up 86 percent⁵ of all financing. These investments are primarily sourced from multilateral development banks (MDBs), bilateral donors, and national governments. In the last 10 years, philanthropy and official development assistance together have also invested US\$13 billion⁶ in the sustainable development of the ocean economy. Despite these efforts, only 2 percent of the US\$31 billion in blended finance mobilised between 2018 and 2020 was directed towards SDG 14. The World Bank has invested over US\$7.4 billion in ocean-based projects as of June 2021 through initiatives such as the ProBlue Programme, whereas the Asian Development Bank (ADB) invested US\$5 billion⁷ in its Action Plan for Healthy Oceans and Sustainable Blue Economies.

Despite growing interest in the blue economy driven by Environmental, Social, and Governance (ESG) considerations, private sector involvement remains limited and risk averse. Insurance companies such as AXA XL⁸ and investors like Impact Alpha⁹ have supported specific initiatives, but these remain the exception rather than the norm. Weak investments are often attributed to the lack of standardised blue finance taxonomy, uncertain returns, inadequate measuring, reporting and verification processes, and comparatively nascent markets for blue financial instruments.

Structural, Institutional, and Market Gaps

The gap in blue economy financing is not just due to lack of capital, but also because of structural, institutional, regulatory, and technical weaknesses that limit the ability to develop and scale investment in sustainable maritime sectors.

1. Limited Concessional and Grant Flows

There is a major shortfall in concessional and grant-based finance from the Global North to the Global South. While climate funds such as the Green Climate Fund (GCF) have made progress in mainstreaming ocean ecosystems in their portfolios, approvals and project pipelines remain slow and protracted. In many cases, national development plans lack dedicated components for blue sector investments. It must be noted that this stands in sharp contrast to land-based restoration projects, which have received comparatively greater policy attention and financial support at both domestic and international levels.

2. Lack of Bankable Blue Projects

Another barrier is the shortage of bankable blue projects.¹⁰ Many marine and coastal projects are considered high-risk and low-return by traditional financial institutions. Projects in mangrove restoration, sustainable aquaculture, or deep-sea restoration often lack clear revenue streams or measurable financial returns, making them less attractive—and even unviable—in comparison to land-based projects. Projects in this sector require 10-15 year investment horizons, while commercial investors typically seek 3-5 year returns. This leads to a fundamental mismatch in expectations. In contrast to the billions of dollars mobilised through the REDD+ for the sustainable¹¹ management of forest ecosystems, there is no equivalent mechanism for marine and coastal ecosystems. This absence highlights a major gap in the global climate finance ecosystem, where ocean-based mitigation and adaptation efforts remain underfunded and structurally unsupported.

3. Institutional Fragmentation and Weak Governance

Institutional and regulatory fragmentation limits the flow of investment in many countries. Ocean governance responsibilities are spread across different ministries—including fisheries, ports, tourism, and environment—

leading to inconsistent regulations, overlapping jurisdictions, and administrative bottlenecks. In several developing countries, frameworks for managing marine property rights and benefit-sharing from ocean-based resources remain absent. The absence¹² of clear, cohesive, and holistic governance arrangements beyond national Exclusive Economic Zones (EEZs) makes it difficult to implement offset projects. The jurisdiction of the UNFCCC¹³ is also limited in regulating marine areas, leaving most of the open ocean and deep-sea areas excluded from the mitigation and adaptation discourse. Furthermore, according to a study, ocean resources and sectors are hardly equitably distributed. Most of the costs from ocean-based economic activities are borne by women, youth, and marginalised communities. Current frameworks that guide blue investments do not adequately support each other and are not yet guided by universally adopted principles or inclusive and just frameworks.

4. Data and Impact Measurement Gaps

In addition, access to ocean finance is limited and not well understood¹⁵ by potential recipients, particularly in developing countries. Data and monitoring challenges further hinder the scaling of blue economy finance. Investors and development finance institutions require baseline data, performance indicators, and impact metrics to assess financial viability and environmental returns. However, many countries lack reliable ocean data infrastructure. The data gap makes it difficult to design bankable projects and complicates compliance, monitoring, and evaluation frameworks.

5. Social and Structural Limitations

Beyond institutional and market barriers, structural issues also pose significant challenges to scaling blue finance. One of the main challenges is the lack of equitable benefit-sharing mechanisms, which leads to distrust among local communities and limited participation in projects. In some cases, conflict of interest among investors, governments, and conservation groups slows down progress and limits funding for nature-based solutions (NbS). Often times, small firms offering NbS lack the capacity needed to meet the rapid pace and scale of investment, especially when funders expect quick returns. Lastly, there is a difference in the degree of awareness among the varied stakeholders involved in the process. They sometimes lack a clear understanding of how mechanisms such as carbon markets or natural capital investments work, and often fail to recognise the importance of traditional knowledge and local participation in ensuring the success of projects.

Innovative Financial Instruments

Innovative financing instruments can help de-risk investments and align private sector capital with global sustainability outcomes. In this section, we evaluate five such key mechanisms—Debt and Equity Market, blended finance, risk insurance, blue carbon credits, and debt-for-nature swaps—that are shaping the emerging innovative financing landscape for the blue economy.

1. Debt and Equity Market

Blue bonds are debt instruments that raise capital for marine and ocean-related projects and support sustainable development. Public and policy interest¹⁶ in ocean conservation through blue bonds has grown since the first sovereign blue bond was issued in 2018. Transactions labelled as blue reached a total value of US\$5 billion¹⁷ between 2018 and 2022. The issuance of the Seychelles Blue Bond remains the most cited example in this regard. The US\$15 million¹⁸ bond, structured with the help of the World Bank and the Global Environment Facility (GEF), helped refinance national debt and mobilised private finance for sustainable fisheries and marine conservation. It showed how Small Island Developing States (SIDS)¹⁹ can harness capital markets to develop a sustainable blue economy, create high-value jobs, and ensure food security. Blue bonds' investments go far beyond marine restoration, affecting other dimensions of the economic and environmental²⁰ area where the use of proceeds is deployed. These partnerships also enable efficient public-private partnerships²¹ through technical assistance, the use of de-risking capital, and other measures to secure long-term sustainability gains.

Green bonds with marine-focused use of proceeds can also be used to finance blue projects. While not always labeled as “blue” (which requires that the bond funds 100% blue projects), several green bond issuances have funded projects like coastal resilience, wastewater treatment, and offshore renewable energy.

Private sector participation is also increasing. For instance, the case of UAE-based DP World, which issued the MENA (Middle East and North Africa) region's first blue bond, highlights how private entities can tap into global capital markets to fund sustainable projects cutting across marine transportation, port infrastructure, marine pollution, and ecosystem conservation (see Table 2). This also highlights the growing trend of private sector participation in

blue economy projects, aligned with the goals of the Paris Climate Agreement and the Kunming-Montreal Global Biodiversity Framework goals.

Table 2: DP World's Blue Bond

Case Study	DP World's Blue Bond
Issuer	DP World (UAE-based logistics firm)
Size	US\$100 million
Year	2024
Tenor	5-years
Coupon Rate	5.25%
Guarantees/ Backed By	T. Rowe Price Associates, Inc (U.S.-based investment firm)
Features	Aligned with 1. ICMA Blue Bond Guidance 2. UN SDG 14 (Life Below Water) 3. UN SDG 6 (Clean Water and Sanitation) 4. DP World's Ocean Strategy and Decarbonization Roadmap Eligible Projects 1. Sustainable Marine Transportation 2. Sustainable Ports Development 3. Marine Ecosystem Conservation and Restoration 4. Marine Pollution

However, linking bonds to specific expenditures reduces flexibility in allocating capital, and without clear safeguards, the capital may be diverted to purposes other than blue-focused activities.

Sustainability-linked loans (SLLs) are another mechanism through which borrowers can raise and earmark funds for blue investments. For instance, the International Finance Corporation (IFC) issued a €100 million²³ blue financing loan in Central and Eastern Europe to increase funding for blue economy projects in Romania. By linking incentives to pre-agreed environmental targets,

such loans can help companies in ocean-based sectors transition to more sustainable operations while maintaining financial flexibility. Quality is essential to the growth of SLLs, as concerns about poor design and greenwashing discourage borrowers from entering the market.

On the equity side, venture capital (VC) and private equity are increasingly targeting the blue economy. VC funding for the blue economy has grown 10x in the last decade.²⁴ Startups working in areas such as shipping and ports, and blue-tech and ocean observation are increasingly attracting investor interest.²⁵ Despite this, access to risk-tolerant investors remains a barrier for early-stage ventures in the sector.

2. Blended Finance

Blended finance involves the use of public or philanthropic funds to de-risk investments and encourage private sector participation in sectors typically considered too risky or unprofitable. A report from the Asian Development Bank (ADB)²⁶ proposed that blended finance platforms could contribute to closing the blue economy financing gap. It has been proven particularly effective in climate finance and is now being increasingly adapted for blue economy sectors and projects. Climate blended finance transactions account for about 49 percent of the blended finance market in terms of deal count and 57 percent²⁷ in aggregate financing. Such models typically combine first-loss guarantees, technical assistance, and concessional loans with private capital. For instance, Mirova's pioneering impact investment fund, Sustainable Ocean Fund (SOF), used blended finance mechanisms and secured a US\$50 million facility with USAID to provide investors with a principal protection guarantee.²⁸ The first ocean-focused blended finance vehicle, the Global Fund for Coral Reefs, offers important lessons on structuring blended funds. It supports pipeline development and business incubation, aligns grant-making and equity investment decision-making frameworks, and has adopted a single robust suite of monitoring and evaluation metrics.²⁹ The main barriers to scaling include deal structuring complexities, limited project pipelines, and weak regulatory environments.

Mechanisms such as blended finance particularly benefit from the intervention of the government, which in turn helps crowd in private investors by improving the bankability of blue projects. Public-Private Partnerships (PPPS) can play a critical role here. Given the capital-intensive nature of blue economy sectors

like coastal infrastructure, marine conservation, sustainable fisheries, and ocean-based renewable energy, PPPs can help address the gap between limited public resources and growing investment needs. However, the success of PPPs depends on strong institution and regulatory oversight, and standardised global frameworks.

3. Risk Insurance Mechanisms

Coastal and marine investments are particularly exposed to climate, weather, and disaster-related risks. Risk insurance mechanisms such as parametric insurance, risk-pooling arrangements, and catastrophe bonds can protect blue economy assets and drive investment. For instance, the Mesoamerican Reef Insurance Programme,³⁰ launched by the Nature Conservancy and other partners in 2021, provides parametric coverage for damage to reefs caused by weather events. A unique feature of the programme is that it releases payouts based on pre-agreed³¹ wind speed thresholds within pre-agreed areas, rather than through post-disaster claims processes. On a larger scale, sovereign climate and disaster risk pools like the Caribbean Catastrophe Risk Insurance Facility (CCRIF) quickly provide³² short-term liquidity to limit the financial impact of hurricanes and earthquakes. Despite their potential, risk insurance mechanisms and tools remain underutilised in blue economy finance. Only a limited number of projects integrate insurance design from inception.

4. Blue Carbon Credits

Blue carbon credits are another emerging market-based mechanism that monetises the carbon sequestration capacity of coastal ecosystems such as mangroves, seagrasses, and salt marshes. Projects that restore, conserve, or protect these ecosystems can generate verified carbon units that can be sold or traded with buyers seeking to offset emissions. While blue carbon credits currently are a nascent part of the market, their fivefold sequestration capacity³³ makes them a powerful tool. Countries like Indonesia³⁴ have already registered blue carbon projects under global standards such as Verra's Verified Carbon Standard (VCS), and Indian states such as Gujarat³⁵ and regions such as Sundarbans are also in the early stages of scaling blue carbon credit projects. However, scaling remains plagued by methodological and legal uncertainties. Carbon markets are complex, and when combined with high transaction costs, fragmented regulatory frameworks, and unclear benefit-sharing mechanisms, they reduce the viability of blue carbon projects. Many countries are still in the process of developing clear legal and institutional

policies on carbon rights, particularly for coastal and Indigenous communities. In addition, Measurement, Reporting, and Verification (MRV) for blue carbon is more complex and costly than for terrestrial forests, raising risks of greenwashing and reducing investor confidence. These challenges have limited the broader uptake of blue carbon credits.

5. Debt-for-Nature and Debt-for-Ocean Swaps

Debt swaps involve restructuring a country's external debt in exchange for commitments to invest in nature conservation and climate action. In 2015, the Nature Conservancy launched its first debt-for-nature swap.³⁶ It enabled the government of Seychelles to refinance US\$21.6 million³⁷ of its sovereign debt at a discount, while increasing investments in marine protection. A debt-for-climate resilience operation successfully enabled Barbados to replace its outstanding, more expensive debt with relatively affordable financing, generating US\$125 million³⁸ in fiscal savings. Such instruments offer triple benefits: fiscal relief for debt-stressed economies, long-term conservation finance, and a commitment to sustainability. However, they do not come without challenges. Eligibility is limited to countries with substantial external debt and conservation-ready instructional structures. Still, with rising debt across the Global South, debt-for-nature swaps are well positioned to gain traction.

Way Forward

1. Standardised global frameworks and a universally accepted taxonomy for Blue Finance

A standardised, universal, and interoperable taxonomy is crucial to channel investments in blue economy ecosystems. Such a framework is essential to define what constitutes as “blue” and to prevent “blue-washing”—the practice of labelling funds as blue without delivering sustainable ocean-related outcomes. The European Union's Sustainable Finance Taxonomy³⁹ includes “sustainable use and protection of water and marine resources” as a key component and can serve as a strong reference point that may be adapted to serve local contexts and geographies. The Sustainable Blue Economy Finance Principles by the ADB and United Nations Environment Programme FI also present a comprehensive approach towards developing a globally accepted blue finance taxonomy. However, it is equally important that such taxonomy and frameworks are mainstreamed at the institutional level. Firms and financial institutions

need to align their internal investment policies and disclosure frameworks with emerging blue finance definitions to maximise impact. Social and human-centric dimensions should be critical in assessing the quality of blue investments.

2. Mainstreaming ocean-based priorities in national climate and development plans

National policy instruments such as Nationally Determined Contributions (NDCs) must include ocean-based climate solutions. These act as a strong policy signal from governments to the private sector and help channel both domestic and foreign capital aligned with a country's priorities. A notable example is Fiji, which has committed in its NDCs to protect 30 percent of its Exclusive Economic Zone⁴⁰ and invest in coastal resilience—partly funded by its sovereign green bond. However, only 62 out of the 168 updated NDCs⁴¹ explicitly reference ocean-based mitigation and adaptation. Mainstreaming ocean-based priorities in national climate and development plans will be key to preserving ocean ecosystems and the livelihoods associated with them.

3. Align incentives across stakeholders

Preserving and promoting the blue economy cannot be sustained by one actor alone and will require a multifaceted, multi-stakeholder approach. While country platforms such as the Just Energy Transition Partnerships (JETPs) have faced controversy and criticism, they provide a useful framework when tailored to serve a particular thematic objective rather than attempting to address a country's entire energy transition—particularly in complex geographies. A JETP-style platform for coastal conservation or preserving marine ecosystems can mobilise large-scale private capital utilising innovative financial instruments, multilateral and bilateral funding, and support from Multilateral Development Banks (MDBs) in the form of concessional finance, technical assistance, grants for feasibility studies, impact assessments, and project pipeline development. With over 3 billion⁴² people dependent on marine biodiversity for their livelihoods, community participation in designing and implementing projects is vital—with a special focus on women, indigenous groups, and youth.

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V Sustainable Port Development: A Catalyst for Inclusive Growth and Community Resilience

Anusha Kesarkar Gavankar

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orts, long seen as vital hubs for trade and economic growth, are increasingly recognised as dynamic socio-ecological systems where economic, environmental, and social interests converge.¹ With more than 90 percent of global trade passing through sea routes, effective port management is essential for ensuring secure and efficient trade flows, fostering economic resilience, and promoting equitable access to resources.² As climate change intensifies and sustainable development becomes a global priority, ports are emerging as key sites and urban hubs for inclusive innovation within the blue economy.³ This chapter explores how port development can be harnessed

to promote equitable growth and strengthen community resilience, particularly in vulnerable coastal regions of the Global South, where the consequences of environmental degradation and exclusionary development are most deeply felt.

Drawing on diverse case studies, the current analysis examines integrated governance models that balance competing priorities through participatory planning, recognising the critical role of local communities and traditional knowledge systems. It evaluates how technological innovation and nature-based solutions (NbS) can reduce ecological harm while enhancing efficiency and climate adaptability. Examples from DP World's global operations as well as comparative models from other ports illustrate how integrating community development, environmental safeguards, and innovation can yield inclusive and resilient port ecosystems. Moving beyond traditional economic metrics, this chapter situates ports as catalysts for social inclusion and environmental stewardship, offering actionable insights to policymakers, port authorities, and community stakeholders committed to a more just and sustainable maritime future.

Ports: Inclusive Blue Economy and Sustainable Development

The evolving view of ports as more than economic infrastructure—encompassing roles in climate resilience, socio-economic inclusion, and environmental governance—reflects a shift toward integrated development.⁴ This aligns with the blue economy framework, which underscores the interconnectedness of economic growth, ecological sustainability, and community well-being in coastal and marine contexts. Ports are uniquely positioned to advance this agenda as hubs of innovation, green infrastructure, inclusive economic activity, and sustainable maritime practices.⁵

Defined by the World Bank⁶ as the sustainable use of ocean resources for economic growth, improved livelihoods, and ecosystem health, the blue economy offers a holistic framework for reimagining port development. It underscores that healthy marine ecosystems are essential to economic prosperity, particularly for the three billion people worldwide whose livelihoods depend directly on marine and coastal biodiversity.⁷ An inclusive blue economy further reinforces this vision by connecting environmental sustainability with social equity, ensuring that vulnerable communities—especially in the Global South—are central to this transition.⁸

Evolving from the Rio+20 green economy agenda, the blue economy integrates principles of sustainability, climate resilience, and social justice.⁹ Today ports are seen as multifunctional assets—commercial hubs, public goods, and environmental stewards—necessitating balanced development.¹⁰ Moreover, port cities, as trade-livelihood nexuses, are vital to advancing inclusive urban growth, promoting integrated port strategies that address environmental, economic, and social objectives.¹¹ Urban Local Bodies (ULBs) play a key role by aligning city planning and services with broader maritime and blue economy goals.

Embedding circular economy principles—like waste reduction, energy efficiency, and resource recovery—can align port operations with sustainable urban systems. In the Global South, where ports intersect with dense populations and informal economies, inclusive governance must ensure local participation, transparent data, and equitable access to adaptation resources. Consequently, blue finance has emerged as a key enabler of this transformation, providing innovative tools to fund sustainable port infrastructure, ecosystem restoration, and community resilience.¹² Such financing is especially critical for regions lacking access to traditional capital sources, helping align port investments with sustainability goals. For instance, DP World became the first company in the Middle East to issue a blue bond, marking a significant step toward mobilising innovative financing to fund sustainable projects in the maritime and water sectors, including port infrastructure and ocean health.¹³

Ports and port cities are crucial drivers of progress across multiple UN Sustainable Development Goals (SDGs).¹⁴ While SDG 14 (Life Below Water) is directly relevant, port development intersects with several other goals, including SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).¹⁵ Realising this potential, however, requires careful and intentional planning, governance reforms, and mainstreaming sustainability into port operations—an ongoing challenge for many port authorities.¹⁶ Within this framework, a number of studies have described ‘port sustainability’ as “the business strategies and activities that meet the current and future needs of the port and stakeholders while protecting and sustaining human and natural activities.”¹⁷

Frameworks like the UN Global Compact’s Sustainable Ocean Principles (2019)¹⁸ offer essential guidance for responsible maritime practices. DP World, a signatory to the Ocean Stewardship Coalition, reflects industry commitment

to science-based approaches, ocean stewardship, and inclusive governance.¹⁹ These principles urge port operators to align economic activity with marine ecosystem health and local community engagement. Ports also play a key role in advancing net-zero goals by facilitating the decarbonisation of maritime logistics and driving innovation of cost-effective, scalable, low-emission technologies.²⁰ India's Harit Sagar Green Port Guidelines, for instance, set ambitious targets to reduce carbon intensity in port operations by 30 percent by 2030 and 70 percent by 2047 (with 2022–23 as the baseline), and aim to electrify 50 percent of port equipment and fleet by 2030.²¹

Yet, their strategic importance in global, national and local trade often drives rapid industrialisation, sidelining environmental and social safeguards.²² At the same time, their coastal locations expose them to climate risks such as sea-level rise and extreme weather—impacts that disproportionately affect vulnerable groups reliant on fisheries, tourism, and informal work.²³ Sustainable port development must therefore move beyond growth-centric models to embrace inclusive, equity-driven governance that respects indigenous rights, promotes decent work, and enhances community resilience—pillars of a just, climate-resilient blue economy. Furthermore, prioritising green marine infrastructure—such as marine green corridors, port electrification, cleaner fuels, and digital innovations for efficiency and emissions reduction—can directly contribute to India's climate commitments under the Paris Agreement and advance the global transition toward decarbonised maritime transport.²⁴

Reimagining Port Development: Key Dimensions

As global ports evolve, promising initiatives offer valuable lessons. However, many remain fragmented, localised, or limited to corporate responsibility rather than driving systemic change. Reimagining port development calls for scaling these efforts, aligning stakeholders, and investing in long-term, inclusive transformation through innovative financing and community empowerment. The following illustrations are not endpoints, but foundations for more integrated and regenerative port systems.

Climate Change and Community Resilience

While port development has historically spurred economic growth, it has often come at the expense of coastal ecosystems and the well-being of local communities, especially those reliant on marine resources for livelihoods

and cultural identity.²⁵ Environmental degradation—habitat loss, pollution, and disrupted livelihoods—disproportionately affects these groups. In 2018, maritime transport contributed 2.89 percent of global greenhouse gas emissions, with port activity playing a key role.²⁶ Without action, these emissions could rise by 50 percent to 250 percent by 2050. Decarbonising ports is crucial for climate goals and a just, low-carbon blue economy.²⁷ The Intergovernmental Panel on Climate Change warns that without inclusive resilience strategies, vulnerable communities face recurring cycles of disaster and loss.²⁸

Sustainable port development requires centring both people and the environment. DP World's Sustainability Strategy, 'Our World, Our Future'²⁹ illustrate how governance, environmental stewardship, and community investment can align. Among the many global initiatives led by DP World are notable success stories (see Table 1), including its operations at Peru's Port of Callao that combines ISO 14001-certified environmental management with community programmes and the integration of NbS to support sustainable coastal development. For instance, coral reef restoration in Seychelles helps protect against storm surges, lowers carbon emissions, and supports livelihoods through eco-tourism and fishing.³⁰ Similarly, DP World's mangrove restoration efforts in Ecuador, Brazil, India, and the Philippines help safeguard coastal ecosystems, enhance carbon capture, and support local livelihoods by partnering with civil society organisations and promoting activities like fishing and honey production.³¹

Risk-Informed Planning and Inclusive Adaptation

Building port resilience requires more than physical upgrades; non-structural interventions such as early warning systems, community-led disaster planning, and climate-informed governance are equally vital. In the Netherlands, the Rotterdam Port incorporates sea-level rise into planning, using floating infrastructure and urban greening under its Resilient Rotterdam 2022–2027 strategy to boost liveability and protect workers.³² In the Global South, Kenya's Port of Mombasa, supported by the World Bank, combines infrastructure upgrades with socio-economic adaptation strategies for adjacent communities.³³ Kochi, India, integrates climate risks into port expansion through sustainable development, community engagement, and flood-resilient infrastructure—showcasing India's focus on climate-resilient port development.³⁴

DP World's Ocean Strategy 2024–2030 showcases private-sector leadership in the Global South,³⁵ with coral and turtle habitat restoration in Somaliland and Senegal,³⁶ and WASH improvements in Mozambique linking ecosystem health to jobs and public well-being.³⁷ The Global Asset Resilience Study³⁸ uses data-driven risk assessments to guide resilience in vulnerable ports like Mundra (India), Paramaribo (Suriname), and Dakar (Senegal). In Gambia, the Port of Banjul Expansion incorporates climate risk through public-private dialogue, ensuring community participation with support from the Global Centre on Adaptation and the African Development Bank.³⁹

Capacity-Building, Livelihoods, and Gender Inclusion

Inclusive port development should prioritise local hiring, skills training, and livelihoods for marginalised and coastal communities. Tanzania's Port of Dar es Salaam supports microenterprises and training,⁴⁰ while private actors like DP World contribute through community-led initiatives. Its *Visión Futuro* programme in the Dominican Republic has trained over 650 at-risk youth and reached 6,000 people through education and empowerment.⁴¹ DP World's logistics academies in eight developing countries offer sector-specific training, and over 2,700 locals have been trained in mobile harbour crane operations at Somaliland's Port of Berbera.⁴²

India's Sagarmala Programme integrates coastal and fisheries infrastructure development and economic growth strategies with skill gap studies, skill development and livelihood generation.⁴³ Further, Jawaharlal Nehru Port Authority's Multi Skill Development Centre in Mumbai has trained over 2,300 youth in maritime and logistics.⁴⁴ India's Vadhvan Port Private Limited, in partnership with the Directorate General of Shipping, offers courses in maritime catering.⁴⁵ These initiatives demonstrate how ports can drive local empowerment and workforce development. However, some cases illustrate how limited community engagement can hinder shared growth.

Gender-inclusive models show how ports can drive social change. Ecuador's Operators of the Future programme at DP World's Posorja Terminal trains women in crane and forklift operations,⁴⁶ with similar vocational initiatives in Chile and Suriname expanding access to skilled trades.⁴⁷ The Solar Mamas programme—supported by Indian Technical and Economic Cooperation,^a Barefoot College,

^a More details on ocean clean energy can be found at <https://mnre.gov.in/en/off-shore-wind/>

and DP World—provides clean energy training and economic opportunities for women in 96 countries in Asia, Africa and Latin America, promoting inclusive sustainable development.⁴⁸ In Kenya, the Port of Mombasa partners with local training centres to equip youth—especially women—with skills in logistics and ship management, boosting coastal employment.⁴⁹ Similarly, Egypt’s VeryNile initiative,⁵⁰ backed by DP World, empowers women to turn plastic waste into marketable products. These efforts show how ports can drive equity and community empowerment alongside economic growth.

Distributional Justice and Participatory Governance

Equity must be central to port development, as environmental harm and displacement often impact marginalised communities the most. Tools like revenue sharing, targeted infrastructure, social impact assessments, and community agreements can promote fairer outcomes. For example, South Africa’s Port of Durban assesses social impacts in the South Durban Basin,⁵¹ while Indonesia’s Tanjung Priok Port supports displaced fishers through resettlement and livelihood programmes.⁵² In the SIDS of Maldives, the UNCTAD-supported TrainForTrade programme enables community-led port management, incorporating local knowledge and ensuring coastal participation in decision-making.⁵³

In Somaliland’s Berbera Economic Zone, managed by DP World, local enterprise is encouraged through trade and logistics, offering various facilities and support for businesses.⁵⁴ Moreover, investments in skills training, local hiring, and water infrastructure have improved access to clean water by 60 percent.⁵⁵ Participatory models are also gaining ground in Southeast Asia. The Philippines’ Integrated Coastal Management framework in Batangas Bay⁵⁶ involves co-management between authorities, fishers, and tourism operators, while Thailand’s Community Port Initiative empowers small-scale, locally managed ports that blend traditional knowledge with sustainable practices.⁵⁷

The absence of such inclusive approaches can lead to adverse outcomes. In Guinea’s Port of Kamsar, bauxite mining operations have led to environmental degradation and displacement.⁵⁸ Reports indicate that mining activities have polluted water sources and degraded farmland, adversely affecting local livelihoods and leading to community grievances. These contrasting cases reinforce that equitable, community-centred governance is foundational to inclusive port development.

Rethinking Maritime Security

Maritime security now goes beyond naval protection to include human security, disaster response, environmental protection, and sustainable development.⁵⁹ Effective port security needs cross-jurisdictional collaboration and local community involvement. Ports also face threats such as trafficking of arms, drugs, and wildlife, along with smuggling activities and Illegal, Unreported, and Unregulated (IUU) fishing, all of which undermine governance, harm communities, and damage natural habitats and biodiversity.⁶⁰

Addressing these threats requires transparency, anti-corruption measures, and community participation. In India, Chennai's port city integrates climate resilience with maritime security, tackling piracy, IUU fishing, and climate risks in partnership with local actors.⁶¹ Mundra Port combines security measures with mangrove restoration and local engagement to combat trafficking and environmental degradation.⁶² Programmes like Ghana's Port Security and Safety Initiative⁶³ and Mombasa's community-led wildlife anti-trafficking⁶⁴ demonstrate how grassroots networks can support enforcement and promote alternative livelihoods.

Lack of coordinated security can worsen port vulnerabilities, as seen in Haiti's Port-au-Prince, where weak oversight has fuelled insecurity and illicit trade.⁶⁵ With climate change driving displacement, resilient and inclusive ports are vital for food security, disaster response, and regional stability. Ports also play a crucial role in humanitarian logistics and disaster response, enabling the swift delivery of aid and resources. For instance, after Cyclone Idai in 2019, Mozambique's Port of Beira was key in delivering aid and supporting community recovery.⁶⁶ Meanwhile, private sector players such as DP World deliver vital support through public-private collaboration, warehouse networks, last-mile solutions, and digital tools that help coordinate and accelerate emergency supply chains.⁶⁷

Table 1: Inclusive and Resilient Port Development: Key Initiatives by DP World

Initiative/ Location	Thematic Focus	Outcomes	Partners/ Affiliates
Green Skills for Youth/ Global	Youth education and skills for the future towards decarbonisation and nature positive ports	The Global Education Platform provides digital resources for students, teachers, and professionals, focusing on logistics, STEM, and green skills. It supports three pillars: access to education, industry exposure, and future skills, and is strengthened through initiatives such as Roots & Shoots with the Jane Goodall Institute (188,000 youth, 44,000+ trees planted) and the Future of Work programme with Teach For All across South Africa, Senegal, Argentina, and Pakistan.	Students, educators, DP World employees, Jane Goodall Institute, Teach For All
Our World, Our Future Sustainability Strategy	Youth Education & Sustainability Awareness	Sustainability education for youth; environmental stewardship, global citizenship, and climate literacy.	Schools; individuals; communities; education ministries; Think Equal; Dubai Cares
Ocean Strategy 2024–2030 – Global	Private Sector Sustainability Leadership	Integrated social and ecological goals in port development, with a Global South focus.	Local governments; conservation groups
Signatory to the Ocean Stewardship Coalition – Global	Ocean Health	Advancing sustainable ocean governance	UN Global Compact - Sustainable Ocean Principles
Global Asset Resilience Study	Climate Risk & Resilience Planning	Data-driven port risk assessments; tailored resilience pathways for vulnerable regions.	Resilience consultants; port authorities; Global Center on Adaptation

Initiative/ Location	Thematic Focus	Outcomes	Partners/ Affiliates
Biodiversity Statement and Sustainable Finance Framework – Global	Climate & Community Resilience	Biodiversity neutrality and socially responsible port development	IFC Performance Standards on Environmental and Social Sustainability
ISO 14001-Certification, Port of Callao, Peru	Climate & Community Resilience	Environmental management; community programmes in education, healthcare, and entrepreneurship.	Local municipalities; community organisations
Mangrove restoration -Ecuador, Brazil, India, Philippines	Nature-Based Solutions & Livelihoods	Carbon capture; livelihoods like fishing/ honey production; local civil society partnerships.	Civil society organisations; local environmental NGOs
Local Capacity Building - Berbera Port, Somaliland	Skills Training, Community Development	2,700+ trained in crane use; 60% improvement in clean water access; women/youth in liaison committees.	Somaliland Government; local vocational centres
Local Capacity Building - Berbera Economic Zone, Somaliland	Inclusive Growth & Local Enterprise Development	Trade/logistics support; local hiring; water & vocational infrastructure.	Somaliland Government
Ecological Renewal and Wellbeing -Mozambique	Ecosystem Restoration & Health	Coral/turtle habitat restoration; WASH infrastructure; job creation; public health outcomes.	Local communities; NGOs
Ecological Renewal and Wellbeing - Senegal & Somaliland, Africa	Biodiversity & Climate Adaptation	Habitat rehabilitation (coral, turtle); job creation.	National governments; environmental NGOs
Visión Futuro - Dominican Republic	Livelihoods & Youth/Gender Empowerment	Training for 650+ youth; education/ employment support for 6,000+; women's empowerment.	Local NGOs; community centres

Initiative/ Location	Thematic Focus	Outcomes	Partners/ Affiliates
Logistics academies - eight Developing Countries	Workforce Development	Technical education for port-linked employment; trained more than 2,700 residents on using mobile harbour cranes.	Local educational institutions
Liaison Committees - Berbera, Somaliland	Participatory Governance & Community Benefit	Investments guided by liaison committees; clean water & skill-building; youth and women represented.	Community organisations; municipal authorities
VeryNile – Egypt	Environmental Clean-up & Women's Economic Inclusion	Converting plastic waste into saleable goods; environmental and economic resilience.	VeryNile; Greenish Foundation; Ministry of Environment (Egypt); local NGOs
Solar Mamas - Asia, Africa, Latin America	Clean Energy & Women's Empowerment	Training women in solar engineering to bring electricity to remote villages; sustainable energy access and gender inclusion.	India's External Affairs Ministry's ITEC, Barefoot College International, India's Ministry of New & Renewable Energy

Way Forward

Leveraging Multistakeholder Partnerships for Sustainable Infrastructure

Implementing sustainable port infrastructure, particularly in resource-constrained developing countries, requires innovative financing and governance. Public-private partnerships (PPPs) offer advantages such as shared risk, technological innovation, and operational efficiency, but their success depends on clear regulations and well-designed contracts. Indonesia's Green Port PPP Programme,⁶⁸ for instance, ties financial incentives to environmental and social performance targets, aligning private investment with national sustainability goals. DP World exemplifies this through its PPP with the Deendayal Port Authority to develop the Tuna Tekra terminal in Gujarat, India. With a US\$510-million investment, the project boosts capacity and trade efficiency, aligning with India's Maritime Vision 2030. It shows how PPPs can mobilise capital for sustainable, resilient infrastructure.⁶⁹

Strengthening Institutional Coordination

Sustainable port development requires cross-sector coordination and alignment across governance levels. Integrated coastal management and marine spatial planning must guide port projects to align with blue economy goals. This includes coordination among port authorities, environmental agencies, ULBs, and community departments to ensure integration with urban planning and local infrastructure. Harmonised regulatory standards across regional ports can also prevent harmful competition over environmental or labour norms. Regional associations, such as those supported by the World Bank's PROBLUE programme, foster sustainability benchmarking and institutional learning. For example, Royal HaskoningDHV's Caribbean projects leverage PROBLUE tools to assess port readiness and prioritise resilience-focused, blue economy initiatives across island states.⁷⁰

Enhancing Community Participation and Benefit Sharing

Community engagement must move beyond tokenism to structured co-ownership. Formal mechanisms like community benefit agreements, local hiring targets, and permanent liaison committees with decision-making power are essential. At Berbera Port in Somaliland, DP World's liaison committees—featuring women and youth representatives—help direct investments into

clean water and skills training.⁷¹ Transparent revenue-sharing and targeted employment programmes for marginalised groups, especially women and informal workers, can expand access to port-linked opportunities. Respecting cultural norms and integrating indigenous knowledge, as seen at Chile's Port of Lirquén with the Mapuche community, ensures development aligns with local values.⁷² Such models show how ports can drive inclusive growth when community benefits are guaranteed.

Advancing Green Innovation Through Inclusive Port Design

Innovation in port infrastructure must go beyond environmental upgrades to embed community inclusion and social equity into sustainability goals. Green port certification systems should assess not just ecological impact but also community benefit and participation. Regulatory and financial incentives must support renewable energy, low-emission technologies, and NbS, while mandating both climate and social impact assessments with meaningful community consultation. Tools like Royal HaskoningDHV's Green Port Maturity Scan and Self-Assessment⁷³ offer structured guidance, increasingly factoring in socio-economic and local outcomes.⁷⁴ Yet in many developing countries, adoption remains limited. A study of Vietnamese ports found that stakeholder collaboration and foreign capital enabled green initiatives,⁷⁵ while funding gaps, outdated tech, and weak regulation were key barriers—issues common across the Global South. Environmental innovation must also tackle pollution, waste, and material sustainability.⁷⁶ Amsterdam's port leads with circular economy practices like closed-loop water systems and recycled materials.⁷⁷ In the Global South, Kenya's Port of Mombasa implements a Green Port Policy, promotes shore power, and safeguards biodiversity.⁷⁸

Enhancing Data Transparency Through Community Engagement and Inclusive Governance

Accountable port governance requires transparent, inclusive data systems that reflect ecological and social impacts. Standardised environmental, social and governance (ESG)-aligned reporting must be accessible not only to regulators but also to local communities. Open-access platforms can democratise information, allowing civil society and residents to monitor performance and demand accountability. Community liaison committees representing women, youth, and traditional leaders can strengthen oversight, while community-based monitoring—where locals and scientists collect data together—ensures

lived experiences shape decisions. Chile's Mejillones Port uses community-led observatories to track pollution and inform policy,⁷⁹ while Visakhapatnam in India aligns green infrastructure with community well-being through solar-powered operations, pollution monitoring, and urban greening.⁸⁰

Conclusion

Sustainable port development is a key driver of inclusive growth and climate resilience within the blue economy. Beyond their economic role, ports and port cities must act as environmental stewards, social integrators, and anchors of human security. Meaningful community engagement, nature- and climate-smart planning, and inclusive governance are essential to ensuring that ports address local needs, avoid conflict, and secure long-term viability. Integrated approaches—such as multistakeholder partnerships, community-based management, and equitable benefit-sharing—can balance economic, environmental, and social priorities. In the Global South, ULBs play a role in aligning port development with urban planning, where circular economy practices and integrated governance can ensure inclusion, transparency, and climate resilience.

By embracing place-based, people- and nature-first development models, ports can evolve into catalysts of urban sustainability, economic justice, and climate resilience—anchoring a just maritime future for all.

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VI Conclusion

Nilanjan Ghosh

This volume set out to provide an understanding of the Blue Economy (BE) in the context of the Global South, with India, a key emerging economy and maritime nation, serving as a focal point. The oceans, as discussed throughout the volume, hold a different meaning for the Global South, as compared to the Global North. This divergence is encapsulated in the concept of the “GDP of the poor”, underscoring the critical dependence of vulnerable coastal populations on marine and coastal ecosystem services.

Oceans cover over 70 percent of the Earth's surface and contain 97 percent of its water, playing a vital role in food security, climate regulation, and oxygen production. Yet, there is still no universal definition of the term 'blue economy'. While the European Commission adopts a broad framing centred on marine-based economic activities, definitions by the World Bank and the United Nations incorporate the dimension of sustainability more explicitly, as this volume has highlighted. This volume has, however, considered the factor of 'sustainability' built into the Blue Economy framework as adopted by the World Bank and UN, and augmented by the WWF.

The significance of the Blue Economy is further highlighted by the scale of oceanic influence on the economy and human livelihoods: 80 percent of global trade is sea-based, 40 percent of the global population live in coastal regions, and over 3 billion people depend on the ocean for their livelihoods.¹ The estimated natural capital of the BE is valued at US\$25 trillion, and its annual output of goods and services is estimated at US\$2.5 trillion,² placing it on a par with the seventh-largest global economy in GDP terms.³ This estimate is only the tip of the iceberg.

Fundamentally, the Blue Economy emphasises the sustainable use of marine and coastal ecosystems. It is projected to contribute between US\$3–6 trillion annually to the global economy and supports around 260 million jobs.⁴ The breadth of ecosystem services—from provisioning (e.g., food, medicine, tourism) to regulating (e.g., carbon sequestration, climate and nutrient regulation, coastal protection)—reflects the multifaceted role that oceans play in sustaining human well-being.

However, these benefits are increasingly threatened by both global and localised stressors. Climate change, ocean acidification, marine pollution, habitat degradation, overfishing, and deoxygenation pose escalating risks. Many of these challenges transcend national jurisdictions, complicating governance frameworks. The United Nations Convention on the Law of the Sea (UNCLOS) of 1994 was pivotal in acknowledging these transboundary concerns, yet newer threats such as illegal, unreported, and unregulated (IUU) fishing (a particularly Global South problem as evident in the Bay of Bengal), plastic pollution, and oil spills continue to emerge.

These impacts are acute in the Global South, where coastal populations are disproportionately reliant on marine ecosystem services for sustenance,

culture, and livelihoods. *The Economics of Ecosystems and Biodiversity (TEEB)*⁵ framework rightly recognises these services as the “GDP of the poor.” Consequently, restoring, conserving, and managing marine and coastal ecosystems becomes not just a matter of sustainability but of social equity.

Given these ecosystem-livelihood linkages, the Global South must play a leadership role in steering the Blue Economy towards inclusive and sustainable development. India, with its extensive coastline and strategic maritime geography, illustrates this potential. As the world’s second-largest fish producer, India sustains over 4 million fisherfolk and a burgeoning shipping and shipbuilding sector. The fisheries industry alone employs over 15 million people and contributes to national nutrition and income generation.

Moreover, oceans represent a vast reservoir of untapped renewable energy—critical in an era of intensifying global energy demands. Maritime and coastal tourism also hold promise, contributing 5 percent of global GDP and projected to generate 8.5 million jobs by 2030.⁶ In the Global South, sustainable blue tourism can offer dual benefits: driving employment and bolstering marine biodiversity conservation. Projections suggest that coastal tourism may account for 26 percent of total maritime industry value added by 2030.⁷

The Blue Economy also intersects with maritime trade and port infrastructure. Although maritime shipping underpins 80 percent of global goods movement, it accounts for 3 percent of global GHG emissions and contributes to oceanic degradation. Sustainable seaport practices—through cleaner technologies, waste management, and ecosystem conservation—are therefore essential. These practices not only minimise ecological footprints but also enhance the resilience of marine ecosystems.

Another critical frontier is blue carbon. Coastal ecosystems such as mangroves, seagrasses, and salt marshes are carbon sinks. Tapping into blue carbon markets where Global South nations act as net sellers offers innovative pathways for climate financing and ecosystem restoration. India, in particular, can lead this shift by pioneering nature-based solutions and institutional frameworks to mobilise blue carbon as a developmental asset.

Yet, despite its promise, the Blue Economy faces a substantial financing gap. Achieving *SDG 14: Life Below Water* demands an annual investment of US\$174.52 billion, but current commitments stand at a mere US\$25.05 billion,

leaving a deficit of over US\$149 billion.⁸ Impediments include weak fiscal policies, reduced development aid, limited private sector participation, and debt burdens in several developing countries.

2. How to Circumvent the Chronic Underinvestment

At the heart of the chronic under-investment in the Blue Economy lies a fundamental market failure: the inability to accurately value the vast and diverse ecosystem services that marine and coastal systems provide. Addressing this requires a multidimensional strategy grounded in economics, equity, and ecological stewardship. The following pathways offer a framework to unlock sustainable finance and investment for the blue economy:

i. Making a Business Case for the Blue Economy

To mobilise private sector engagement, it is essential to present the blue economy as a viable business opportunity. Historically, companies have been hesitant to invest in environmental and social infrastructure due to perceived low financial returns. However, this narrow focus on the economic rate of return (return on investment or RoI) is giving way to a broader recognition of *the social rate of return*, especially as sustainability increasingly influences consumer preference, investor sentiment, and regulatory frameworks.

By aligning profit motives with environmental and social outcomes, the blue economy offers compelling prospects for *Creating Shared Value (CSV)*⁹—a concept where businesses generate economic value in ways that also create value for society and the environment. This shift not only enhances long-term resilience for businesses but also embeds them meaningfully in the socio-ecological systems they depend on.

ii. Enhancing Blended Finance Mechanisms

Blended finance provides a strategic means to bridge the funding gap in the blue economy. By combining public finance with private capital—and integrating climate finance with development and disaster resilience funding—blended approaches can de-risk investments in areas such as sustainable fisheries, marine biodiversity conservation, ocean-based renewable energy, and resilient coastal infrastructure. Such integration ensures that resources are mobilised at scale while balancing risk across stakeholders.

iii. Advancing South–South Cooperation for Ocean Sustainability

South–South cooperation offers a promising platform for knowledge exchange, policy innovation, and financial solidarity tailored to the shared realities of the Global South. Countries across Africa, Asia, Latin America, and the Pacific often confront similar challenges—vulnerability to climate change, external debt, overfishing, and pollution—exacerbated by extractive global economic systems.

Through mutually respectful partnerships, countries in the Global South can co-develop and co-finance ocean sustainability strategies, drawing on shared experiences and contextual expertise. Platforms like the United Nations Office for South-South Cooperation (UNOSSC) and the SDG Fund can catalyse such efforts by facilitating concessional finance, technical cooperation, and joint policy development, particularly for Least Developed Countries (LDCs) and Small Island Developing States (SIDS).

iv. Building Equitable North–South Partnerships

Achieving the Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water), requires reimagining North–South partnerships along fair and inclusive terms. Current financing structures—shaped largely by institutions and shareholders in the Global North—often fail to reflect the needs and development priorities of the Global South.

A just transition in the blue economy must involve shared responsibilities, equitable financing models, and participatory governance. Global financial institutions, including the IMF, World Bank, and regional development banks, must ensure that their mandates and conditionalities align with climate justice, livelihood protection, and ecosystem resilience in the South. Promises of decarbonisation, phasing out of fossil fuels, and support for climate adaptation must translate into tangible benefits for the billions facing multidimensional poverty and ocean-based vulnerability.

v. Mobilising Philanthropy for Ocean Stewardship

Philanthropy can act as a catalytic source of capital in the early stages of blue economy projects—particularly those with high potential but perceived high risk. Whether in ocean-based renewable energy, blue carbon restoration, or marine biodiversity conservation, philanthropic funding can de-risk innovation

and attract co-investment from private and public sources. A portion of the necessary funds for blue economy development could be mobilised through philanthropic partnerships, impact funds, and strategic donor alliances that prioritise nature-based solutions and inclusive development.

vi. Rebalancing Climate Finance: Adaptation vs. Mitigation

Global climate finance remains tilted toward mitigation—supporting decarbonisation, energy transitions, and low-carbon technologies. However, many blue economy priorities—such as coastal resilience, livelihood protection, biodiversity restoration, and adaptive governance—fall under the *adaptation* umbrella, which remains underfunded.

Given the acute climate risks faced by coastal populations in the Global South, *equitable climate finance* must redress this imbalance. Adaptation finance is not merely a technical requirement but a justice imperative—one that ensures all nations, especially those historically marginalised, can access the resources necessary for resilient ocean-based development.

vii. Establishing Market-Based Instruments: Payments for Ecosystem Services (PES)

Innovative financing mechanisms such as *Payments for Ecosystem Services (PES)* offer opportunities to monetise and incentivise the preservation of marine and coastal ecosystem functions. Downstream beneficiaries—such as tourism operators, fisheries, and coastal developers—can be encouraged to compensate those who maintain or restore ecosystem services upstream.

Mechanisms like REDD+, carbon credits from blue carbon ecosystems (e.g., mangroves, seagrasses), and biodiversity offsets are promising tools, but their successful application requires addressing challenges:

- Accurate valuation and monitoring of ecosystem services (e.g., coastal protection, carbon sequestration).
- Managing risks in dynamic marine environments vulnerable to natural and anthropogenic threats.
- Identifying and balancing the interests of ecosystem service providers and beneficiaries.

- Establishing transparent governance and benefit-sharing frameworks to ensure equity.

When designed effectively, PES schemes can strengthen both conservation and community well-being, contributing to a more resilient and inclusive blue economy.

3. The Role of Shipping, Logistics, and Port Development Companies

Shipping, logistics, and port development companies are important stakeholders in the blue economy, as they form the backbone of global trade and maritime connectivity. As this volume argues, companies like DP World have intervened in this space by reorienting their strategies and investments towards sustainability. The following are some of the future pathways by which these industries can play a catalytic role in building resilient, inclusive, and environmentally sound blue economy infrastructure:

i. Greening Maritime Infrastructure

- *Decarbonising Shipping Fleets:* Transitioning from heavy fuel oil to low-emission alternatives such as LNG, green hydrogen, ammonia, and electric propulsion can significantly reduce maritime emissions. Companies can also invest in wind-assisted propulsion and energy-efficient vessel design.
- *Energy-Efficient Retrofits:* Retrofitting existing ships with energy-saving technologies, such as air lubrication systems, hull coatings, and waste heat recovery, can lower fuel consumption and emissions.
- *Adhering to IMO Regulations:* Aligning operations with IMO 2023 and 2050 GHG reduction strategies enhances compliance and reduces the environmental footprint of shipping.

ii. Developing Sustainable Ports

- *Eco-Port Design:* Incorporate green building principles, shore power (cold ironing) facilities for ships at berth, and LED-based lighting systems to reduce operational carbon footprints.
- *Waste Management Systems:* Deploy advanced waste reception and treatment systems to handle ship-borne and port-generated waste, including oil residues, ballast water, and plastics.

- *Digital Port Operations:* Automate and digitise port logistics to improve efficiency and reduce congestion, thus minimising emissions from idling vessels and trucks.

iii. Enhancing Multimodal Connectivity and Hinterland Integration

- *Seamless Logistics Corridors:* Develop multimodal logistics corridors (rail-road-sea integration) to shift freight away from carbon-intensive road transport, reducing emissions across the supply chain.
- *Blue Economy Industrial Clusters:* Ports can anchor marine industrial clusters that include green shipbuilding, aquaculture hubs, coastal tourism, and clean energy zones.

iv. Supporting Coastal Resilience and Ecosystem Services

- *Nature-Based Solutions (NbS):* Invest in green buffers such as mangrove belts, salt marshes, or dune systems around port perimeters to enhance natural coastal protection and biodiversity.
- *Marine Spatial Planning:* Work with governments and scientists on marine spatial planning to ensure that port expansions and shipping routes minimise habitat disruption and avoid sensitive ecological zones.

v. Promoting Innovation and Green Finance

- *R&D Investment:* Fund research in low-emission shipping technologies, carbon capture onboard vessels, and AI-driven logistics for route optimisation.
- *Blue Bonds and Sustainability-Linked Loans:* Raise capital via blue finance instruments for port upgrades, emission-reducing technologies, and ecosystem restoration.

vi. Community Engagement and Inclusive Development

- *Livelihood Integration:* Ensure that port expansion projects integrate the needs of local fishing communities and small-scale traders, including provisions for alternative livelihoods and inclusive stakeholder consultations.
- *Skill Development:* Invest in training local youth and workers in marine logistics, ship repair, and renewable energy operations to build human capital for the blue economy.

vii. Transparency, ESG Accountability, and Certification

- *Environmental and Social Governance (ESG) Reporting:* Publish regular ESG impact reports to demonstrate alignment with global sustainability standards and the Sustainable Development Goals (particularly SDG 9, 13, and 14).
- *Certification and Standards:* Adopt global standards like EcoPorts, Green Marine, or ISO 14001 to benchmark performance and continually improve environmental practices.

viii. Collaborating in Global and Regional Initiatives

- *Partnerships for Decarbonisation:* Join alliances like the Getting to Zero Coalition, Clean Cargo Working Group, and World Ports Sustainability Program (WPSP) to co-develop solutions and share best practices.
- *Regional Blue Economy Platforms:* Collaborate with governments and multilateral institutions on initiatives such as IMO's Blue Solutions, UNCTAD's Port Management Programme, and Africa's Integrated Maritime Strategy 2050.
- *Multistakeholder Partnerships for Sustainable Infrastructure and Institutional Coordination:* As stated in the volume, this can entail public-private partnerships (PPPs) that can diversify investment risk, help in technological innovation and operational efficiency, and increase the total factor productivity. Again, their success depends on clear regulations and well-designed contracts. In this context, cross-sector coordination and alignment in regulatory and governance architecture become important to reduce the transaction costs of business and diminish, if not eliminate, any opportunity for regulatory arbitrage.

The Blue Economy presents itself with immense opportunities and challenges. Circumventing the challenges will enhance the opportunities further. This necessitates a strategic realignment of policy, institutional, regulatory and financing frameworks. This volume calls for a renewed Global South agenda for the Blue Economy—with India as a focus. It needs to be understood that what makes the problem complex and different for the Blue Economy challenge in the Global South, as compared to the Global North, is the intensive and inextricable linkage of the ecosystem services with human livelihoods, which qualifies the “GDP of the poor” argument here. Such an argument is not valid for the Global North.

It is this intention to extract more from the oceans and a lack of awareness in the Global South that creates problems like IUU fishing. Therefore, the Blue Economy needs a separate governance agenda for the Global South, one that is unique compared to that for the Global North. While there may remain a tendency in the Global South economies to concentrate on extractive and exploitative practices over the marine resources for pursuing unbridled economic growth, with little attention paid to environmental sustainability and social equity, there remains the need for the elaboration of specific governance principles and regulation. India's engagement in the Blue Economy has been rising, with its active involvement in international and regional dialogues on the Blue Economy, maritime and marine cooperation.

In this context, Indian PM Modi's call for LiFE (Lifestyle for the Environment) at COP26 in Glasgow in November 2021 becomes important. The concept combines provisioning, supporting and regulating services of the natural ecosystem that form the basis of human survival, for which principles of the conservation of the marine and coastal ecosystems need to be prioritised. This is not for short-term economic growth but for long-term developmental needs. It needs to be appreciated that BE is not merely an altruistic intent, but a development imperative from the perspective of the Global South.

It is in this context that this volume has talked about the opportunities and the pathways to address the challenges in its attempt to advance sustainable maritime practices through the building of resilient infrastructure, leveraging nature-based climate solutions, and unlocking innovative financing instruments. Only then can the Blue Economy fulfil its dual promise of ecological sustainability and inclusive economic growth.

Endnotes

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- ⁹ The concept of Creating Shared Value (CSV), introduced by Michael E. Porter and Mark R. Kramer in 2011, emphasises the interdependence between economic success and social progress. It posits that businesses can foster innovation, contribute to global development, and deliver societal benefits through three strategic pathways. See Porter, Michael E., and Mark R. Kramer, "Creating Shared Value," *Harvard Business Review* 89, nos. 1-2 (January–February 2011): 62–77.



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