The Ocean Economy to 2050

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BETTER POLICIES FOR BETTER LIVES

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Foreword

The ocean economy is a vital component of our global economy and policymakers require data-driven and evidence-based insights to guide their decision-making.

The Ocean Economy to 2050 builds on a new quantitative and foresight analysis of potential pathways for the ocean economy's development, highlighting that a healthy ocean is crucial for climate and biodiversity processes, as well as for the economy. If the ocean economy were a country, it would be the fifth largest economy in the world. But the sustained growth and resilience of the ocean economy of the past 25 years is not set to continue. Growing pressures need to be tackled to keep the ocean economy on a path that contributes to sustainable economic development with employment that millions rely on.

To move forward, science-based decisions and improved ocean management are needed—only a quarter of the ocean floor is mapped, very few countries have developed full scale marine spatial planning, and much remains to be discovered and protected in the deep sea. Harmful subsidies must end, in fishing for instance. Transitions to cleaner energy and greater use of digital technologies should be encouraged, both are critical to mitigating climate change and boosting the productivity of ocean industries.

Developing unbiased evidence to guide decisions on ocean management and governance will be key. This report builds on more than a decade of OECD ocean economy work, with statistical measurement and ocean science and innovation at its core, supported steadily by several countries. The OECD *Ocean Economy Monitor* programme supports informed decision-making on a global scale. It provides insights into the economy-, science- and innovation-related aspects of the ocean economy as well as its policy environment. Leveraging harmonised country-level statistics from OECD's unique Inter-Country Input-Output (ICIO) tables and other quantitative and qualitative data sources, the Monitor currently tracks 33 ocean economic activities across 142 coastal countries, spanning more than 25 years. It forms an unprecedented source of new analysis to support evidence-based policies.

The consistent measurement methods applied across countries are unlocking unparalleled opportunities to empower OECD member countries and partner economies with new evidence to support their strategic objectives and involvement in different multilateral processes. Through collaboration with OECD member countries and partner economies, the benefits of this work should be widely shared, enabling more countries to harness the potential of the ocean economy while safeguarding its long-term sustainability.

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Reader's guide

This reader's guide describes the ocean economy, provides a definition of ocean economic activities and introduces how they are measured in this report. It also provides the list of countries combined in the different regional and income groupings and a glossary of technical terms.

What is the purpose of this report and who is it for?

The Ocean Economy to 2050 report is a new OECD resource to enhance understanding of the evolving ocean economy landscape. It presents unprecedented data on the ocean economy covering almost three decades (1995-2020) for more than a hundred countries and thirty-three ocean economic activities. In addition, it provides a comprehensive analysis of possible projected growth trajectories, challenges, and opportunities within the global ocean economy over the next 25 years.

Building on ten years of dedicated OECD ocean economy work (with the landmark 2016 report on "The Ocean Economy in 2030"), and highlighting important OECD wide ocean work, this report aims to offer insights into how ocean economic activities can contribute to prosperity, employment, and innovation, while ensuring the conservation, restoration and sustainable use of marine ecosystems. By examining emerging trends, technological advances, and policy developments, the report seeks to inform stakeholders about possible future paths of the ocean economy All at a time when ocean health deterioration, climate change acceleration and biodiversity loss are increasingly affecting countries around the world.

This report is intended for a diverse audience including policymakers, industry leaders, researchers, and civil society organisations engaged in ocean-related activities.

The report is structured in six chapters:

- Chapter 1 provides an overview of the main findings from the publication and key recommendations for policymakers.
- Chapter 2 provides the general context-setting for the rest of the publication, with a brief review of major evolving ocean policy landscape and governance issues that are impacting the ocean economy.
- Chapter 3 delivers new OECD statistics and analysis on ocean economic activities and their evolution over recent decades.
- Chapter 4 identifies key factors of performance for the ocean economy. Based on these, it projects potential ocean economy growth to 2050 under the assumption that historical trends persist and establishes a theoretical baseline scenario used in the next chapters.
- Chapter 5 analyses how major shaping forces could affect potential ocean economy trajectories o as describes how the historical record is not necessarily a good indicator of future ocean economic growth.

- Chapter 6 explores further how combinations of several of these global shaping forces may affect specific areas of the ocean economy in the decades to come. It then outlines two future scenarios for the ocean economy differentiated by alternative approaches to the global energy transition.

Basic concepts used in measurements of the international ocean economy in the OECD Ocean Economy Monitor and featured in this report

Ever since the 2016 release of *The Ocean Economy in 2030* (OECD, 2016[2]), the OECD has described the ocean economy as an interrelated system of two pillars: economic activity and the marine ecosystem assets and services that they rely on. Interlinkages between ocean economic activity and the marine environment are therefore a founding concept in analysis of the ocean economy: discussion of one pillar is incomplete without considering the effects that changes in it may have on the other.

Although work is ongoing in various international fora to develop the standards and guidelines required to account for the marine environment, coherent cross-country statistics are not yet available. The quantitative elements of this report are therefore focused on statistics on ocean economic activities. The marine economic-environmental linkages described in this report use either ad-hoc data from external sources or are dealt with qualitatively. As and when internationally comparable statistics on marine environmental-economic linkages become available, the *OECD Ocean Economy Monitor* will expand to include them. This novel OECD programme provides a unique platform for measuring the global ocean economy over time using harmonised country-level statistics and other data sources.

The OECD *Blueprint for Improved Measurement of the International Ocean Economy* (Jolliffe, Jolly and Stevens, 2021[6]) provides a definition of ocean economic activities for the purposes of scoping statistical measurement. The OECD *Eight Lessons Learned from Comparing Ocean Economy Measurement Strategies Across Countries* (Jolliffe and Jolly, 2024[7]) working paper uses principles from the system of national accounts to highlight commonalities and differences in approaches and provides recommendations for integrating ocean economy measurements with national statistics. The OECD Ocean Economy Monitor applies definitions from the OECD Blueprint and many of the principles of national accounting from the OECD comparison of national approaches to the measurement of international statistics on ocean economic activities.

Current scope and coverage of measurements of the international ocean economy in the OECD Ocean Economy Monitory and featured in this report

Ocean economic activities are defined in the OECD Ocean Economy Monitor and this report according to the OECD Blueprint (Jolliffe, Jolly and Stevens, 2021[6]) as groups of establishments from any institutional sector engaging in the same or similar kinds of economic activity that:

- take place on or in the ocean
- produce goods and services primarily for use on or in the ocean
- extract non-living resources from the marine environment
- harvest living resources from the marine environment
- use living resources harvested from the marine environment as intermediate inputs
- would likely not take place were they not located in proximity to the ocean, or,
- gain a particular advantage by being located in proximity to the ocean

The economic statistics produced for the OECD Ocean Economy Monitor and presented in this report are currently harmonised across 33 individual ocean economic activities for 142 coastal countries between 1995 and 2020. Each ocean economic activity is measured as distinct from all others so that ocean economic activities can be aggregated into wider groupings called *ocean economic activity groups*. There are seven ocean economic activity groups and the economic statistics in this report are generally focussed on this level of aggregation. Estimates of the *total ocean economy* refer to the aggregation of all 33 currently measured ocean economic activities within a country. The links between the three levels of the hierarchy in the *OECD Ocean Economy Monitor* are presented in Table 1. Estimates of the *global ocean economy* in this report refer to the aggregation of all 33 currently measured ocean economic activities in all countries.

Table 1. Ocean economic activity classification in the OECD Ocean Economy Monitor

Ocean economic activity	Ocean economic activity group	Total
Marine fishing	Marine fishing, marine aquaculture & marine fish processing	Total ocean economy
Marine aquaculture		
Marine fish food processing		
Marine fish beverage processing		
Offshore oil & gas extraction	Offshore oil/gas extraction & offshore industry	
Offshore industry		
Offshore wind electricity generation	Offshore wind & marine renewables	
Marine renewable energies electricity generation		
Maritime shipbuilding	Maritime shipbuilding & maritime equipment manufacturing	
Maritime equipment manufacturing		
Maritime transport	Maritime transport & maritime ports	
Maritime ports		
Marine & coastal tourism: Accommodation	Marine & coastal tourism	
Marine & coastal tourism: Food & beverage		
Marine & coastal tourism: Road & railway transport		
Marine & coastal tourism: Water transport		
Marine & coastal tourism: Air transport		
Marine & coastal tourism: Transport rentals		
Marine & coastal tourism: Travel agencies		
Marine & coastal tourism: Sport, culture & recreation		
Ocean research & development services	Marine & maritime industry trade, transport & R&D services	
Marine fishing trade services		
Marine fishing transport services		
Marine aquaculture trade services		
Marine aquaculture transport services		
Marine fish food processing trade services		
Marine fish food processing transport services		
Marine fish beverage processing trade services		
Marine fish beverage processing transport services		
Maritime shipbuilding trade services		
Maritime shipbuilding transport services		
Maritime equipment trade services		
Maritime equipment transport services		

The estimation procedure uses a range of internationally comparable datasets with country-level data drawn from the tables underlying the OECD Inter-Country Input-Output (ICIO) database. The 2023 edition of the OECD ICIO tables (2023 edition) used for this analysis cover 76 economies, plus a category comprising “the Rest of the World” (Table 2). Given the consistent measurement method used across countries, these statistics are can be aggregated to form estimates of the global ocean economy or further disaggregated to compare the size of ocean economic activities to each other or across countries.

Table 2. The OECD Inter-Country Input-Output (ICIO) database currently includes 76 countries with a "rest of the world" category

Countries included in the ICIO database
Australia, Austria, Belgium, Bangladesh, Bulgaria, Belarus, Brazil, Brunei Darussalam, Canada, Switzerland, Chile, China (People's Republic of), Côte d'Ivoire, Cameroon, Colombia, Costa Rica, Cyprus, Czechia, Germany, Denmark, Egypt, Spain, Estonia, Finland, France, United Kingdom, Greece, Hong Kong, China, Croatia, Hungary, Indonesia, India, Ireland, Iceland, Israel, Italy, Jordan, Japan, Kazakhstan, Cambodia, Korea, Lao (People's Democratic Republic), Lithuania, Luxembourg, Latvia, Morocco, Mexico, Malta, Myanmar, Malaysia, Nigeria, Netherlands, Norway, New Zealand, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Senegal, Singapore, Slovakia, Slovenia, Sweden, Thailand, Tunisia, Türkiye, Chinese Taipei, Ukraine, United States, Viet Nam, South Africa

Note: The OECD Inter-Country Input-Output (ICIO) tables serve as an international statistical framework, mapping the flows of production, consumption, and investment within countries, as well as international trade in goods and services between countries. These flows are categorised by economic activity and country, providing a consistent and comprehensive global perspective.
Source: To learn more, visit OECD (2025), OECD Inter-Country Input-Output (ICIO) database.

This internationally comparable approach does not account for all ocean economic activities included in every national ocean economy study, which are measured by individual countries using differing methodological approaches. For example, the OECD approach does not currently include economic activity belong to the industrial category 'public administration and defence' since there are no existing internationally comparable data sources from which these estimates could be derived. This category has been measured at the national level in some studies, such as the US Marine Economy Satellite Account by the US Bureau of Economic Analysis and the National Oceanic and Atmospheric Administration. Some national studies might therefore present larger national ocean economies than presented in this report, because of the chosen scope, different coverage of activities and methodological approaches.

Country groupings used in the report

Country groupings used in this report are based on either United Nations regional country groupings or World Bank country income groups. Income groupings change slightly every year and consequently cannot be detailed to the full extent in this document. Please refer to the World Bank World Bank Country and Lending Groups for the countries belonging to each group in each year.

Table 3. United Nations regional groupings used in the report

United Nations regional group	Countries
Eastern Asia	China, Japan, Korea
Europe	Albania, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovenia, Spain, Sweden, Ukraine, United Kingdom
Latin America and the Caribbean	Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela
Northern Africa and Western Asia	Algeria, Bahrain, Cyprus, Egypt, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, Türkiye, United Arab Emirates, Yemen
Northern America	Canada, United States
South-eastern Asia and Oceania	Australia, Cambodia, Fiji, Indonesia, Kiribati, Malaysia, Marshall Islands, Micronesia, Myanmar, New Zealand, Palau, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Thailand, Timor-Leste, Tonga, Vanuatu, Viet Nam

Southern Asia and Central Asia	Bangladesh, India, Iran, Maldives, Pakistan, Sri Lanka
Sub-Saharan Africa	Angola, Benin, Cameroon, Comoros, Congo, Djibouti, Equatorial Guinea, Eritrea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Mauritania, Mauritius, Mozambique, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Tanzania, Togo

Source: See the United Nations Regional groups of Member States for more details.

Table 4. Other country groupings used in the report

Countries' grouping	Countries
OECD	Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye, United Kingdom, United States.
EU 27	Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.
G7	Canada, France, Germany, Italy, Japan, United Kingdom, United States.
G20	Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Türkiye, United Kingdom, United States, the European Union, the African Union.

Glossary of technical terms used in the report

The following section presents the definitions of key economic terms found in this publication.

- Chained volume index: Measures changes in the quantity or quality of goods and services produced over time independently of changes in the price level. Chained volume indices provide a more accurate measure of growth than fixed-base indices (often called "constant prices") but are non-additive, meaning components of an aggregate cannot be summed up directly.
- Current prices: Monetary value of goods, services, and assets at the time production takes place expressed as an absolute figure.
- Full-time equivalent (FTE) employment: Total annual hours worked in an industry divided by the average annual hours worked in full-time jobs in an industry.
- Gross output: Industry aggregate of the goods or services produced within establishments and made available for use outside of the producing establishment plus any goods and services produced for establishments' own final use.
- Intermediate consumption: Industry aggregate of the goods and services consumed as inputs in production, excluding fixed assets whose consumption is recorded as consumption of fixed capital.
- Gross value-added (GVA): Industry aggregate of the value of gross output less the value of intermediate consumption.
- Multi-factor productivity (MFP): An indirect measure of the efficiency with which multiple inputs, typically labour and capital, are used to produce output in the production process. It reflects the portion of output growth that cannot be explained by the accumulation of these inputs alone. Changes in MFP capture factors such as technological advances, improvements in management practices, organisational changes, and economies of scale.
- Single Input Factor Productivity (SFP): it measures how efficiently a single input—such as labour or capital—is used to produce output. It is a partial productivity measure that does not account for the combined effects of multiple inputs.
- Territorial sea: A belt of water which extends up to 12 nautical miles from the baseline of a State and which is regarded as sovereign waters of that State.

Selected references of the readers' guide:

Jolliffe, J., C. Jolly and B. Stevens (2021), "Blueprint for improved measurement of the international ocean economy: An exploration of satellite accounting for ocean economic activity", OECD Science, Technology and Industry Working Papers, No. 2021/04, OECD Publishing, Paris, https://doi.org/10.1787/aff5375b-en.

Jolliffe, J. and C. Jolly (2024), "Eight lessons learned from comparing ocean economy measurement strategies across countries", OECD Science, Technology and Industry Working Papers, No. 2024/01, OECD Publishing, Paris, https://doi.org/10.1787/1cb42a67-en.

Yamano, N. et al (2025), "Development of the OECD Inter Country Input-Output Database, 2023 edition", OECD Science, Technology and Industry Working Papers, OECD Publishing, Paris (forthcoming).

Executive summary

The ocean economy is important for the global economy

The ocean covers 71% of Earth's surface, comprises 90% of the biosphere, provides food security for over three billion people, enables the transportation of over 80% of global goods, and hosts sea cables carrying 98% of international Internet traffic. New OECD statistics and analysis reveal the vital role that the ocean plays in the economies and livelihoods of hundreds of millions of people.

If considered a country, the ocean economy would be the world's fifth-largest economy in 2019. From 1995 to 2020, it contributed 3% to 4% of global gross value added (GVA) and employed up to 133 million full-time equivalents (FTEs).

The global ocean economy doubled in real terms in 25 years from USD 1.3 trillion of GVA in 1995 to USD 2.6 trillion in 2020, growing at an annual average rate of 2.8%. Employment levels remained relatively constant, reaching a peak of 151 million Full Time Equivalents (FTEs) in 2006, falling to 101 million in 2020 due to COVID-19, with recovery since then.

Over 75% of global ocean economic growth between 1995 and 2020 originated in countries in Asia and the Pacific. Eastern Asia alone accounted for 56% of global ocean economy expansion, while Europe and North America experienced slower growth. The People's Republic of China, the United States, Japan, Norway, and the United Kingdom had the largest ocean economies in absolute terms on average over the period. However, countries like Norway had the highest ocean-to-overall economy share, demonstrating regional disparities in reliance on the ocean economy.

Tourism and offshore oil and gas extraction generated about two-thirds of total gross value added. However, workforce distribution varied widely. Marine and coastal tourism was the largest employer, while offshore oil and gas extraction created high economic output but relatively low employment. Output from shipbuilding and offshore wind energy also expanded rapidly albeit from a smaller base.

Major disruptions will reshape the ocean economy in the coming decades

If historical trends were to continue, the global ocean economy could be nearly four times larger by 2050 than in 1995. However, various forces could slow or even reverse growth by 2050 if no policy actions are taken.

Global shaping forces will impact ocean health and the ocean economy. Factors such as population growth, climate change and other environmental pressures, trade and globalisation, the energy transition, technological advances, and geopolitical dynamics – along with their interactions – will shape ocean health and the future growth trajectory of the ocean economy. Qualitative and quantitative projections highlight climate change, energy transitions, and advances in science, technology, and innovation as key drivers.

Faltering productivity trends and digitalisation gaps will also shape the ocean economy's future potential. While some ocean economic activities outpaced average industry growth between 1995 and 2020, multifactor productivity declined in more than half the ocean economic activity groups analysed. The contribution of capital services to ocean economic growth was heavily tilted towards non-information and communication technology assets providing some evidence that ocean economic activities are not making the most of powerful drivers of productivity to prepare for an increasingly automated future.

Different pathways for a global energy transition will affect ocean economic growth in different ways. In an accelerated transition to low-carbon energy, the ocean economy would continue to grow through 2050 to around 2.5 times the size it was in 1995. The composition of the ocean economy would change, with marine and coastal tourism remaining dominant and offshore oil and gas declining as a proportion of total ocean economy GVA. A stalled transition scenario could lead to a decline in overall ocean economic activity from the level reached in 2020, mainly due to a combination of a lack of investment in productivity and increasing negative effects of climate change on many parts of the ocean economy.

Four strategic priorities can help achieve a productive and environmentally sustainable ocean economy

By strengthening ocean governance, promoting technological innovation, enhancing ocean data collection, and ensuring the inclusion of developing countries in global value chains, policymakers can lay the foundations for a future ocean economy that is both economically vibrant and environmentally sustainable.

- **Strengthening ocean governance and regulatory frameworks** can be realised with the use of science-based ocean management tools that balance economic and environmental priorities such as maritime spatial planning and marine protected areas. With national territorial claims expanding to over nearly 39% of the global ocean, national positions on ocean issues can be boosted by pragmatic international co-operation through agreements such as the WTO Fisheries Subsidies Agreement and the High Seas Agreement (BBNJ). These efforts can help close regulatory and enforcement gaps (e.g. reforming harmful subsidies that often drive overfishing) and align economic incentives with sustainability goals.
- **Promoting technological innovation and digital transformation**. Governments should encourage public and private investment in ICT-driven solutions, automation, and robotics to enhance productivity and competitiveness and reduce environmental externalities. This would involve strengthening workforce development programmes to upskill workers in key industries, preparing them for a more digitalised economy and supporting ocean economy innovation clusters to foster cross-industry and -sector collaboration and advances.
- **Enhancing ocean observation data collection and scientific research**. Expanding ocean knowledge is critical for science, conservation, and the economy. With only 25% of the seabed mapped, ocean exploration and observation networks should expand using new digital technologies. These efforts should enhance science-based decision-making and resource management. To support these developments, better public and private ocean data accessibility policies will be essential.
- **Expanding developing countries' participation in the ocean economy while safeguarding against environmental harms.** With shifting demographics and evolving natural resource availability, developing countries can benefit from greater ocean economy participation. Achieving this will require integrated ocean strategies that place the conservation and sustainable use of the marine environment as their primary objective. Policies like sustainable fisheries management and eco-friendly tourism incentives should be encouraged. Additionally, fostering new international partnerships will facilitate two-way knowledge-sharing while enhancing financial support and technology transfers.

1 Steering the ocean economy to be productive and sustainable

This first chapter summarises the key findings and recommendations from this report on *The Ocean Economy to 2050*. The report underlines the ocean economy's importance for the global economy over the last few decades, as well as its resilience, and highlights the pressing need to address structural vulnerabilities. Looking ahead, many of the major forces shaping the future of the ocean economy threaten to weaken both its growth and resilience. By strengthening governance, promoting technological innovation, enhancing data collection, and promoting the inclusion of developing countries, policymakers can lay the foundations for an ocean economy that is both economically vibrant and environmentally sustainable. This coordinated approach will be critical to creating jobs, generating revenue, and ensuring long-term ocean health in an increasingly digital and interconnected world.

Introduction

The ocean supports life on earth, representing 90% of the planet's biosphere, covering about 71% of Earth's surface and providing over half of the planet's oxygen. It also plays a vital role for the global economy. Ocean economic activities contribute to prosperity, with fisheries and marine harvesting supporting food security for over three billion people. Shipping and ports facilitate international trade with more than 80% of goods transported by sea, while undersea cables carry over 98% of international Internet traffic, underpinning digital connectivity worldwide. Beyond these already impressive numbers, the ocean economy represents revenues and jobs for hundreds of millions of people.

This chapter summarises the key findings and recommendations from the report on *The Ocean Economy to 2050*, which provides new OECD insights on the importance of ocean economic activities in the global economy. It also delivers sobering insights into potential future trends, as ocean health faces mounting pressures from overexploitation, environmental degradation, and climate change impacts, while the ocean economy exhibits some structural vulnerabilities as well. A more sustainable future is possible—if policymakers leverage advances in science and innovation, and apply existing policy and regulatory instruments, to adopt practices that balance economic growth with conservation efforts.

This Chapter delivers first unprecedented data on the ocean economy's performance between 1995 and 2020. It then explores potential trajectories for the ocean economy evolution in the coming decades, highlighting some major shaping forces. It ends with proposed actions that policymakers could take to sustain ocean-based employment and revenue, while setting the ocean economy on more sustainable pathways.

Box 1.1. The ocean economy in figures

- The global ocean economy represented 3% to 4% of the global overall economy annually between 1995 and 2020
- The size of the ocean economy doubled in real terms from USD 1.3 trillion in 1995 to USD 2.6 trillion in 2020, accruing an annual average growth rate of 3%
- At its peak, the ocean economy employed 151 million FTE in 2006, gradually falling to 134 million FTE in 2019, and then to 101 million FTE in 2020, as COVID-19 restrictions set in. Recovery occurred since then.
- Marine and coastal tourism and offshore oil and gas extraction were the two largest ocean economic activities. GVA generated by marine and coastal tourism reached a high of USD 789 billion in 2019, while offshore oil/gas and offshore industry peaked at USD 988 billion in 2020
- Marine and coastal tourism was the largest employer in the ocean economy by a wide margin, with employment reaching a peak of 95 million FTE in 2003 before falling to 79 million FTE in 2019
- Over 75% of global ocean economic growth is from countries in Asia and the Pacific with more than 55% created by countries in Eastern Asia alone
- Although high-income countries generated the most global ocean economy GVA, this dominance weakened over time with their share falling from 71% in 1995 to 52% in 2019
- Eastern Asia and Southern and Central Asia were the largest employers in aggregate at regional level, with respective contributions of 29% and 21% to global ocean economy FTE in 2019
- Only a small share of FTEs in the global ocean economy were employed in high-income countries, ranging from 15% in 1995 to 12% in 2019

Source: OECD Ocean Economy Monitor, January 2025.

The ocean economy's performance between 1995 and 2020

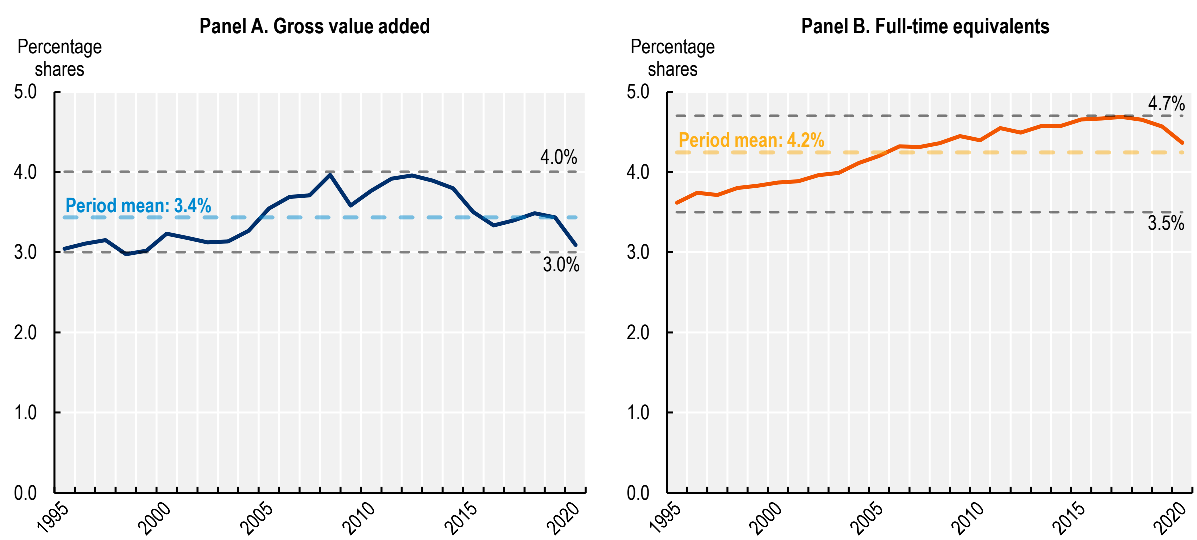
Between 1995 and 2020, the ocean economy contributed a sizable share of global economic output and provided a consistent source of prosperity for hundreds of millions of people. This section summarises the past performance of the global ocean economy, the factors that could threaten or strengthen its prospects, and projections of its potential through to 2050.

The ocean economy is an important part of the global economy

The global ocean economy generated USD 2.3 trillion of current price gross value added (GVA) and 102 million full-time equivalent (FTE) jobs in 2020 (the latest year international statistics are available). The equivalent figures in 2019 – the last year available before Covid-19 disrupted economies globally – are USD 2.7 trillion in GVA and 133 million FTEs. Annually between 1995 and 2020, the global ocean economy contributed 3.0% to 4.0% of the total GVA in the overall global economy (Figure 1.1) and 3.5% to 4.7% of total FTEs. If considered a country, the global ocean economy would have been the world's fifth largest economy in GVA terms in 2019 (seventh in 2020) having risen from eighth in the 1995 ranking.

Figure 1.1. The global ocean economy provided between 3.0% and 4.0% of global economic output and between 3.5% and 4.7% of global employment annually from 1995 to 2020

Global ocean economy gross value added and full-time equivalents shares of global overall economy gross value added and full-time equivalents



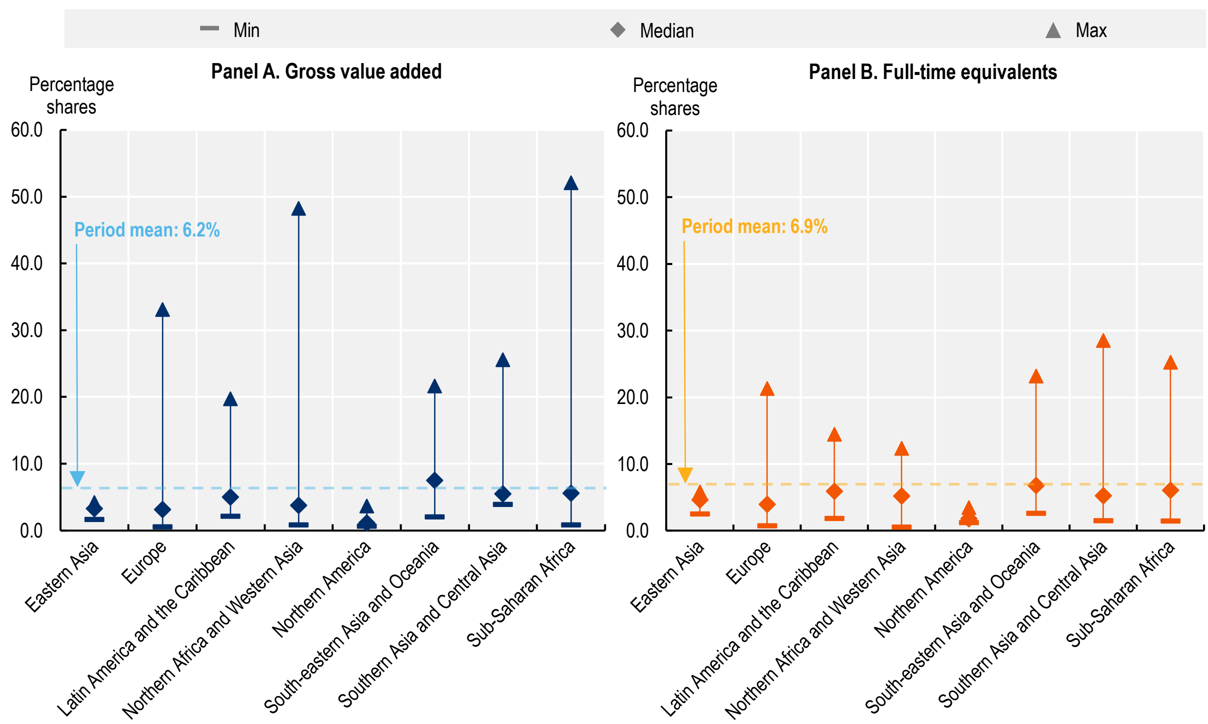
Note: Total global gross value added in current price US dollars and employment in full-time equivalents generated by ocean economic activities as a share of total global overall economy gross value added in current price US dollars and employment in full-time equivalents in each year.
Source: OECD Ocean Economy Monitor, January 2025.

The median share of country-level overall economy GVA and FTEs attributable to the ocean economy remained roughly similar across regions between 1995 and 2020 (Figure 1.2). The lowest median ocean economy to overall economy GVA share is in 'Northern America' (1.6% of overall GVA and 2.1% of overall FTE) and the highest FTE share is in 'South-eastern Asia and Oceania' (7.6% of overall GVA and 7.3% of overall FTE).

The relatively narrow range in median shares across regions masks noticeable country outliers (Figure 1.2). In Europe, for example, Norway's ocean economy represents a much higher share of its overall economy GVA (26.8%) and FTE (17.1%) than the average (3.1% of GVA and 4.0% of FTEs). The regions with the highest country-level ratios of ocean-economy to overall-economy GVA are 'Northern Africa and Western Asia' and 'Sub-Saharan Africa', both of which contain ocean and overall economies that are dominated by offshore and terrestrial oil and gas extraction. The largest FTE shares on average over the period are found in 'Southern Asia and Central Asia' and 'South-Eastern Asia and Oceania' where marine and coastal tourism dominate.

Figure 1.2. Average ocean economy to overall economy shares are mostly similar across regions, but some countries have large shares relative to their peers

Country-level total ocean economy to overall economy gross value added and full-time equivalents shares by region



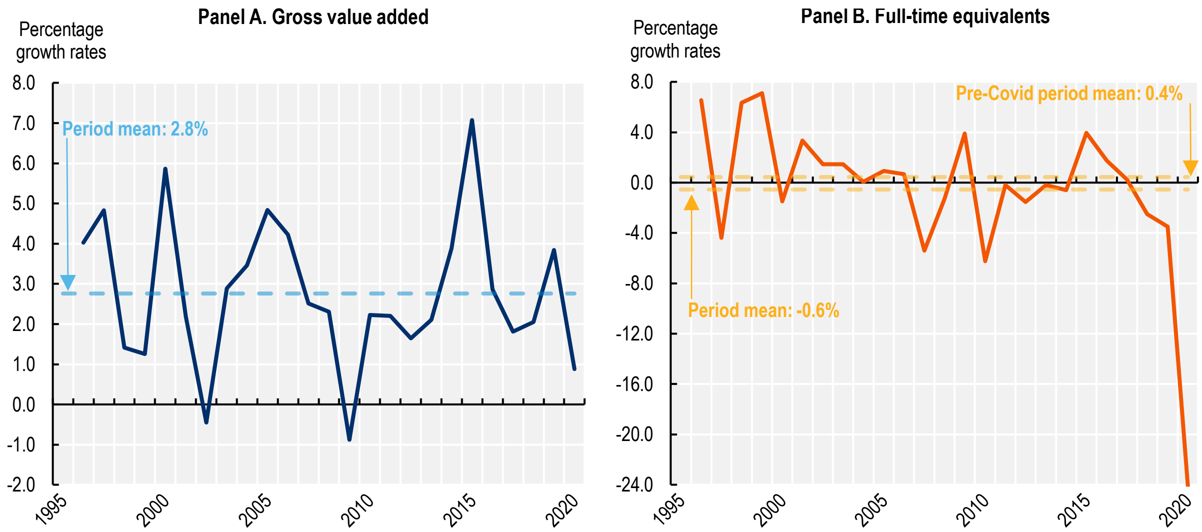
Note: Country-level total ocean economy gross value added and full-time equivalents shares of overall economy gross value added and full time equivalents are calculated first. The chart displays the minimum and maximum country-level shares in each region and the median of the country-level shares in each region as well as the arithmetic means across countries over the whole period.
Source: OECD Ocean Economy Monitor, January 2025.

Ocean economic output grew steadily between 1995 and 2020 and this growth was disproportionately generated in Asia and the Pacific

The global ocean economy – as measured by real-terms GVA – grew at an average rate of roughly 2.8% per year without experiencing any prolonged episodes of negative growth (Figure 1.3). This resulted in a doubling of real-terms GVA from USD 1.3 trillion in 1995 to USD 2.6 trillion in 2020. Global ocean economy employment remained relatively stable over the period, growing from 122 million FTE in 1995 at an average of 0.4% per year to 134 million in 2019 (Figure 1.3). It suddenly dropped to 102 million in 2020 at the onset of Covid-19 restrictions, which notably hit tourism, but started to recover the following years.

Figure 1.3. Global ocean economy output grew at 2.8% and employment at 0.4% on average between 1995 and 2020

Annual growth rates in global ocean economy real-terms gross value added and full-time equivalents



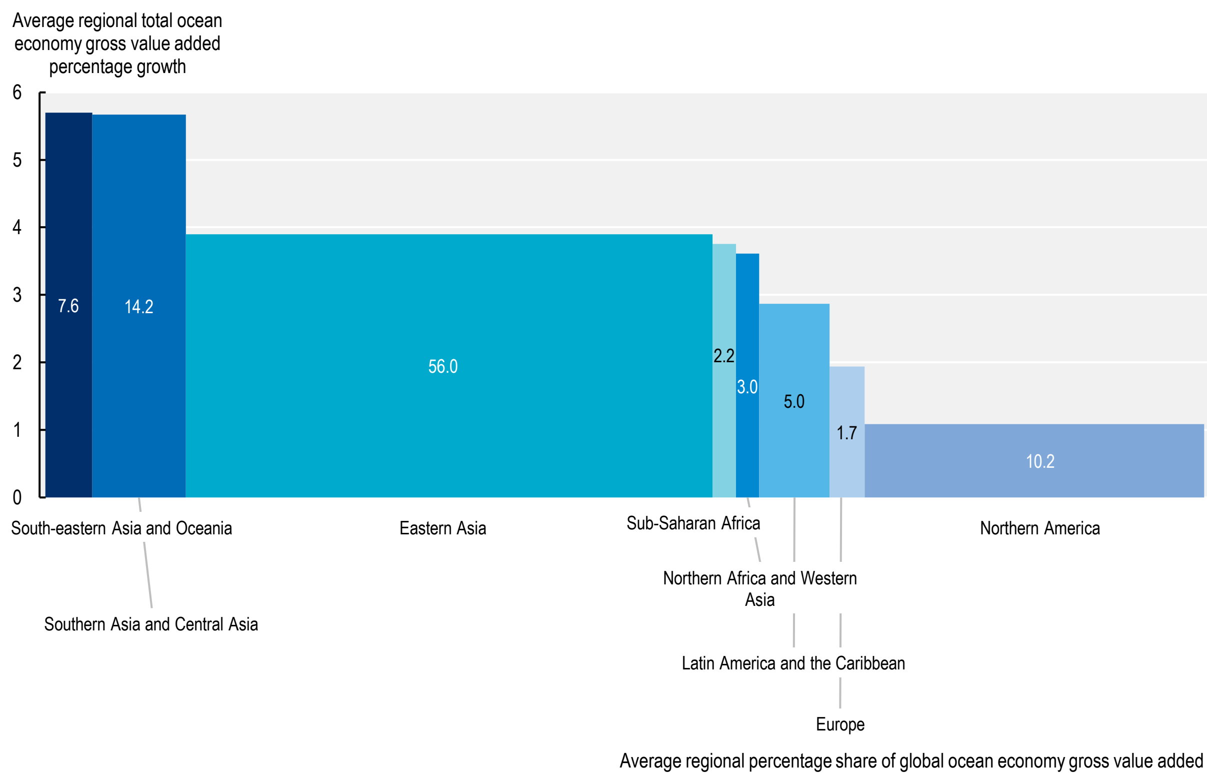
Note: Annual percentage changes in total global ocean economy gross value added chained volumes and employment full-time equivalents.
Source: OECD Ocean Economy Monitor, January 2025.

The majority – roughly 75% – of growth in global ocean economy real-terms GVA between 1995 and 2020 was generated in regions in Asia and Pacific. Figure 1.4 plots average regional GVA shares of global ocean economy GVA against average regional ocean economy real-terms GVA growth rates so that the area of each bar represents the contribution of each region to global ocean economy growth.

The region with the highest average growth rate (given by the height of the bar) was 'South-Eastern Asia and Oceania'. But this region represented a relatively small part of the global ocean economy (given by the width of the bar), leaving its weighted contribution to average ocean economy growth at 7.6%. 'Northern-America', on the other hand, represents a much larger portion of the global ocean economy but grew much slower than all other regions hence the flatter rectangle towards the right-hand side of Figure 1.4. Although it did not possess the largest average growth rate, the region with the highest weighted contribution was 'Eastern Asia' which generated 56.0% of global ocean economy growth on average over the period.

Figure 1.4. Over 75% of global ocean economic growth is from countries in regions in Asia and the Pacific with more than 55% created by countries in Eastern Asia alone

Regional average total ocean economy real-terms growth weighted by the regional average share of global ocean economy real-terms gross value added



Note: The area of each bar is proportional to the average of countries in each regions' share of global ocean economy real-terms gross value added growth between 1995 and 2019. The regional 1995 to 2019 arithmetic mean of country-level total ocean economy real-terms gross value added plotted against the regional weighted average compound annual growth in total ocean economy real-terms gross value added between 1995 and 2019.
Source: OECD Ocean Economy Monitor, January 2025.

Some countries have large ocean economies while others are reliant on the ocean economy as a proportion of their overall economy

In 2020, the countries with the largest ocean economies were the People's Republic of China (hereafter 'China') with 23.6% of global ocean economy current price GVA, Japan (7.1%), United States (7.0%), India (5.0%), and the United Kingdom (4.9%).

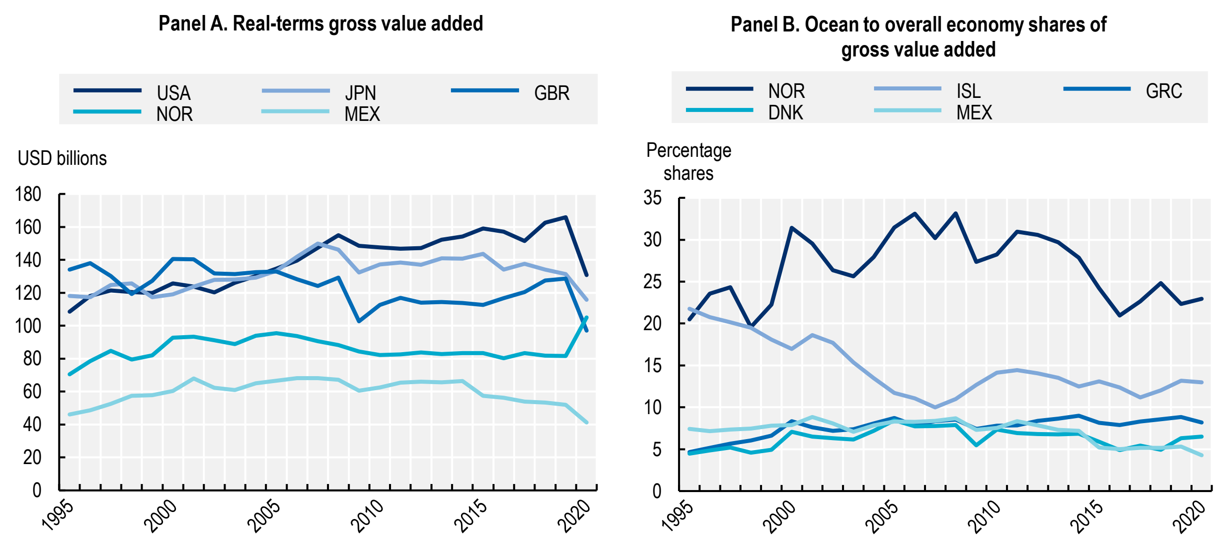
As a comparison, China contributed 3.2% of global ocean economy current price GVA and ranked ninth in 1995. The highest-ranking countries in 1995 were Japan (21.4%), United States (11.0%), United Kingdom (9.2%), Italy (5.6%) and Saudi Arabia (3.5%). On average over the period, Japan was the largest ocean economy with an average 1995 to 2020 share of global ocean economy current price GVA of 11.7%, followed by China (10.5%), United States (9.3%), United Kingdom (7.6%) and Norway (5.3%).

In real-terms gross value added, the United States was the OECD member country with the largest ocean economy between 2008 and 2020 (Panel A of Figure 1.5). Pre-2008, the top position switched between the United Kingdom, Japan and the United States. The top five OECD member country ocean economies in average real-terms GVA also includes Norway and Mexico.

The largest OECD member country ocean economy as a proportion of its overall economy was Norway with 26.6% on average between 1995 and 2020 (Panel B of Figure 1.5). Iceland (average of 14.7% of overall economy GVA), Greece (7.7%), Mexico (7.2%) and Denmark (6.3%) also feature in the top five OECD member countries. Norway's ocean economy reached a peak as a share of its overall economy in 2006 at 33.1% (the lowest share in Norway was in 1995 at 20.5%). Iceland's ocean to overall economy share dropped from a high of 21.8% in 1995 to a low of 10.0% in 2007 before levelling off to an average of 12.9% for the remainder of the period. All other top five OECD member countries' shares remain roughly equal over the time period.

Figure 1.5. Within the OECD, the United States had the largest ocean economy in absolute terms and Norway had the largest ocean economy as a proportion of its overall economy

Country-level total ocean economy real-terms gross value added and total ocean to overall economy gross value added shares



Note: Coastal OECD member countries are ranked according to their average total ocean economy real-terms gross value added and their ocean to overall economy current price gross value added shares across the period. Annual real-terms gross value added and ocean to overall economy shares for the top five countries in this ranking are displayed in the charts.
Source: OECD Ocean Economy Monitor, January 2025.

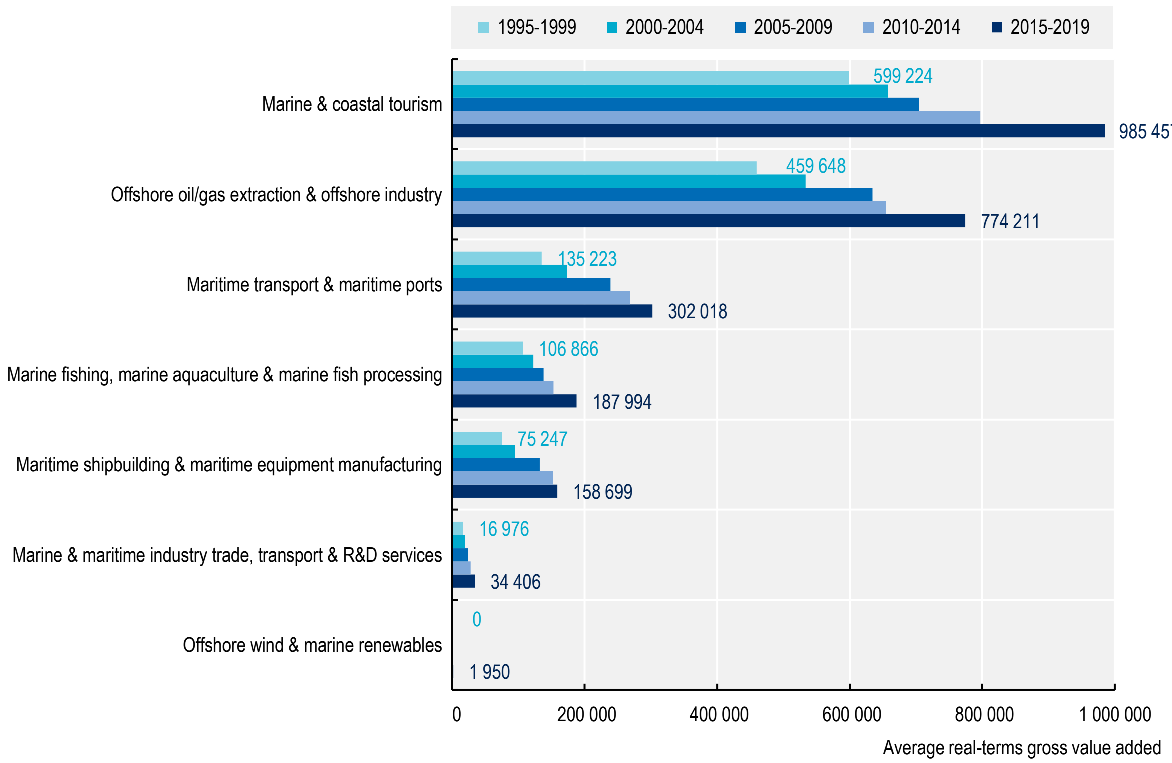
A diverse set of economic activities are included in the ocean economy

The OECD Ocean Economy Monitor measures 33 individual ocean economic activities and provides seven separate activity aggregates called ocean economic activity groups. The ocean economic activity groups 'marine and coastal tourism' and 'offshore oil/gas extraction and offshore industry' were the largest contributors to global ocean economy GVA between 1995 and 2020 — together accounting for around two-thirds of the total in each year (Figure 1.6).

In annual terms, 'marine and costal tourism' was the largest ocean economic activity group in global real-terms GVA between 1995 and 2019 when it hit a peak of USD 1.06 trillion. Real-terms GVA in the activity group then fell to USD 910 billion in 2020 because of the restrictions put in place during Covid-19. Conversely, 'offshore oil/gas extraction and offshore industry' reached a peak in 2020 at USD 987.4 billion and replaced 'marine and coastal tourism' as the largest ocean economic activity that year.

Figure 1.6. Two ocean economic activity groups dominate the global ocean economy: 'Offshore oil/gas extraction and offshore industry' and 'marine and coastal tourism'

Five-year period average global ocean economic activity group real-terms gross value added

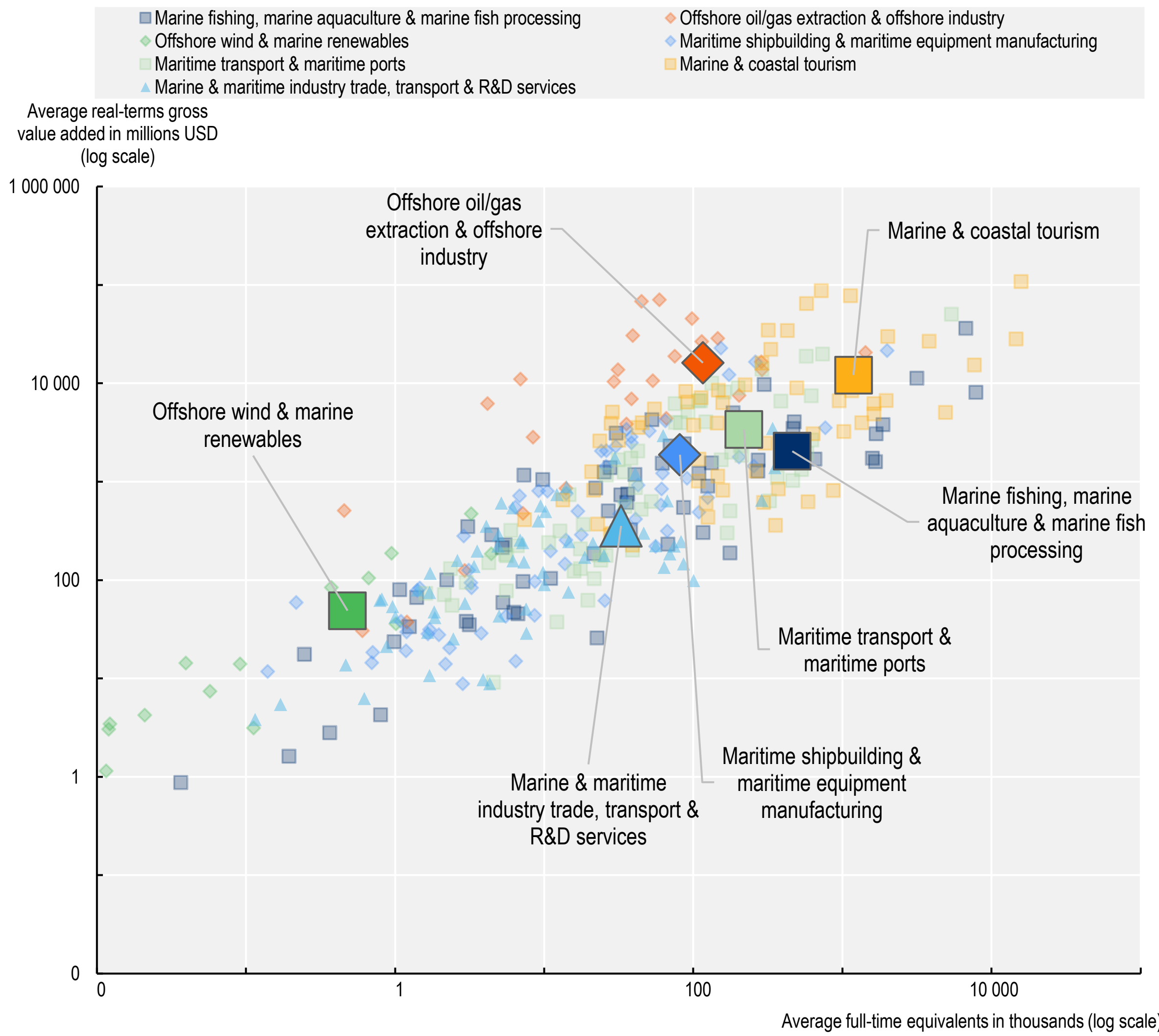


Note: The arithmetic mean of global ocean economic activity group chained volume measures for each five-year period between 1995 and 2019.
Source: OECD Ocean Economy Monitor, January 2025.

Ocean economic activity groups generating high levels of GVA do not employ high levels of full-time equivalents. Differences in the average levels of real-terms GVA and FTE across ocean economic activity groups in different countries can be seen in Figure 1.7, where each point represents the average performance of a country for a given ocean economic activity group. The ‘oil and gas extraction and offshore industry’ group is represented by a noticeable cluster of orange diamonds positioned toward the upper-left of Figure 1.7. This indicates a combination of higher-GVA and lower-FTE levels compared to other ocean economic activity groups and suggests this group generates substantial output but employs fewer workers relative to others. In contrast, ‘marine and coastal tourism’ (yellowish squares) exhibits both high GVA and high FTE figures in general. Another cluster of green diamonds – representing ‘offshore wind and marine renewables’ – is noticeable towards the bottom-left of Figure 1.7, underlining its current status as a low GVA and low FTE activity group.

Figure 1.7. Ocean economic activity groups generating high levels of gross value added do not necessarily create high employment and vice versa

Average ocean economy activity group full-time equivalents and average ocean economy activity group gross value added



Note: The arithmetic mean of country-level ocean economy activity group full-time equivalents between 1995 and the arithmetic mean of country-level ocean economy activity group real-terms gross value added between 1995 and 2019. Only the 76 OECD Inter-Country Input Output Tables countries are included in the chart for clarity.
Source: OECD Ocean Economy Monitor, January 2025.

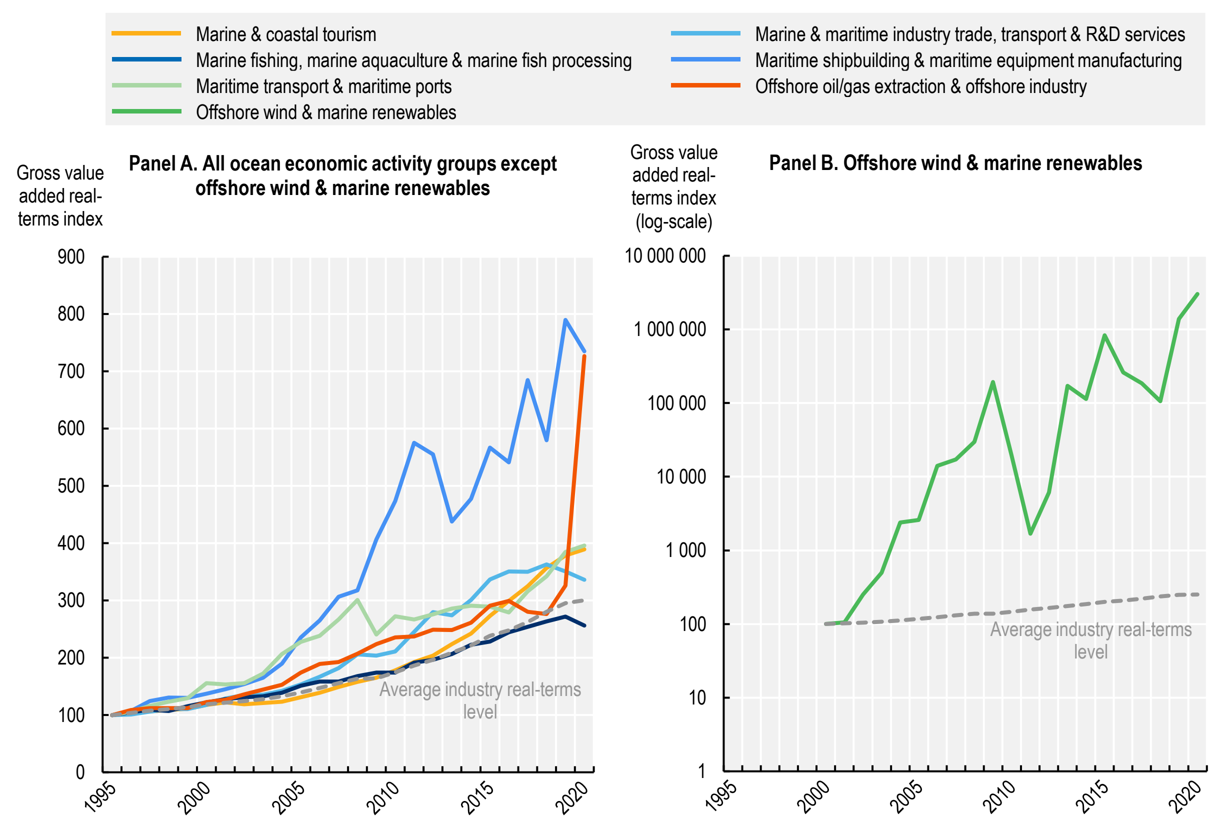
Growth in many ocean economic activities outpaced average industry growth between 1995 and 2020

Real-terms GVA in most ocean economic activity groups grew at a faster rate than average industry growth in the wider economy each year between 1995 and 2020 (Figure 1.8). Between 2008 and 2020, ‘maritime shipbuilding and maritime equipment manufacturing’ performed particularly strongly growing at a rate three times higher than average industry growth at its top level in 2011. ‘Maritime transport and maritime ports’, ‘marine and maritime industry trade, transport and R&D services’ and ‘offshore oil and gas extraction and offshore industry’ all consistently outperform average industry real-terms GVA growth. ‘Marine and coastal tourism' did not distinguish itself from average industry growth until 2010 when it begins to pick up. However, 'marine fishing, marine aquaculture and marine fish processing' grew at a rate roughly equivalent to average industry growth throughout the period.

Real-terms gross value added in 'offshore wind and marine renewables' increased dramatically from 2000 when industrial production from the activity group is first recorded in the OECD Ocean Economy Monitor. 'Offshore wind and marine renewables' real-terms GVA grows from USD 38.2 million in 2000 to USD 4.6 billion in 2020 – exhibiting an average annual growth rate far beyond all other ocean economic activity groups and the average industry in the overall economy.

Figure 1.8. Economic growth in ocean economic activity groups outpaced average industry growth between 1995 and 2020

Global ocean economic activity group real-terms gross value added index and global weighted average industry real-terms gross value added index



Note: Gross value added chained volume indexes with a reference year of 2015 set so that 1995 equals 100 in Panel A and 2020 equals 100 in Panel B are calculated for each ocean economic activity group and the average industry. The weighted industry average is measured by calculating relevant industry group level real-terms growth rates, weighting each industry group by the share of its contribution to total overall economy gross value added, and chaining together. Panel B is based on 2020 because it is the first year in which offshore wind and marine renewables begins to produce gross value added according to the OECD Ocean Economy Monitor.
Source: OECD Ocean Economy Monitor, January 2025.

How might the ocean economy grow in the coming decades?

If historical trends were to continue, the global ocean economy could become four times larger in real terms by 2050 than it was in 1995. Productivity analysis outlined in Chapter 4 serves as the foundation for a baseline projection of the future ocean economy through to 2050. The contribution of various input factors – information and communication technology (ICT) capital services, non-ICT capital services, the education composition of the labour force and multifactor productivity – to GVA growth are estimated. Past trends in these contributions are then used in a projection model that estimates real-terms GVA growth through to 2050. However, analysis of the forces shaping future ocean economic growth outlined below suggest basing projections solely on the historical record would lead to overly optimistic growth trajectories.

Pressures on the ocean economy will likely grow in the coming decades

Most ocean economic activities should continue benefitting from underlying economic and social trends in the next two decades. However, even with innovations on the horizon to face some of these challenges, pressures are mounting on many fronts for the ocean and several ocean economic activities. In all scenarios, ocean economy growth will be affected and may eventually decline if no actions on improving ocean governance are taken.

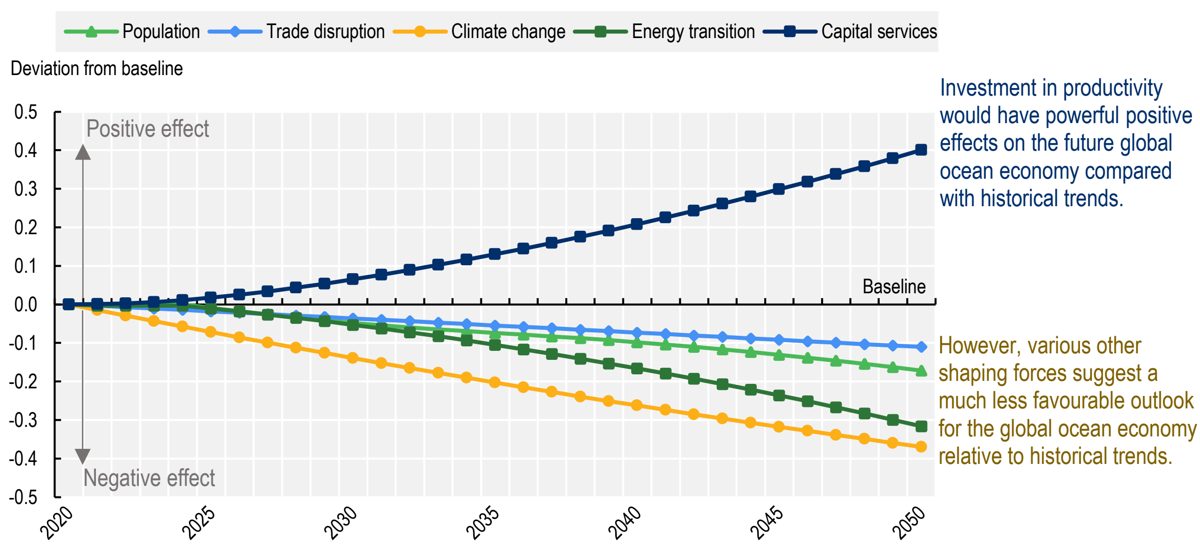
- The policy frameworks and governance mechanisms for the ocean and the ocean economy have been strengthening over the past decade at both national and international levels. However, as strategic and economic interests in the ocean continue to expand, so do the challenges of co-operation and effective management of this global commons (Chapter 2). The increasing territorial claims over ocean waters—now encompassing approximately 39% of the global ocean under some national sovereign rights—along with the expansion of illicit activities at sea, are transforming the ocean into an increasingly competitive environment. A range of critical issues—from safeguarding freedom of navigation, regulating greenhouse gas emissions from ships, and combating illicit activities such as illegal, unreported, and unregulated (IUU) fishing, drug trafficking, and industrial pollution from both land and maritime sources—would require increased attention from policymakers at different levels and in coordination. Without actions, these challenges could become ever more complex and intertwined, threatening not only further ocean health but also economic activities.
- The rapid expansion and concentration of ocean industries, coupled with overfishing, expanded biological and mineral extraction, and continued harmful subsidies in fishing in particular——risk exacerbating environmental externalities globally. The rapid expansion and concentration of ocean industries, coupled with insufficient regulatory oversight—resulting in overfishing, unsustainable biological and mineral extraction, and continued harmful subsidies—risk exacerbating environmental externalities globally. These impacts extend beyond coastal areas, potentially undermining the long-term viability of key ocean economic activities in some countries, such as artisanal capture fisheries and marine and coastal tourism (Chapter 2).
- Growing climate change effects (sea level rise, acidification, changing fish stocks patterns…) will affect not only ocean health and its biodiversity, but also industries faced with growing risks of extreme weather and sea level rise impacts (growing threats to infrastructure at sea: oil and gas rigs, offshore wind, aquaculture and ports, as well as capture fisheries) (OECD, 2022[1]; OECD, 2016[2]).
- Increased terrestrial pollution (plastics, chemicals, waste management) will be impacting several ocean-based industries, particularly those relying on living resources (capture fisheries) and pristine environment (coastal and marine tourism). The amount of plastic entering the environment annually by 2040 is for instance expected to nearly double compared to 2022 if there are no policy reorientations (OECD, 2024[3]).
- Furthermore, the ocean economy risks missing out on potential productivity gains from major economic transformations expected in the decades to come. Investment in the ocean economy has been tilted away from information and communication technologies (ICTs) and towards capital

such as machinery and equipment. But ICTs can drive efficiency gains and the failure to integrate advances in the underlying technologies may over time lead to serious loss of competitiveness.

Recent scientific and economic literature have been used to recognise differences in the magnitude of the potential effects of various shaping forces on the future global ocean economy. Figure 1.9 displays the results of this modelling work. Each shaping force is considered in isolation, all else remaining equal, and compared to the baseline projection which assumes that historical trends persist. The shaping force with the largest upside potential on the global ocean economy is an increase in capital services productivity across ocean economic activity groups. The shaping force with the largest downside concerns the effects of climate change on income.

Figure 1.9. Isolated shaping forces are likely to have effects of different magnitudes on the future ocean economy

Global ocean economy real-terms gross value added under the influence of isolated shaping forces relative to the baseline projection



Note: Gross value added chained volume indexes for the overall economy are calculated under various assumptions outlined in Chapters 4 and 5. The relative index is calculated as the ratio of each shaping force (Chapter 5) chained volume index to the baseline projection (Chapter 4) chained volume indexes setting the baseline projection chained volume indexes equal to 0. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity.
Source: OECD Ocean Economy Monitor, January 2025.

Different approaches to the energy transition may drive substantial changes in future ocean economic growth

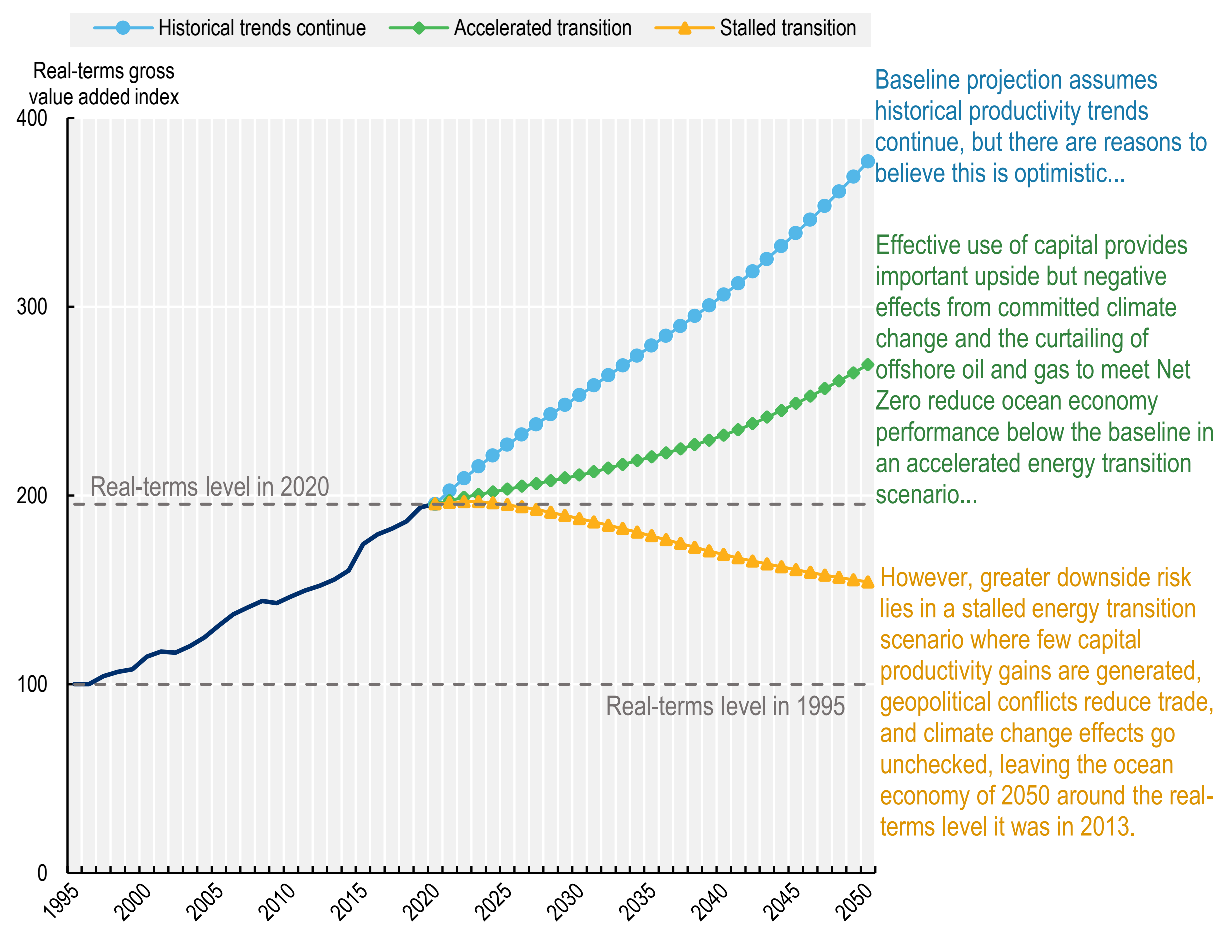
Building on the analysis of major shaping forces, two possible scenarios for the future of the ocean economy are explored based on alternative global energy transition pathways. In the first scenario, the energy transition accelerates through to 2050. In the second scenario, the transition barely progresses until the end of the period (as detailed in Chapter 6).

In both scenarios, global ocean economy GVA growth results in an ocean economy that is larger in real-terms than it was in 1995 when the historical period begins – 2.5 times larger than 1995 under an accelerated transition and 1.5 times larger under a stalled transition (Figure 1.10). The global ocean economy could grow around 40% higher than its 2020 level by 2050 under an accelerated transition scenario. In a stalled energy transition scenario, global ocean economic activity would decline to end the period around 20% lower than it was in 2020.

The alternative scenarios also drive important differences in the composition of the ocean economy. In the accelerated transition scenario, a pronounced shift away from offshore oil and gas extraction reduces the activity's share of total global ocean economy GVA from a third in 2020 to one-fifth in 2050. In a stalled transition, the effect goes in the other direction and offshore oil and gas extraction increases its share of the total ocean economy to become the dominant activity around 2030. In the accelerated transition scenario, marine and coastal tourism remains the dominant ocean economy activity group through to 2050. But a stalled transition would reduce its share substantially as offshore oil and gas extraction expands. Offshore wind and marine renewables expand at a much faster rate in the accelerated transition, arriving in 2050 with a share 21 times larger than in 2020 as compared with a three-fold increase in the stalled transition.

Figure 1.10. Important shaping forces suggest the future global ocean economy will not grow as fast as historical precedents suggest and may even go backwards

Global ocean economy real-terms gross value added indexes according to three projection scenarios



Note: Gross value added chained volume indexes (1995 = 100) for the global ocean economy are calculated under the assumptions given in Chapter 4 for the baseline projection and Chapters 5 and 6 for the accelerated and stalled transition scenario projections. Each line represents the mean predicted value from the relevant projection.
Source: OECD Ocean Economy Monitor, January 2025.

Stronger climate, biodiversity, and energy policies are key to the ocean economy's future

Climate change mitigation and adaptation, and the conservation and sustainable use of biodiversity including marine ecosystems, alongside support for the energy transition, are policy priorities that extend well beyond the ocean economy itself (OECD, 2024[4]). However, as seen in the different scenarios, climate change and energy transition pathways could impact deeply the growth of the ocean economy under different assumptions, as compared to historical trends with even the possibility of an eventual decline in global ocean economic activity.

Successfully developing a resilient and more productive ocean economy will depend largely on the world's ability to control climate change and mitigate its worst effects, by enhancing biodiversity conservation, sustainable use and restoration as well, and harnessing the expected transformation of the global energy system.

The ocean plays a crucial role in climate regulation, absorbing approximately 25% of global carbon emissions, with stored carbon locked away in seafloor deposits for potentially hundreds of years (IPCC, 2021[5]). This process is supported by a diverse range of marine species, from plankton to mesopelagic fish, which help sustain carbon sequestration (IPBES, 2019[6]). However, while this absorption is part of the climate's natural cycle, the current levels of emissions are increasingly disrupting the ecological functions of marine organisms, threatening biodiversity and the ecosystem services it provides, but also different ocean processes including ocean circulation (Mercator, 2025[7]).

- ***Continued commitment to curb overall carbon emissions will be necessary,*** as the impacts of climate change increasingly compromise ocean health and the ocean economic activities that depend on it, as shown in this report. Eutrophication and acidification are placing increasing pressure on marine ecosystems; while rising temperatures, sea levels and extreme weather patterns further exacerbate these challenges, posing various degrees of risk to key activities such as shipping, fisheries, coastal tourism, and port infrastructure. Every incremental increase in temperature compounds these risks, underscoring the need for decisive action. The consequences will be particularly severe for coastal communities and low-income countries in particular lacking finance for adaptation.
- ***Preventing the rapid loss of biodiversity, including species and marine ecosystems*** — such as mangroves, salt marshes, coral reefs, and seagrass—driven by human activities particularly in populated coastal areas will be vital. Accelerated loss threatens not only critical roles of these ecosystems in regulating water quality, acting as carbon sinks, and providing coastal defences but also disrupts key ocean-based economic activities, including fishing and coastal tourism that provide food security and livelihoods. Widespread pollution, from plastics but not only, also contributes to these losses (OECD, 2025[8]). Deep sea ecosystems and their role in supporting marine food webs and climate processes are also only starting to be understood, thanks to improved ocean and seabed exploration and mapping (Levin, 2021[9]). Conservation, sustainable use as well as restoration policies with enforcement mechanisms, are needed to support these valuable ecosystems.
- ***Steering the global energy and transportation system on a path to transition to low-carbon emissions would improve ocean health***, despite a reliance on fossil fuels for the foreseeable future (IEA, 2024[10]). An acceleration would mitigate long-term climate change impacts, while adaptation strategies could be implemented in parallel to prepare for accelerated changes in ocean conditions. Science and technology, and particularly digitalisation have a role to play in this transition, enabling more efficient and sustainable ocean management.

Addressing these challenges requires sustained and targeted public and private investments, which not only support economic resilience but also generate long-term benefits for societies and businesses alike

(OECD, 2021[11]; OECD, 2025[12]). Overall, encouraging the use of advanced technologies to reduce emissions and enhance energy efficiency would strengthen the long-term performance of ocean economic activities, while meeting wider climate and biodiversity goals.

What actions can policymakers take to set the ocean economy on a more sustainable pathway?

The report highlights both strengths and vulnerabilities of the ocean economy. While ocean economic activities have outpaced overall economic growth for the past two decades, several structural weaknesses remain and will only grow in view of mounting pressures. Productivity growth has been sluggish in many ocean economic activities, and serious challenges lie ahead in terms of ocean health, governance, and digitalisation.

A combination of stronger governance mechanisms, responsible business practices, and scientific innovation can contribute to have economic activities coexist better with the ocean's health, ensuring that the ocean remains a global common for future generations while supporting sustainable economic growth.

Four main strategic orientations for targeted policy interventions are needed:

1. Strengthening governance frameworks and collaboration
2. Promoting technological innovation and digital transformation
3. Enhancing sustained ocean observations and scientific research to develop knowledge on ocean processes and improve management
4. And expanding the integration of developing countries in the ocean economy

1. Strengthening governance frameworks and collaboration

To harness the economic potential of the ocean and ensure conservation, sustainable use and restoration of marine ecosystems, critical ocean governance and regulatory frameworks need to be put in place (OECD, 2016[2]). Few countries have comprehensive ocean strategies, and priorities for the ocean economy vary widely depending on cultural and socio-economic contexts. The ocean's cultural significance, strategic role, and economic importance differ for example between different small developing island states in the Caribbean and Pacific on the one hand, and countries with vast but underutilised coastlines on the other. In most cases and as a first step, encouraging improved policy coherence by refining and harmonising existing sectoral policies can effectively address complex ocean governance challenges, leveraging synergies and managing trade-offs (OECD, 2025[13]).

Given the numerous challenges in ocean management highlighted in this report—from balancing competing commercial uses and enhancing a country's position in the global ocean economy to combating illicit activities at sea—key pragmatic actions to strengthen national ocean governance would include:

- **Establishing science-based ocean management frameworks:** Over 70 countries have already developed some level of marine spatial planning (MSP) to address growing conflicts of usage along their coasts and beyond (e.g. balancing artisanal fishing ground, marine aquaculture, shipping corridors and marine protected areas) and controlling better their waters. As a growing number of sea basins suffer from combinations of challenges, from agricultural runoffs and land-based pollution to excessive industrial ocean activities, the most effective ocean management systems are the ones based on the best available science, setting up control and enforcement mechanisms (Troya, Ansong and O'Hagan, 2023[14]). This is particularly important for marine protected areas, which provide the most socio-economic benefits when they are fully protected and monitored properly (Pike et al., 2024[15]). More countries are moving beyond MSP to implement "sustainable ocean plans", so that improved ocean management benefit their economic and sustainable development (Ocean Panel Secretariat, 2021[16]).

- **Strengthening engagement in multilateral co-operation to enhance national strategic positioning:** Consensus can be hard to reach internationally on many issues, however groups of like-minded countries can effectively advance a global ocean health agenda by ensuring that several key multilateral agreements come into force. International agreements—such as the high seas governance agreement (BBNJ), the World Trade Organization's (WTO) Agreement on Fisheries Subsidies, decarbonisation frameworks under the International Maritime Organization, and treaty efforts to curb plastic pollution —should provide eventually transparent, enforceable rules and strengthen national strategic positioning. Several agreements are open for signature and ratification (Table 1.1). Their rapid or delayed implementation will affect the future of the ocean economy, including further national and commercial investments in selected ocean economic activities.
- **Addressing and reducing regulatory gaps:** Countries can use a range of regulatory instruments to support efficient natural resource management, with the OECD providing illustrations and tracking of these instruments for the benefit of users (OECD, 2025[17]). Reforming subsidies that risk encouraging unsustainable or illegal, unreported, and unregulated (IUU) fishing in the absence of effective management, as well as investing in improving the monitoring, control and surveillance of fishing fleets are both fundamental to sustainable fisheries. Combating IUU fishing should continue with ongoing discussions at WTO and OECD contributing to this effort (OECD, 2025[18]). There are as yet no global guidelines for countries engaging in seabed mining in national waters (usually in shallow waters), from sand to critical minerals, but the OECD has developed "*Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas*", which provides advice as they apply to all mineral supply chains (OECD, 2016[19]). For deep sea mining in the high seas, precautionary approaches should be applied by all to avoid irreversible damage to the ocean environment, as discussions continue within the International Seabed Authority membership.
- **Foster proactive public-private dialogue:** Governments should set clear policy signals and align economic incentives with sustainability objectives to encourage responsible business practices, while maintaining oversight to ensure that private-sector innovation advances social and environmental priorities. Some companies already align around common sustainability principles (UN Global Compact, 2019[20]). As seen in Chapter 2, industry concentration plays a significant role in many ocean economic activities, with a few major players accounting for the majority of revenue generation. This is evident across sectors such as shipping, offshore oil and gas, and cruise tourism, where large corporations dominate the market. This can be an opportunity for encouraging responsible business practices amongst their peers.

Table 1.1. Status of selected multilateral agreements relevant to ocean governance as of January 2025

Agreement	Number of Signatures	Number of Ratifications (Needed for entry into force)
United Nations Convention on the Law of the Sea (UNCLOS)	168	168 (In force since 1994)
Agreement under UNCLOS on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ Agreement)	107	16 (60 needed)
World Trade Organization's Agreement on Fisheries Subsidies	115	91 (111 needed)

2. Promoting technological innovation and digital transformation

Technological progress is a critical lever for closing productivity gaps in the ocean economy and preparing it for a digital future, while using advances to improve in parallel the knowledge base on ocean processes and how they are impacted by ocean economic activities and other pressures. This is a message from the analysis of the performance of ocean economic activities in recent decades (Chapter 4). Policymakers should drive investments in advanced technologies while also encouraging private actors to continuously upgrade workforce skills and capabilities.

- **Invest in advanced technologies:** Policymakers should drive investments in advanced technologies, notably as part of support programmes to help different industries transition to low carbon emissions. Much R&D is still needed in many industries including marine aquaculture, energy production and shipbuilding (OECD, 2025[21]). Further investment in ICT-intensive capital, automation, robotics, and digital solutions should be explored, as they can boost productivity as well.
- **Strengthen workforce development in the ocean economy:** Policymakers should encourage with private actors the development of long-term pipelines of talent, skills and knowledge in ocean domains of expertise, while implementing comprehensive up-skilling and re-skilling programmes (OECD, 2019[22]). Several countries have also set up fast-track apprenticeship schemes, contributing to retain and make better use of the experience of older workers, while enhancing on-the-job training (Norwegian Ministry of Climate and Environment, 2023[23]). Regular updates of education curricula to equip workers with the tools needed for a more automated, digital world are also increasingly necessary in almost all ocean economic activities, from shipbuilding to ports operations and marine aquaculture. In addition, safety aspects will remain crucial in many ocean economic activities, from artisanal fishermen to ocean manufacturing. For example, the move from conventional engine design to alternative fuel systems in shipping (especially ammonia) requires not only new engineering and maintenance expertise but also safety protocols for fuel handling.
- **Leverage maritime clusters and innovation hubs:** Policymakers should encourage the development and optimisation of maritime clusters and technology hubs to promote cross-industry synergies, reduce shared costs, and improve competitiveness. OECD work on ocean innovation networks has shown the advantages of cross-industry platforms for joint pre-competitive innovation (OECD, 2019[22]). Optimising current practices in OECD countries would involve revisiting existing industry clusters to unlock further their potential and consider establishing new networks where gaps exist, while facilitating further exchanges among researchers from different disciplines and industry leaders. In the context of geopolitical tensions, governments must strengthen international frameworks to secure and manage technology and financial flows, ensuring access to advanced solutions.

3. Enhancing sustained ocean observations and scientific research

Effective decision-making in the ocean economy depends on robust, real-time data. Strengthening ocean observation systems is crucial to addressing data gaps that limit the capacity to monitor ocean health and inform policy.

- **Expand ocean observation networks and ocean data accessibility to inform science-based policies and sustainable management practices:** ocean observations provide critical data that enhance public safety, economic efficiency, and environmental stewardship (OECD, 2019[22]). By delivering public information on coastal waters and beyond, the US National Oceanic and Atmospheric Administration (NOAA), in close coordination with private actors, informs for example decision-making for activities such as marine navigation, fisheries management, and defence, by offering insights into ocean conditions that affect operational planning and safety measures

(Stevens, Jolly and Jolliffe, 2021[24]). Publicly-funded ocean observing networks contribute as well essential data that are then reused in many commercial products and services, multiplying the economic benefits from ocean observing (Rayner, Gouldman and Willis, 2019[25]; Jolliffe and Aben Athar, 2024[26]). Ocean data will increasingly feed new "ocean digital twins" to inform better decision-makers, connecting oceanographic data to biodiversity hotspots and real-time traffic (Mercator, 2025[7]). Governments should invest in sustained ocean observation systems to ensure comprehensive coverage—from seabed initial mapping to the monitoring of marine ecosystems. Joint programmes for under-observed regions such as the Southern Ocean should be as well receive more support to advance knowledge on major ocean processes (Clem et al., 2024[27]).

- **Promote transformative research and technologies for the ocean:** In view of the many challenges, policymakers should encourage science, technology, and innovation policies that prioritize ocean health and sustainable ocean uses (IOC-UNESCO, 2024[28]). This was reaffirmed at key international ministerial conferences, including the OECD Science and Technology Policy Ministerial Conference in April 2024, to better address major societal challenges such as climate change and biodiversity loss. The *OECD Agenda for Transformative Science, Technology and Innovation Policies* provides a framework that would be conducive to raise the visibility of the benefits of ocean science and innovation (OECD, 2024[29]; OECD, 2024[30]).

4. Expanding the integration of developing countries in the ocean economy

With shifting demographics and evolving natural resource availability, many developing countries will stand to gain from greater participation in the ocean economy, and their experiences would benefit the broader community. Policy measures should support these countries in leveraging ocean-based activities for sustainable growth, while protecting the marine environment on which they depend.

- **Adopt integrated ocean strategies:** Developing countries, as most of the advanced economies before them, stand to benefit from developing long-term national ocean economy strategies that balance economic growth with ecosystem integrity (OECD, 2016[2]). Several emerging economies have already developed or are working on long-term ocean strategies. However, few low- or lower-income countries are following suit. Also, many developing countries still need to integrate monitoring frameworks to deliver on their objectives (OECD, 2025[31]).
- **Lower barriers to growth:** Developing countries should ideally implement as well cross-sectoral policies—including marine spatial planning, improved fisheries management, and sustainable tourism incentives—to improve policy coherence and set conducive environments for sustainable growth (OECD, 2025[13]). The aims are to reduce access barriers related to finance and technology, and to improve access to policy evidence using such tools as ocean thematic accounting frameworks (Jolliffe, Jolly and Stevens, 2021[32]). On financing, development assistance should be steered to support these frameworks as recommended in the forthcoming OECD Guidance for Development Partners (OECD, 2025[31]). In parallel, there are opportunities to build or strengthen maritime clusters and ocean innovation networks in developing regions through joint public–private initiatives and capacity-building programmes (OECD, 2019[22]).
- **Foster partnerships between developing and advanced economies**: Continue to foster partnerships through multilateral forums and expert exchanges, thereby facilitating the transfer of knowledge, technology, and best practices. Financing issues will remain key and the *OECD Guidance for Development Partners* to enable a sustainable ocean economy transition in developing countries provides advice and recommendations to ensure that the ocean-related support is well-targeted, effective, and coherent (OECD, 2025[31]).

The report *The Ocean Economy to 2050* identifies both the decades-long resilience of the ocean economy and the pressing need to address its structural vulnerabilities. By strengthening governance, promoting science and technological innovation, enhancing data collection, and ensuring the inclusion of developing countries, policymakers can lay the foundations for an ocean economy that is both economically vibrant and environmentally sustainable. This coordinated approach will be critical to creating jobs, generating revenue, and ensuring long-term ocean health in an increasingly digital and interconnected world.

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2 Evolving policy context for the ocean economy

This chapter provides an overview of some recent advances in the continually evolving policy frameworks and ocean governance systems surrounding the ocean economy. From national policies and multilateral agreements to recent scientific and technological progress and the implications for ocean governance, it provides context for the following chapters. It also highlights less-known aspects having an impact on the ocean economy, such as increasing ocean territorialisation, industry concentration and industrialisation, and the growth of illegal activities at sea, the so-called "dark ocean economy".

Introduction

Recent years have seen the overall environment of the ocean economy and the ocean on which it depends undergo considerable change. Powerful forces have been building up which are increasingly affecting the ocean economy. Foremost perhaps among these forces are climate change, slowing population growth and ageing, mounting obstacles to the largely open international trade system, a shifting geopolitical and geo-economic landscape, technological progress, and an accelerating world energy system transition. These global forces shaping the future of the ocean economy are addressed at some length later in the report.

Largely as a response to many of those global changes, the policy frameworks and governance mechanisms surrounding the ocean and the ocean economy, have been strengthening. The ocean economy is undergoing significant transformations, driven by technological advancements, economic expansion, environmental challenges, and shifting governance structures. As the economic importance of the ocean and its resources grows, so too, does the complexity of governing their use in a sustainable and equitable manner in order that ocean health is preserved, and fragile marine ecosystems are conserved and restored.

This chapter provides a brief overview of the evolving policy landscape and ocean governance systems shaping the ocean economy, as context-setting for the chapters that follow. It examines recent regulatory and policy developments at national and multilateral levels, and some of the opportunities and challenges associated with ocean scientific and technological progress. It also explores relatively new trends such as growing ocean territorialisation, industry concentration, and the expansion of illicit activities at sea.

Ocean governance in a complex and dynamic policy environment

The ocean economy encompasses a broad range of ocean economic activities, including marine fisheries, aquaculture, maritime transport, offshore energy, marine and costal tourism, and emerging sectors such as marine biotechnology (OECD, 2016[1]). Together, these activities generate significant economic value, providing employment and supporting livelihoods, particularly in coastal communities. Their expansion has been facilitated by technological innovation, increased private sector investment, and policy initiatives aimed at fostering sustainable growth in the past twenty years or so.

However, the rapid evolution of the ocean economy presents governance challenges that require coordinated national and often international responses. The increasing demand for marine resources, coupled with the growing economic stakes in ocean industries, has led to tensions between economic development and environmental protection. Climate change, biodiversity loss and pollution further compound these challenges, necessitating integrated governance frameworks that align economic, social, and environmental objectives (OECD, 2025[2]). Ensuring the long-term sustainability of the ocean economy requires a policy environment that fosters responsible investment, promotes innovation, and strengthens resilience to external shocks.

National ocean policies

National policy frameworks play a critical role in shaping global ocean governance (OECD, 2016[1]). Countries have adopted diverse approaches to regulating marine activities, from integrated ocean management to sector-specific policies for fisheries, energy, and maritime transport. While some countries have established dedicated ocean economy strategies, others have embedded ocean governance within broader economic or environmental policies (OECD, 2020[3]).

Achieving policy coherence in national ocean strategies is a complex endeavour, often hindered by overlapping jurisdictions, conflicting interests, and resource constraints (OECD, 2025[4]). The OECD identifies several challenges, including the alignment of national policies with regional and international frameworks, coordination among various governmental agencies, and the integration of scientific data into policymaking (OECD, 2016[1]). For example, discrepancies between national regulations and international commitments can lead to enforcement gaps, undermining conservation efforts and sustainable resource use.

The effectiveness of ocean policies depends on institutional coordination, regulatory enforcement, stakeholder engagement, and regular evaluation of the policy instruments in place (Karousakis, 2018[5]; OECD, 2020[3]). They also require reliable and standardised data on the ocean economy, integrated within broader national economic accounting frameworks (Jolliffe, Jolly and Stevens, 2021[6]; Jolliffe and Jolly, 2024[7]). The development of ocean thematic accounts, which systematically capture ocean-related economic activities within national accounting systems and eventually connects with ocean environmental accounting, represents a significant step forward in assessing the importance of the ocean both via macroeconomic statistics and natural capital accounting (UNESCAP and GOAP, 2021[8]; OECD, 2019[9]).

Financial support to ocean management is key as well (OECD, 2020[3]). Developing countries face particularly difficult conditions, with less than 1% of official development assistance going to ocean-related projects. The *OECD Guidance for Development Partners* aims to enable a sustainable ocean economy transition in developing countries. It provides advice and recommendation to ensure that the ocean-related support is well-targeted, effective, and coherent (OECD, 2025[10]).

Overall, best practices highlight the importance of multi-stakeholder collaboration, adaptive management approaches, and cross-sectoral policy integration in achieving sustainable ocean governance and management (Ocean Panel Secretariat, 2021[11]).

Multilateral policy frameworks

The governance of ocean resources at international level is inherently complex involving multiple national jurisdictions, regulatory frameworks, and stakeholder interests (OECD, 2016[1]). Some multilateral agreements apply to quasi-all countries governing parts of the activities occurring in, above, and beneath the ocean's surface and water column. Others are regional, covering specific ocean economic activities such as regional fisheries management organisations (RFMOs). These seventeen organisations and their memberships, sometimes overlapping, are responsible for sustainably managing fish stocks including migratory ones like tuna (FAO, 2020[12]). Coherence across different governance mechanisms remains challenging, with still gaps for controlling commercial activities occurring in the high seas (Blasiak and Claudet, 2024[13]).

At the multilateral level, the United Nations Convention on the Law of the Sea (UNCLOS) serves as the foundational legal framework governing maritime zones and the rights and responsibilities of states. Recent policy initiatives reflect growing international recognition of the need for enhanced ocean governance to address biodiversity conservation, sustainable resource use, and equitable benefit-sharing, as shown in Box 2.1.

Box 2.1. Selected major multilateral efforts relevant for the ocean economy

- *The Agreement under the United Nations Convention on the Law of the Sea (UNCLOS) on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ Agreement)*. This accord (called sometimes the "high seas treaty") aims to strengthen the sustainable governance of the high seas, which constitute 54% of the Earth's surface, by introducing mechanisms for establishing marine protected areas (MPAs), conducting environmental impact assessments (EIAs), and ensuring the equitable sharing of marine genetic resources. The agreement opened for signature in September 2023 and will enter into force once ratified by 60 states, as of February 2025, 21 countries have ratified it.

- *The Kunming-Montreal Global Biodiversity Framework* was adopted at COP15 in December 2022 by the Parties to the Convention on Biological Diversity. Its sets out multiple targets for halting and reversing nature loss, including the 30x30 target—aiming to protect at least 30% of terrestrial, inland, and marine areas by 2030. It has reinforced the importance of ocean and marine conservation, integrating key ocean sustainability goals into broader global biodiversity commitments (OECD, 2025[2]). It is now in the implementation phase, with countries working to translate its targets into national biodiversity strategies and action plans.
- *The International Maritime Organization Strategy on Reduction of Greenhouse Gas (GHG) Emissions from Ships* – This strategy adopted by all 174 member states of the International Maritime Organization, sets out targets—including a reduction of at least 50% in total greenhouse gas emissions by 2050 relative to 2008 levels—with the long-term goal of phasing out emissions of shipping entirely (International Maritime Organization, 2023[14]).
- *The World Trade Organization's Agreement on Fisheries Subsidies* is aimed at eliminating subsidies that contribute to overcapacity, overfishing, and illegal fishing. Despite recent progress, a legally binding agreement has not yet been reached. Many issues remain under discussion—such as setting appropriate transition periods, distinguishing between beneficial support and harmful subsidies, and establishing effective compliance mechanisms (OECD, 2025[15]).
- *The Global Plastics Treaty* negotiations are ongoing aimed developing an international legally binding instrument on plastic pollution, including in the marine environment. A comprehensive approach is taken to address the full life cycle of plastic, including its production, design, and disposal (OECD, 2022[16]; OECD, 2024[17]).
- *The International Seabed Authority (ISA) Mining Code* – ISA is working on drafting comprehensive regulations for deep seabed mining with its Member States, with negotiations still underway. While draft provisions exist, a legally binding mining code has not yet been adopted, as discussions continue concerning environmental safeguards, resource management, and revenue-sharing mechanisms (International Seabed Authority, 2024[18]).
- *The London Protocol* aims to protect the marine environment by prohibiting the dumping of wastes at sea, except for a specified list of permissible materials. It entered into force in 2006, ratified by 89 Parties. In 2013, the Protocol was amended to prohibit the placement of matter into the sea for marine geoengineering activities, specifically ocean fertilization, unless explicitly authorized under a permit system. Since 2022, a process is ongoing to evaluate and potentially regulate four emerging marine geoengineering techniques: ocean alkalinity enhancement, macroalgae cultivation for carbon sequestration (including artificial upwelling), marine cloud brightening, and surface albedo enhancement using reflective particles, because of their potential for "deleterious effects that are widespread, long-lasting or severe; and […] the considerable uncertainty regarding their effects on the marine environment, human health, and on other uses of the ocean" (IMO, 2023[19]).
- *The Protocol on Environmental Protection to the Antarctic Treaty* entered into force in 1998, it designates Antarctica as a "natural reserve, devoted to peace and science". The Protocol sets strict measures to protect the Antarctic environment, including a prohibition on mineral resource activities (other than for scientific research), stringent waste management rules, and requirements for environmental impact assessments for any human activities. There are today

ongoing negotiations to set up large marine protected areas to conserve the region's unique biodiversity. The Protocol is due for a review in 2048, 50 years from its entry into force. (Antarctic Treaty Secretariat, 2024[20]).

- Other agreements are important for ocean governance, such as the Hong Kong Convention on recycling of ships (IMO, 2024[21]).

Scientific and technological progress and its implications for ocean governance

Scientific and technological progress is playing a transformative role in shaping the ocean economy, providing new information and knowledge, and driving efficiency, sustainability and competitiveness across various ocean economic activities, but also bringing new governance questions to the forefront.

The ocean science-policy nexus

Interaction between ocean science and policymaking is fraught with challenges, primarily due to the multifaceted nature of governance structures and the wide variety of ocean-related sciences (IOC, 2017[22]). Effective policymaking necessitates the integration of robust scientific data; however, translating scientific findings into actionable policies is often impeded by communication gaps, differing priorities among stakeholders, and the inherent uncertainties within scientific research. These challenges can lead to delayed responses to environmental issues and hinder the implementation of sustainable ocean management practices (Ocean Panel Secretariat, 2021[11]).

The ocean sits indeed at the nexus of very diverse scientific disciplines, from oceanography to climate science, and biodiversity. These interconnected fields offer insights that underpin a comprehensive science-policy interface. However, integrating the varied communities and processes presents a significant challenge. The Intergovernmental Oceanographic Commission (IOC), the Intergovernmental Panel on Climate Change (IPCC), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), all play a role in bridging these divides to address the complex interplay between the ocean and the broader Earth system (IPBES, 2019[23]; IPCC, 2018[24]; IOC, 2020[25]). New proposed initiatives such as the International Platform for Ocean Sustainability (IPOS) are also trying to contribute to these efforts (Ocean Sustainability Foundation, 2024[26]). Looking beyond the third United Nations Ocean Conference (UNOC3) taking place in June 2025 with a particular focus on science, all these platforms should provide more opportunities to share best practices and align research objectives with policy needs.

The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) aims to contribute to bridge these gaps by fostering a collaborative framework. This initiative promotes partnerships among governments, scientific communities and other stakeholders to generate and disseminate ocean knowledge that can be acted upon by policymakers. The Barcelona Statement, issued during the UN Ocean Decade Conference held in April 2024, took stock of the progress three years after the Decade's start. It identified three sets of priorities for the different ocean scientific communities: targeted ocean knowledge and science generation to inform management decisions, improved marine pollution monitoring and ocean observations infrastructure; and cross-cutting issues such as co-designing initiatives and embracing all knowledge systems (IOC-UNESCO, 2024[27]).

Ocean observations supporting ocean governance

New capacities to monitor the ocean have brought novel opportunities for improved ocean management, as well as governance challenges. Satellite monitoring, new types of in-situ observing systems, artificial intelligence, environmental DNA, and big data analytics have significantly improved the capacity of ocean observations to support science but also to bring socio-economic benefits to a wide variety of users (OECD, 2019[9]; Malde et al., 2020[28]). Sustained ocean observations enable for instance policymakers to establish the bounds of the economic use of the ocean more effectively and help to achieve the conservation and sustainable use of the marine environment (Commonwealth of Australia, 2019[29]). Advanced digital twins of the ocean represent the next step for using various compilations of data for ocean science and ocean management objectives (Mercator, 2025[30]).

As an illustration, the Argo system involves some thirty countries, with the US National Oceanic and Atmospheric Administration (NOAA) leading many of the developments in close cooperation with the American manufacturers (Rayner, Gouldman and Willis, 2019[31]). Argo forms a global array of almost 4 000 robotic profiling floats that measure the temperature and salinity of the upper 2 000 meters of the ocean (Wong et al., 2020[32]). New generations are being deployed with around 400 floats able now to measure six types of biochemical parameters, and others able to dive down to 6 000 meters to provide information on water column profiles (González-Santana et al., 2023[33]). The Argo system – like many other ocean observing systems – brings crucial data that contribute to monitor the ocean, feeding into weather and climate models, as well as generating additional socio-economic benefits, as ocean data collected once can be reused by a broad range of actors as demonstrated by OECD analysis of marine data value chains (Jolly et al., 2021[34]; Jolliffe and Aben Athar, 2024[35]).

To maximise the benefits from ocean observation, data collection and dissemination are needed over long periods. Some universally accepted data protocols are in place to facilitate data collection and sharing, such as the International Hydrographic Organization's standards and guidance on bathymetric data that contribute to map the world's seabed with inputs from national hydrographic organisations and from ocean industries (Nippon Foundation-GEBCO, 2022[36]). The Global Ocean Observing System (GOOS) and the International Oceanographic Data and Information Exchange (IODE) of UNESCO-IOC contribute as well to standardise marine data formats (GOOS, 2018[37]; IOC-UNESCO, 2024[27]). However, ocean observing and data management infrastructures come at a cost and the effective implementation of FAIR principles (Findability, Accessibility, Interoperability, and Reusability) is complex, given the variety of marine data, the diversity of stakeholder interests, the corporate rules limiting diffusion of data (e.g. from oil rigs), and data sovereignty laws and security issues that often limit cross-border sharing (Tanhua et al., 2019[38]; IOC, 2017[22]; European Marine Board, 2021[39]). Security risks play a growing role, particularly in maritime surveillance, naval operations, and deep-sea infrastructure data, as also explored in Chapter 5. Governments and defence agencies may impose restrictions on real-time oceanographic data sharing due to national security concerns, creating tensions between transparency objectives and confidentiality needs.

Despite the remarkable progress made to date in ocean observing systems, real-time observations and local to global coverage for many types of ocean data remain insufficient. Some locations are not well covered, such as the Southern Ocean and even some of the most advanced countries coastal information from seabed and marine-ecosystem mapping is lacking (Clem et al., 2024[40]). Gaps in observations of important parameters – such as measurement of biological parameters or ocean carbon – also limit the volume and quality of information available to many governments and other stakeholders for their ocean strategies. The result is a reduction in the understanding of the marine environment leading to decisions that are not properly informed. This call for sustained and improved ocean observations was mentioned in the context of the OECD Scientific and Technological Policy meeting at Ministerial level, held on April 2024. The adoption of the 2024 Ministerial Declaration emphasised the need for transformative science, technology and innovation policies to help meet the challenges of climate change, biodiversity loss and pollution, featuring ocean health as one of the priorities (OECD, 2024[41]).

Ocean engineering advances

Recent advances in ocean engineering have enabled the development of swarms of autonomous underwater vehicles and floating offshore wind farms (OECD, 2019[9]). Innovations in marine bioprospecting have led to the discovery of novel pharmaceutical compounds, biofuels, and sustainable aquaculture feed alternatives (OECD, 2017[42]; Thompson, Kruger and Thompson, 2017[43]). The quasi-monthly discovery of new marine species in the deep ocean and the rapid development of biotechnology is opening new frontiers in marine resource utilisation, while a biodiversity protection regime still needs to address the ethical and equity implications of genetic resource exploitation (Inniss, Simcock and United Nations., 2016[44]; Crespo et al., 2019[45]; Blasiak et al., 2018[46]).

The deployment of carbon dioxide removal (CDR) technologies is also increasingly considered an important tool for fulfilling commitments to climate targets, as outlined by the IPCC (IPCC, 2022[47]). However, scaling up CDR at the pace required to offset residual emissions by mid-century presents significant challenges, as the effectiveness and possible irreversible damages of CDR technologies are still hard to gauge (see Box 2.2 mentioning the London Protocol on geoengineering projects). They would not substitute for necessary carbon emissions reductions, but rather act as complementary measures to mitigate hard-to-abate emissions (Smith et al., 2023).

All these technological developments are beneficial for ocean science and for the development of many ocean economic activities. But by their nature, they also bring up many questions about their potential impacts on the ocean environment.

The growing intersection of public and private sector interests

The governance of ocean economic activities increasingly involves a complex interplay between public and private sector actors, as the number of commercial uses of the ocean increases. Governments play a central role in setting regulatory frameworks, establishing marine spatial planning mechanisms, and investing in critical infrastructure to support sustainable ocean development. At the same time, private sector stakeholders—including multinational corporations, start-ups, and impact investors—are driving innovation, capital investment, and market-driven solutions to ocean sustainability challenges.

Public-private partnerships have emerged as an effective mechanism for promoting sustainable ocean industries, particularly in areas such as offshore energy, marine conservation finance, and sustainable fisheries management. For example, blended finance approaches, which leverage public funding to mobilize private investment, are being used to support marine protected areas and ecosystem restoration projects (OECD, 2020[3]). Additionally, voluntary industry initiatives, such as the Poseidon Principles for responsible shipping finance and the Global Tuna Alliance for sustainable fisheries, demonstrate the increasing role of corporate responsibility in ocean governance (UN Global Compact, 2019[48]). Financing remains a major issue. The *Sustainable Blue Economy Finance Principles* from the United Nations Environment Programme is a guiding framework for investors, banks and insurers to channel finance into more sustainable environmental practices (UNEP FI, 2020[49]).

Despite these positive developments, attaining the appropriate balance between public and private interests remains problematic. While private sector engagement can drive efficiency and innovation, ensuring that corporate activities align with social and environmental priorities requires regulatory oversight, transparency, and accountability mechanisms. Governments must play a proactive role in setting clear policy signals, aligning economic incentives with sustainability objectives, and fostering multi-stakeholder dialogue to achieve an equitable and resilient ocean economy.

Box 2.2. The ocean’s multifaceted commercial uses in selected figures

- There are around 3 800 maritime ports around the world, and approximately one-third are situated within a tropical zone highly exposed to the most severe impacts of climate change (Economist Impact, 2023[50]).
- There are 939 container ports globally receiving regular liner shipping services. Shanghai was

the most connected port in 2020, with 288 direct connections, followed by Busan (274 direct connections), Antwerp (268) and Rotterdam (264) (Hoffmann and Hoffmann, 2020[51]).

- Some 105 500 vessels of 100 Gross Tonnage and above transport goods across the ocean, with oil tankers, bulk carriers, and container ships accounting for 85% of total capacity (GT is a measurement of a ship's overall internal volume) (UNCTAD, 2023[52]).
- Some 5 600 container ships are operating globally, with the fleet having experienced large growth over the past decades. In 2021, about 1.95 billion metric tons of cargo were shipped globally, up from approximately 100 million metric tons in 1980 (UNCTAD, 2023[52]).
- There are about 450 sea cable systems spanning more than 1.5 million kilometres. Over 98% of international communication occur via submarine cables and nearly 200 000 km of new cables were installed in 2024 alone (ITU, 2024[53]; ITU, 2024[54]).

Ocean governance operates across multiple policy dimensions, each with distinct implications as seen in the previous sections. National and regional policies shape regulatory frameworks, directly influencing marine resource management and economic activities, while multilateral frameworks address transboundary challenges, requiring international coordination to manage shared ocean resources and spaces. Current scientific and technological progress should enhance sustainability and efficiency in principle, but it also raises new governance issues, including regulatory adaptation and equitable access. Meanwhile, the growing public-private sector interplay in the ocean domain is growing and is becoming more complex, as governments sometimes must catch up to set the right regulatory frameworks while private actors drive innovation and investment. Aligning these many policies through integrated governance will be essential to balancing ocean economic growth and sustainable resource management in the future. This is especially relevant considering some of the deep-seated structural changes that the ocean economy is undergoing, as described in the next sections.

Transformations of the ocean economy

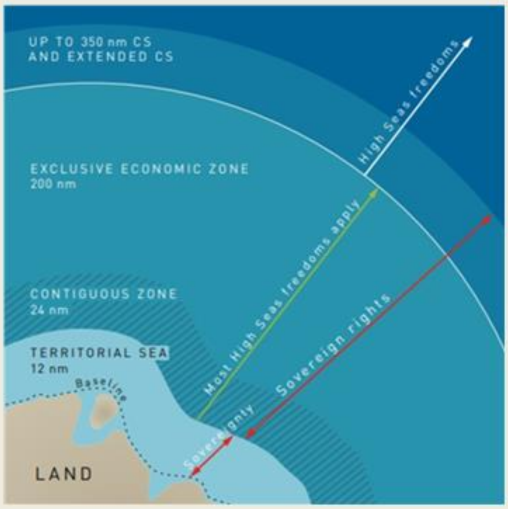
The global ocean economy is undergoing changes driven by territorial expansion, industry concentration and industrialisation, and by the rise of illicit activities at sea with the growing presence of a "dark ocean economy". States are increasingly asserting sovereignty over marine resources, leading to geopolitical tensions but also opportunities for improved ocean management. Simultaneously, large-scale industries are consolidating market power, raising concerns about economic equity and environmental sustainability. And illicit activities such as Illegal, unreported and unregulated (IUU) fishing and maritime trafficking pose growing risks to security at sea. These developments underscore the need for coordinated policy responses, international cooperation, and adaptive regulatory frameworks to ensure a sustainable ocean economy.

Increasing territorialisation of the ocean

One of the defining features of the contemporary ocean economy is the increasing territorialisation of marine spaces. Approximately 39% of the global ocean falls under national jurisdiction, encompassing areas such as territorial seas and exclusive economic zones (EEZs). Countries continue to expand their territorial claims, thanks to advances in ocean exploration and seabed mapping of continental shelves, asserting sovereign rights over vast ocean areas. This trend has led to more geopolitical disputes over maritime boundaries and resource rights, particularly in regions with overlapping claims (OECD, 2016[1]).

As mentioned earlier, the United Nations Convention on the Law of the Sea (UNCLOS) establishes a legal framework defining maritime zones (Box 2.3). This regime outlines, in varying degrees of detail, the rights and obligations of different states in each zone, ensuring governance and jurisdiction over ocean activities.

Box 2.3. Countries have different sovereign rights over maritime zones



Territorial Waters (up to 12 nautical miles): Full sovereignty, similar to land territory, but with the right of innocent passage for foreign vessels.

Contiguous Zone (12-24 nautical miles): Limited control for enforcing laws on customs, immigration, and security.

Exclusive Economic Zone (EEZ, up to 200 nautical miles): Sovereign rights over natural resources (fishing, oil, gas) and economic activities (energy production), while allowing freedom of navigation for other states.

Continental Shelf (CS can extend beyond 200 nautical miles if geologically justified): Sovereign rights over seabed resources (oil, gas, minerals), but does not extend to the water column beyond the EEZ ocean shipping routes

Source: UNODC (2020[55])

The expansion of national jurisdiction over different ocean spaces can contribute to improved management, with the setting up of marine spatial planning and even sustainable ocean plans (Jay, 2017[56]; Lubchenco et al., 2016[57]; Ocean Panel Secretariat, 2021[11]). More monitoring and presence at sea, including an active military presence in ocean space and in waterways is becoming ever more important for a few countries to protect commerce and their strategic interests. This trend has as well significant implications for economic development, marine conservation, and global trade, underscoring the need for effective dispute resolution mechanisms and cooperative management frameworks (Blasiak and Claudet, 2024[13]). Some examples are provided below with the introduction of different types of zoning such as green corridors at sea and marine protected areas, ending with recent issues concerning maritime chokepoints.

Setting up green corridors at sea – Emission Control Areas (ECA) aim to mitigate pollution from maritime transport, with ships required to adopt cleaner fuels or install exhaust gas cleaning systems (scrubbers) to meet stringent emission standards (OECD, 2025[58]). Beyond generating carbon emissions, shipping contributes to about 30% of global nitrogen oxides emissions, which – along with sulphur oxide emissions – degrade air quality, especially in coastal areas, and are linked to respiratory and cardiovascular diseases, as well as premature deaths (OECD, 2022[59]). Recent developments in ECAs show an expansion of regulated zones, with the Mediterranean Sea set to become an ECA for sulfur oxides in May 2025. This addition follows the existing ECAs in the Baltic Sea, North Sea, North America, and parts of the Caribbeans. Discussions are ongoing about potential expansions in Asia and other high-traffic regions. The effectiveness of ECAs is evident in reduced sulfur and nitrogen oxide emissions in regulated waters, leading to improved air quality and public health benefits (International Council on Clean Transportation, 2024[60]). However, challenges remain, including compliance costs, enforcement difficulties, and infrastructure limitations for alternative fuels. Despite these hurdles, ECAs continue to push the industry toward greener practices, with increasing investments in low-emission technologies and cleaner fuel alternatives.

Setting up marine protected areas - As of May 2024, there were around 18 200 marine protected areas and almost a hundred other area-based conservation measures covering over 29 million square kilometres or 8.3% of the ocean, according to the World Database on Protected Areas (WDPA) (UNEP IUCN, 2025[61]). This represents more than a tenfold increase in marine protected area coverage since 2000, largely due to the establishment of very large areas exceeding 100 000 square kilometres. Progress has stalled since 2020, however. The Kunming-Montreal Global Biodiversity Framework commits to establishing protected areas to safeguard zones of particular importance for biodiversity, with the aim to cover up to 30% of the ocean by 2030. But reaching the target by 2030 would call for effectively managing important sites totalling on average an additional 1.13 million square kilometres of ocean each year. Additionally, the Agreement on Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ) aims to protect marine biodiversity in international waters and the seabed.

MPAs aim to protect various ecosystems such as mangroves, salt marshes, and seagrass beds, which cover around 0.5% of the ocean and contribute to preserve biodiversity, enhance coastal protection, and support fisheries, while offering a level of carbon sequestration that may be important but which is still difficult to quantify (Macreadie et al., 2021[62]; Oschlies et al., 2025[63]). The level of actual protection of MPAs is however quite low due to lack of monitoring and enforcement, with estimates of 1,3% to 3% of effectively protected MPAs (Pike et al., 2024[64]). Setting up ocean observations systems to monitor biodiversity and ecosystem changes and enforcement mechanisms will be key (Miloslavich et al., 2018[65]). In addition, setting up more networks of connected marine protected areas in the future, equipped with protected corridors for ecological connectivity, would also make both scientific and economic sense, although they need to take into account coastal communities' needs particularly in developing countries (Bohler-Muller, 2014[66]; Popova et al., 2019[67]).

Managing maritime chokepoints – Disruptions to shipping schedules, service reliability, security measures, freight costs and insurance premiums are increasingly affecting overall seaborne trade geography (UNCTAD, 2024[68]). Globally, an estimated 180 international maritime straits and passages are important for global trade. Historic routes such as the Cape Horn and the Cape of Good Hope, which played pivotal roles during early globalisation, are now of secondary importance, though they remain significant alternatives when other passages are blocked. The Strait of Malacca leads in total global maritime flows, handling 18.5% of traffic with approximately 80 000 vessels transiting annually, followed by the Taiwan Strait (18%), the Dover Strait (Pas de Calais) (15%), and the Strait of Gibraltar (12.3%). Recent crises in the Red Sea, Suez Canal and Panama Canal have hindered the free movement of goods, impacting industries like construction, automotive, chemicals, energy, food distribution, and machinery that depend on Asia-Pacific imports. Incidents on the Panama and Suez Canal due to climate-induced low water levels and regional conflicts led to a drop in traffic of over 50% by mid-2024 (UNCTAD, 2024[69]). The freedom of Chapters 5 and 6 will discuss further these implications.

Industrialisation and industry concentration

Parallel to the territorialisation of ocean spaces, the ocean economy is experiencing rapid industrialisation and industry concentration. Large-scale marine industries, including offshore oil and gas, commercial fishing, and maritime transport, are increasingly dominated by multinational corporations and vertically integrated business models. While this trend has driven efficiency gains and innovation, it has also raised concerns about market concentration, equity of resource access, and environmental sustainability. Ensuring fair competition and responsible business conduct in the ocean economy requires regulatory oversight, transparent governance mechanisms, and policies that support small-scale and community-based enterprises.

Some ocean industries are highly concentrated, dominated by a few large players, notably offshore oil and gas, shipping and increasingly ports. Others are concentrated at different segments of the value chain, such as in the case of fisheries and aquaculture. The top 10 companies in eight key ocean economy industries collectively generate an average of 45% of industry revenues, while the 100 largest firms account for 60% of total revenues (Virdin et al., 2021). This can lead to valid discussions around equity, like in other domains of the global economy, but also as an opportunity to boost more sustainable practices If leaders adhere to the same principles (UN Global Compact, 2019[48]).

Offshore Oil and Gas – The number of offshore oil and gas platforms in use around the world stands at around 7 500, the bulk of them in the Gulf of Mexico and Western Europe but with considerable numbers of them operating in Southeast Asia and the Asia Pacific region (OECD, 2019[9]). Many of these platforms are nearing the end of their service life. For example, in the Gulf of Mexico, the decommissioning of offshore structures has been a longstanding regulatory priority under the oversight of the United States Bureau of Safety and Environmental Enforcement (BSEE). Since the 1980s, operators and contractors have undertaken the removal of approximately 150 to 250 offshore installations annually, ensuring compliance with environmental and safety regulations while managing the structural lifecycle of offshore energy infrastructure (Zeldovich, 2019[70]). In cases where rigs are partially left in place, marine species use the platforms' structures on the seafloor as artificial reefs. These artificial habitats attract an array of species over a relatively small area of seafloor, rather like apartment buildings for small fish, clams and molluscs (OECD, 2019[9]). This industry is dominated by multinational corporations like ExxonMobil, Shell, BP, and Chevron, with national oil companies (e.g., Saudi Aramco, Petrobras) playing a major role in regions with vast natural reserves. The increasing consolidation and growing number of partnerships in exploration and production, as well as a gradual shift toward offshore renewables, contribute to make the energy industry ever more concentrated.

Shipping – Maritime transport is the backbone of global trade in goods, accounting for more than 80% of the volume of global trade in goods and more than 70% of its total value (OECD, 2025[58]). In 2023, global maritime trade was transported on board around 105 500 vessels of 100 GT and above, with oil tankers, bulk carriers, and container ships accounting for 85% of total capacity (UNCTAD, 2023[52]). The value of world merchandise trade totalled some USD 24.1 trillion in 2023, and the volume of merchandise trade grew more than twice as fast as real world GDP in the 1990s, and 1.5 times as fast in the early 2000s (WTO, 2024[71]). The principal products transported by sea in terms of weight are bulk commodities, which tend to have relatively low weight unit values, such as iron ore, coal, crude oil, and grain. Higher value container freight accounts for about 15% of total tonnage but represents about 60% of the total value of seaborne trade (OECD/EUIPO, 2021[72]).

The top 10 companies control over 85% of container shipping capacity (Table 2.1). While mergers and acquisitions have reduced competition and increased economies of scale, the development of shipping alliances like 2M, Ocean Alliance and The Alliance are further increasing market concentration by pooling resources and sharing routes. This is not new, but the highly concentrated market is raising competition and level playing field concerns in most parts of the world (International Transport Forum, 2018[73]), providing considerable bargaining power to carriers with regard to acquiring ports and terminals, as shown in the next section. The cruise market is also dominated by a few major companies. Carnival Corporation, Royal Caribbean, and Norwegian Cruise Line control over 80% of the global cruise market. And the increasing focus on luxury and expedition cruises, which require significant investment, further benefits large players.

Table 2.1. Top 20 container companies

Company	Country(ies)/economy(ies) of headquarters	Number of ships	Capacity (in TEU)	
			Total (thousand TEU)	Market share (%)
Mediterranean Shipping Company	Switzerland	862	6,133	20.0
Maersk	Denmark	715	4,393	14.3
CMA CGM Group	France	644	3,786	12.4
COSCO Group	China	508	3,281	10.7
Hapag-Lloyd	Germany	294	2,261	7.4
ONE (Ocean Network Express)	Japan	246	1,939	6.3
Evergreen Line	Chinese Taipei	220	1,712	5.6
HMM Co Ltd	Korea	78	880	2.9
Zim	Israel	129	754	2.5
Yang Ming Marine Transport Corp.	Chinese Taipei	93	695	2.3
Wan Hai Lines	Chinese Taipei	124	533	1,7
PIL (Pacific Int. Line)	Singapore	93	348	1.1
X-Press Feeders Group	Singapore	100	193	0.6
SITC	Hong Kong, China	116	182	0.6
Sea lead shipping	Singapore	49	180	0.6
KMTC	Korea	66	161	0.5
UniFeeder	Denmark	97	155	0.5
IRISL Group	Iran	30	143	0.5
Sinkor Merchant Marine	Korea	78	138	0.5
TS Lines	Hong Kong, China	41	100	0.3

Source: Alphaliner (2024), Alphaliner Top 100, https://alphaliner.axsmarine.com/PublicTop100/ (accessed on 10 October 2024)
Note: The twenty-foot equivalent unit (abbreviated TEU) is a general unit of cargo capacity, often used for container ships and container ports.

Ports ownership - Shipping and ports connect global value chains and support global economic interconnectivity (OECD/EUIPO, 2021[72]). Port management is influenced by national priorities, economic strategies, and historical developments. Globally, most port authorities are publicly owned, with central governments and local municipalities serving as primary stakeholders. For instance, the Port of Rotterdam Authority in the Netherlands is an unlisted public limited company, with approximately 70% of its shares held by the Municipality of Rotterdam and around 30% by the Dutch government (Port of Rotterdam, 2024[74]). Private ownership of port authorities is not as common but is increasingly concentrated, with a few large conglomerates, often operating globally, leveraging economies of scale, expertise, and capital. The growth of private involvement is often driven by public-private partnerships (PPPs), privatisation of specific operations (e.g., terminals), or the outright sale or lease of port facilities. This trend is particularly notable in regions where governments seek to attract private investment to modernize infrastructure, increase efficiency, or reduce public expenditure.

The world's leading shipping companies have made significant investments in recent years in port logistics, including ownership and operation of ports and terminals, directly or via subsidiaries. Container carriers achieved unprecedented profits in 2022 estimated at almost USD 300 billion in earnings before interest and taxes (UNCTAD, 2023[52]). The operational profit margin of the ten largest container shipping companies reached an estimated USD 160 billion in 2021, a substantial part of which has been used to fund acquisitions in the freight forwarding and logistics business to achieve vertical integration (OECD ITF, 2022[75]). Maersk (Denmark) operates its terminal services through its subsidiary, APM Terminals, which manages a global network of 74 ports in 38 countries. MSC Group (Switzerland) bought in 2022 the Bolloré Group's (France) shipping, logistics and terminals operations including 42 ports in Africa, 16 container terminal concessions, with three railway concessions.

Other private conglomerates include Hutchison Ports (China), a subsidiary of CK Hutchison Holdings, which operates 52 ports across 27 countries, including major facilities in the United Kingdom, Germany, and until recently the Panama Canal (Tang, 2025[76]). PSA International (Singapore) which operates a global portfolio of 60 terminals in 26 countries, including in Singapore; Antwerp and Mumbai, and DP World (UAE) which operates 90 ports and terminals. This blend of ownership structures underscores the diverse approaches to port management worldwide, influenced by national priorities, economic strategies, and historical developments.

Industrial bottom fishing - trawling – Bottom fishing / trawling has been going on for centuries, but the industrial scale of these fisheries activities is threatening the sustainability of fish stocks (OECD, 2025[15]). Bottom fishing involves dragging nets across the seafloor (benthic trawling) or towing a net just above seafloor (demersal trawling) to catch marine species living at the bottom and semi-pelagic species (e.g. squid, cod, shrimp).

Bottom fishing occurs almost entirely in EEZs (99%, only 1% in high seas) and accounts for around one quarter of the global marine fisheries catch (Costello et al., 2020[77]). The annual total amount of seafood caught by bottom trawling in EEZs is roughly equivalent to all the seafood caught by the world's artisanal fishers (Steadman et al., 2021[78]). It is almost entirely an industrial scale fishing activity, being more time- and cost-efficient than artisanal activity, but often also more destructive. The practices have negative effects on benthic communities and habitats that have been documented over years (ICES, 2021[79]; Long et al., 2021[80]), particularly as knowledge improves on the composition of deep-sea biodiversity (Good et al., 2022[81]). Although some mobile fauna may rapidly recolonise regions, where trawling has ceased, ecosystem recovery in soft sediments can remain limited even after 30 years, and for deep-sea organisms that are long lived and grow slowly, recolonisation and recovery could be on a timescale of centuries (Paradis et al., 2021[82]; de Juan, Demestre and Sánchez, 2011[83]).

Seabed mineral extraction – Much of current seabed extraction activity is conducted by the international dredging industry. Dredging is a routine requirement in waterways around the world because sedimentation—the natural process of sand and silt washing downstream—gradually fills channels and harbours (European Dredging Association, 2022[84]). It is also vital for civil engineering works (e.g. harbour construction, coastal protection infrastructures) and removal of hazardous waste and polluted sediment. The full cycle of dredging involves collecting, bringing up, and clearing away material and objects from the bed of a river or channel, and then transporting it to a relocation site and unloading it safely (NOAA, 2022[85]). Notwithstanding its essential role in keeping waterways and port access open and reducing the environmental risks of polluted water bodies, dredging in its various forms can have long-standing impacts on the environment.

Seabed mining is a long-established practice by several countries within their own national waters, usually involving the extraction of minerals from nearshore and shallow-water deposits (United Nations, 2021[86]). Among the oldest of such forms of extraction is dredge mining. This involves the retrieval of various aggregates such as sand, clay and gravel, i.e. for construction purposes, as well as mineral dredging involving the extraction of gold, diamonds, tin, so-called mineral sands (ilmenite, rutile, zircon) and phosphates (Schneider, 2020[87]). The technical feasibility, environmental impacts and economic models vary substantially depending on whether the extractive activities occur in shallow waters down to 200 metres (the case of most current seabed mining activities) or in the deep ocean (at depths greater than 200 metres). The impacts of mining practices have been documented in well-established shallow-water extractive activities (e.g. sand, diamonds, tin) (Kaikkonen and Virtanen, 2022[88]).

In recent years, more "placer deposits" (i.e., natural concentrations of often valuable minerals) have been identified by countries when surveying their national seabed, particularly in coastal, island and archipelagic States. There are no specific guidelines for countries engaging in seabed mining, but the OECD has developed "Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas", which may provide advice as they apply to all mineral supply chains (OECD, 2016[89]).

Deep seabed mining would involve extracting polymetallic nodules and seafloor sulphide deposits at depths of below 200 metres, and much of the deep seabed is to be found in international waters. Few countries are known to be mining the deep seafloor in their territorial waters so far, since the technical difficulties (dark environment, high pressures) and risks of potentially major environmental impacts are important. Deep seabed mining seems to have been carried out for the first time in 2017 by Japan within its exclusive economic zone at a water depth of 1 600 metres (Washburn et al., 2023[90]). Prototype projects have already been tested at depths of 1 600m and 4 500m, and exploratory operations are underway to provide proof of concept for the technologies used to extract minerals (International Seabed Authority, 2022[91]). Technological developments in tools for mining cobalt-rich ferromanganese crusts, on the other hand, are lagging (UN, 2021[92]).

No deep seabed mining is taking place in international waters. However, exploration has been going on for many years under the aegis of the International Seabed Authority (ISA, which was established by the United Nations Convention on the Law of the Sea to regulate activities in the deep seabed to prevent damage to ecosystems and biodiversity, and to level out across countries the potential economic advantages of eventual seabed exploitation. So far, ISA has permitted limited exploration of the seabed with 42 contracts of a 15-year duration, and the results of the research are starting to be shared internationally via different platforms (International Seabed Authority, 2022[91]). No permits for mineral exploitation have been issued so far by ISA, although a mining code is under negotiation, against a background of mounting calls for precautionary approach and an international moratorium on deep seabed mining.

The expansion of illegal activities at sea: the "dark ocean economy"

In addition to ocean economic activities that are often regulated under different frameworks, the growth of illegal activities at sea poses a growing challenge to ocean governance. Transnational organised crime groups have always exploited the ocean's vast, less-patrolled waters and coastal areas, to traffic illicit drugs and other contraband. The economic fragility of many countries and high levels of corruption have also led to a steady rise of illegal activities in many parts of world, from piracy to illegal fishing (United Nations Office on Drugs and Crime, 2024[93]). All these illegal activities at sea constitute what could be coined a "dark ocean economy" that threatens not only citizens and companies with violence, but often contributes to pollution and the destruction of the marine environment. Such high-profit activities are extremely hard to counter as national maritime surveillance, enforcement and criminal justice systems need to be in place and able to respond.

Illegal, unreported, and unregulated (IUU) fishing remains a pervasive issue, undermining marine conservation efforts and jeopardizing the livelihoods of communities dependent on fisheries (Hutniczak, Delpeuch and Leroy, 2019[94]). IUU fishing could account for up to 20% of the global fish catch, with some regions experiencing rates as high as 50%. IUU not only depletes fish stocks but also destabilizes marine ecosystems and economies reliant on sustainable fishing practices. The OECD highlights that IUU fishing is often facilitated by inadequate regulatory frameworks, insufficient enforcement, and, in some cases, government subsidies that inadvertently support illegal operations (Delpeuch, Migliaccio and Symes, 2022[95]). Addressing these issues requires comprehensive policy reforms and enhanced monitoring and surveillance capabilities. (Plan Bleu and UNEP/MAP, 2024[96]).

Illicit movement of drugs, arms, and humans - The maritime sphere has witnessed a concerning rise in trafficking activities, encompassing the illicit movement of drugs, arms, and humans. Criminal networks exploit vast and often poorly monitored oceanic expanses to conduct these operations, posing significant challenges to law enforcement agencies (United Nations Office on Drugs and Crime, 2024[93]). For instance, fishing vessels are increasingly utilised as conduits for drug smuggling, with transshipment at sea enabling the transfer of narcotics between ships to evade detection. Additionally, there are documented cases where organised crime syndicates engage in human trafficking under the guise of legitimate fishing operations, subjecting individuals to forced labour and deplorable conditions. The OECD emphasizes the need for integrated maritime security strategies that address the multifaceted nature of these illicit activities (Yamaguchi, 2023[97]).

Recent data indicate a substantial rise in seizures and increasingly sophisticated smuggling methods. According to the United Nations Office on Drugs and Crime (UNODC), approximately 89% of global cocaine seizures between 2015 and 2021 were linked to maritime trafficking valued at some USD100 billion per year. Cocaine seizures surpassed 2,700 tons in 2024 (Maritime Information Cooperation and Awareness Center, 2025[98]). Cocaine continues to be trafficked primarily from South America, as well as via Central America to Europe and North America. Other routes, such as that via the Indian Ocean, connect Afghanistan and East African nations, serving both as consumer markets and transit points for further distribution to Europe and other regions. The smuggling of “captagon”, an illicit drug containing amphetamine, also continues to increase notably across the Near and Middle East, and to some extent in North Africa. Smugglers continuously adapt their tactics, exemplified by the growing threat of narco-piracy along the shores of Ecuador and Colombia.

Marine pollution: Marine pollution includes the release of toxic material or dumping of illegal waste in coastal areas or the high seas, by all types of platforms and ships including cruise liners and ships transporting live animals (Boada-Saña, 2021[99]). Some of the major polluting accidents that have occurred at sea have triggered responses from policymakers to improve the regulation of commercial activities (e.g. polluter-pays principle used for the ocean). In the case of accidental oil spills, there have been huge reductions in spill volumes since the 1970s (Ritchie, Samborska and Roser, 2022[100]). Nonetheless the largest spills have released tens of millions of litres of oil and have resulted in fouled coastlines, polluted fisheries, dead and injured wildlife, and lost tourism revenues. In some cases, the review of the long-term impacts have gone on for years (e.g. BP’s Deepwater Horizon Oil Spill in 2010).

Summary

The overall context in which the ocean economy and the ocean itself have been evolving in recent decades has been greatly influenced by a whole range of powerful forces – economic, environmental, geopolitical and technological.

These in turn have in many cases elicited strong responses both from policymakers – in the form of rapidly evolving policy frameworks and ocean governance systems – and from other stakeholders such as decision makers in industry and the science and research communities. Hence, while progress has been made, many challenges remain. Further action is needed to improve policy coherence, foster greater cooperation among stakeholders, and strengthen governance mechanisms to achieve a healthier, more sustainable, secure and prosperous ocean.

Considering all the complex changes that have unfolded in and around the ocean economy in recent decades, how has its economic performance fared over time? This is the subject of the following chapter.

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3 The evolution of the ocean economy: empirical trends 1995 to 2020

This chapter presents an overview of new OECD international ocean economy statistics for 1995 to 2020 broken down by ocean economic activity group, country, region, and income group. These estimates provide a novel insight into the size, performance, and composition of the global ocean economy over a 25-year period and form the basis of the productivity analysis and foresight exercise detailed in subsequent chapters.

Introducing new OECD international ocean economy statistics 1995 to 2020

Effective measurement of the ocean economy requires comprehensive, comparable, and robust data to precisely analyse economic trends and reliably inform policymakers. Acquiring such data has proved to be a major obstacle in attempts to establish an accurate picture of the ocean economy, its constituent economic activities, and their performance over time. However, in recent years considerable progress has been made to improve the range, quality and accessibility of relevant economic statistics in a number of pilot countries and at international levels (Jolliffe and Jolly, 2024[1]; Jolliffe, Jolly and Stevens, 2021[2]; OECD, 2019[3]).

Such advances have enabled the OECD to establish the OECD Ocean Economy Monitor – a unique programme measuring the global ocean economy over time using harmonised country-level statistics. The current dataset covers 33 ocean economic activities and 142 coastal countries for the years 1995 to 2020. Please refer to the Reader's Guide for more information on the methodology, classifications and country groupings used in this analysis.

Given the consistent measurement methods used, country-level statistics can be used to compare ocean economic activities within or across countries and aggregated to form estimates of larger groupings such as the global ocean economy. Thus, the OECD Ocean Economy Monitor opens a new frontier for comparable analyses of the ocean economy and its constituent activities, building a stronger evidence base to improve policy making.

This chapter draws on this newly established database to provide an overview of relevant ocean economy developments between 1995 and 2020. This was a period during which the global economy experienced spells of relatively stable growth, interspersed with global and regional economic shocks such as financial crises and, at the end, a global pandemic.

The global ocean economy contributed consistent shares of global economic output and employment throughout the period

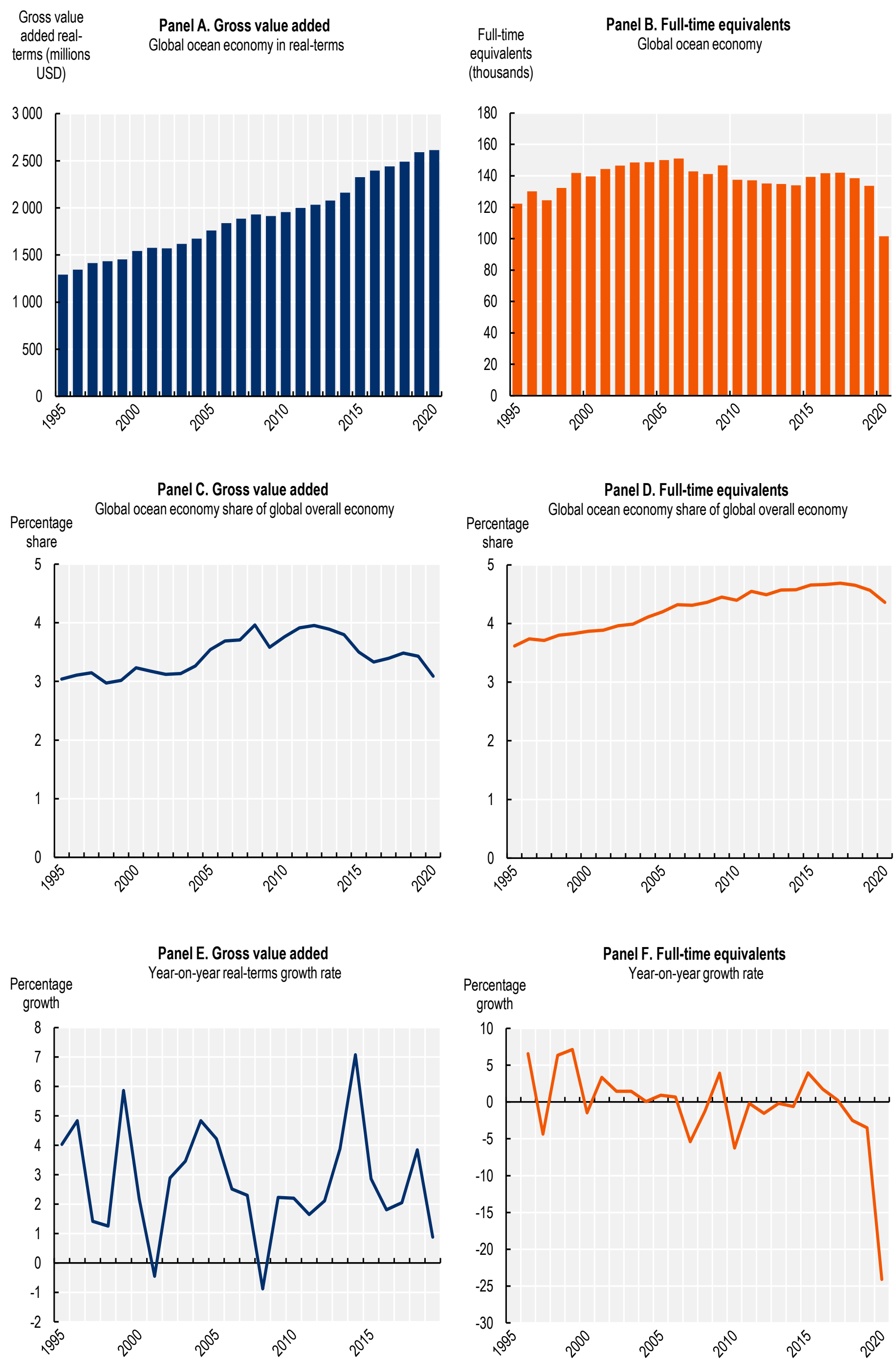
The ocean economy evolved markedly between 1995 and 2020, reflecting the real-terms expansion of many ocean economic activities. In its most aggregated form, global ocean economy gross value added (GVA) relative to that of the overall global economy remained relatively stable – ranging from about 3.0% in the late 1990s to a peak of 4.0% in 2008 before a post-financial crisis gradual decline towards 3.1% in 2020 (Figure 3.1).

Global ocean economy GVA doubled in real terms from 1.3 trillion USD in 1995 to 2.6 trillion USD in 2020, accruing an annual average growth rate of 2.8% (Figure 3.1). Economic growth remained stable for the most part without any prolonged periods of negative growth, suggesting the global ocean economy is resilient to large downturns in the face of economic shocks such as the 2008 financial crisis and Covid-19.

Ocean economy employment measured in full-time equivalents (FTEs) experienced an initial period of growth between 1995 and 2006 before registering consecutive years of shrinkage between 2007 and 2015 (Figure 3.1). At its peak, the ocean economy employed 151 million FTEs in 2006, gradually falling to 134 million FTE in 2019, and then to 102 million FTE in 2020. This translates to an average annual growth rate of negative 0.6% over the entire period. Any gains in FTEs accumulated between 2014 and 2019 were offset by a sudden fall in 2020 at the onset of Covid-19 precipitated by a severe decline in 'marine and coastal tourism'. The annual average FTE growth rate is positive 0.4% if 2020 is removed from the analysis due to the disruption caused by Covid-19.

Figure 3.1. The global ocean economy consistently generated 3.0% to 4.0% of global economic output and 3.5% to 4.7% of global employment

Global ocean economy real-terms gross value added and full-time equivalents in absolute terms, as a share of the global overall economy, and annual percentage growth rates

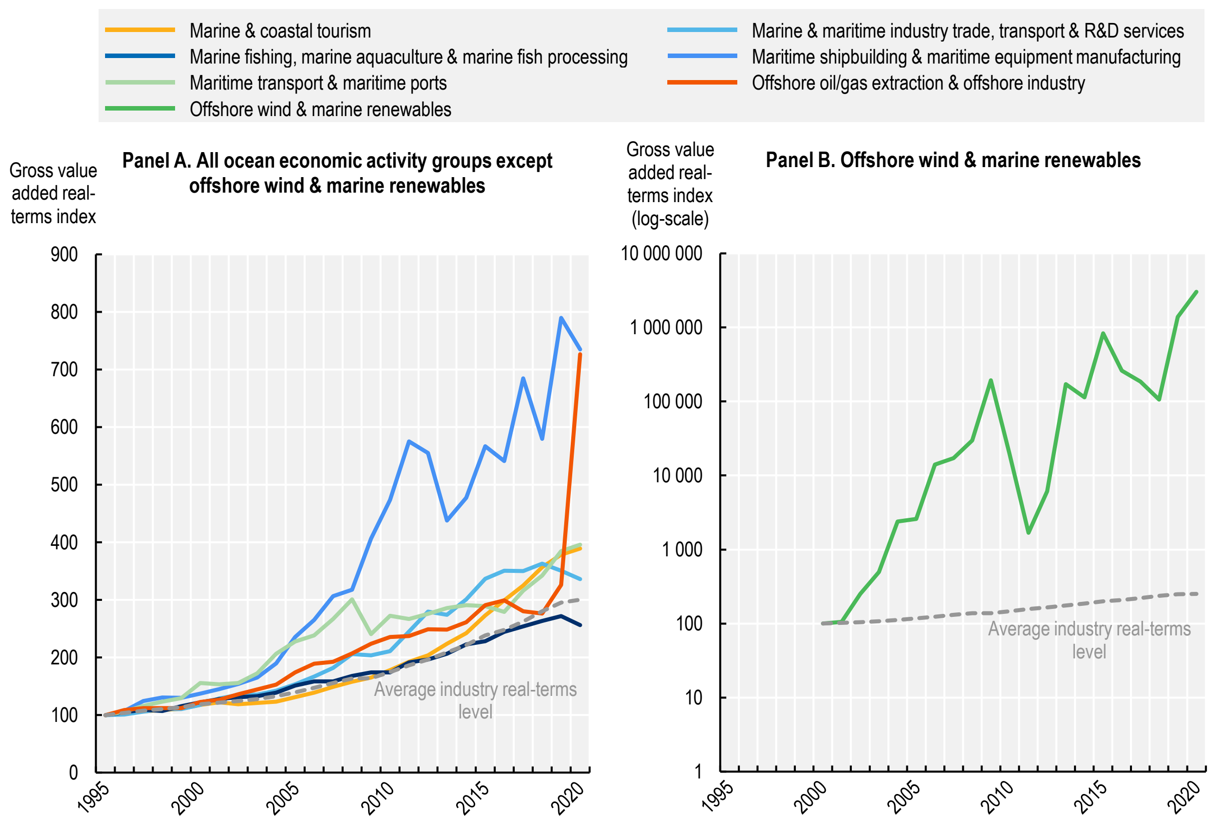


Note: In the first row, global ocean economy gross value added is given in chained volume measures. In the second row, global ocean economy gross value added is given in current price US dollars and employment in full-time equivalents as a share of global overall economy gross value added in current price US dollars and employment in full-time equivalents. In the third row, annual percentage changes are in global ocean economy gross value added chained volumes and employment full-time equivalents.
Source: OECD Ocean Economy Monitor, January 2025.

Annual growth across most ocean economic activity groups outpaced that of the average industry in the wider economy (Figure 3.2). Growth in 'offshore wind and marine renewables' increased especially rapidly since the mid-2000s reflecting large scale investments in offshore wind infrastructure in multiple countries as a means of reducing dependency on fossil fuels. Despite being the largest ocean economic activity group in GVA and FTE terms over much of the period, 'marine and coastal tourism' experienced limited growth until around 2012 when it began to perform better than the average overall industry. 'Marine fishing, marine aquaculture, marine fish processing' consistently performed at or below the overall economy industry average. Real-terms GVA in all ocean economic activity groups except 'offshore wind and marine renewables' and 'offshore oil and gas extraction and offshore industry' declined in 2020 at the onset of Covid-19.

Figure 3.2. Economic growth in all-but-one ocean economic activity group outpaced the average industry between 1995 and 2020

Global ocean economic activity group real-terms gross value added index and global weighted average industry real-terms gross value added index



Note: Gross value added chained volume indexes with a reference year of 2015 set so that 1995 equals 100 in Panel A and 2020 equals 100 in Panel B are calculated for each ocean economic activity group and the average industry. The weighted industry average is measured by calculating relevant industry group level real-terms growth rates, weighting each industry group by the share of its contribution to total overall economy gross value added, and chaining together. Panel B is based on 2020 because it is the first year in which offshore wind and marine renewables begins to produce gross value added according to the OECD Ocean Economy Monitor.
Source: OECD Ocean Economy Monitor, January 2025.

Global ocean economic output was dominated by fossil fuel extraction and tourism, while overall employment was dominated by tourism

On average between 1995 and 2020, ‘marine and coastal tourism’ and ‘offshore oil and gas extraction and offshore industry’ were the two largest global ocean economic activity groups by a substantial margin (Figure 3.3).

Real-terms GVA generated by ‘marine and costal tourism’ reached a peak of USD 1.06 trillion in 2019, before falling to USD 910 billion in 2020 due to restrictions on economic activity to combat Covid-19. ‘Offshore oil and gas extraction and offshore industry’ peaked in 2020, increasing from USD 789 billion in 2019 to USD 987 billion in 2020 and replacing ‘marine and coastal tourism’ as the largest ocean economic activity group in the process. Over the period, this corresponded to an increase in the share of global ocean economy GVA attributable to ‘offshore oil and gas and offshore industry’ from 19% in 1995 to 33% in 2020 and a decrease in that of ‘marine and coastal tourism’ from 51% to 40%.

‘Marine fishing, marine aquaculture and marine fish processing’, ‘maritime shipbuilding and maritime equipment manufacturing’, and ‘maritime industry trade, transport and R&D services’ all experienced steady, increasing trends before falling in 2020. GVA in ‘marine fishing, aquaculture and fish processing’ rose from USD 101 billion in 1995 to USD 195 billion in 2019 in real terms, before falling to USD 182 billion in 2020. ‘Maritime shipbuilding and maritime equipment manufacturing’ rose from USD 66 billion in 1995 to USD 165 billion in 2019, before falling to USD 157 billion in 2020. ‘Maritime industry trade, transport and R&D services’ rose from USD 17 billion in 1995 to USD 36 billion in 2019, before falling to USD 31 billion in 2020. The trend for ‘maritime transport and maritime ports’ was less smooth with the industry shouldering a drop of 18% in real-terms GVA from USD 272 billion in 2008 to USD 224 billion in 2009. This suggests a heightened vulnerability to economic shocks relative to other ocean economic activity groups.

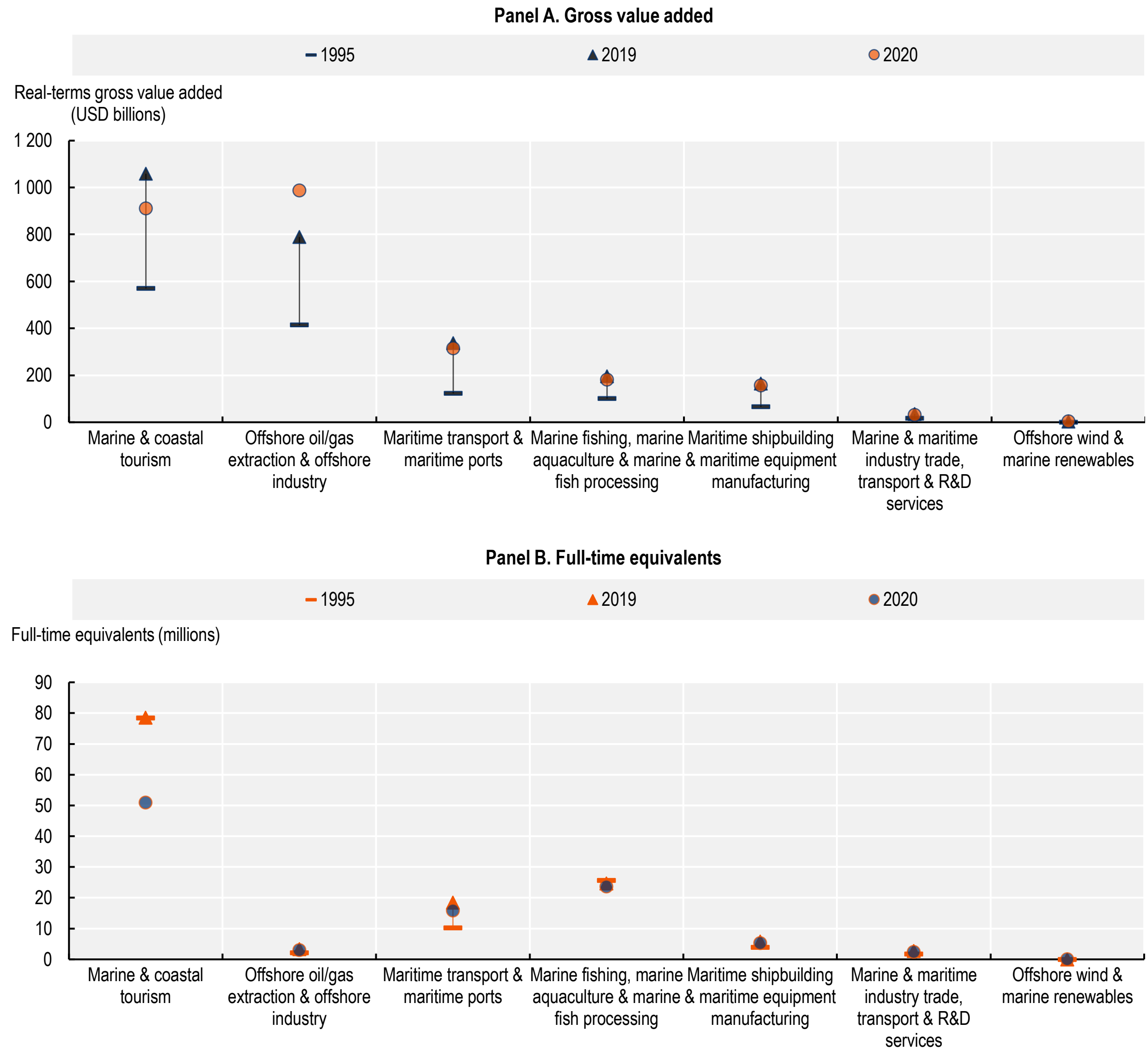
Despite an impressive growth record (Figure 3.2), GVA in ‘offshore wind and marine renewables’ remained negligible compared to other ocean economic activity groups peaking at 0.1% of global ocean economy GVA in 2015. The activity group grew from USD 38 million in 2000 to USD 5 billion in 2020, exhibiting an annual average growth rate of 31%. This is much smaller in absolute terms to the second smallest ocean economic activity group – ‘marine and maritime industry trade, transport and R&D services' – whose GVA reached a peak of USD 36 billion in 2019. Thus, even though ‘offshore wind & marine renewables’ performed remarkably well over the period, it was still far from generating GVA at the same level of the dominant ocean economic activity groups. Huge additional output would be required for renewable energy generation to contend with offshore oil and gas extraction in terms of its contribution to the ocean economy.

In addition to being one of the largest contributors to global ocean economy GVA, ‘marine and coastal tourism’ consistently employed the greatest number of FTEs (Figure 3.3). ‘Marine and coastal tourism’ FTEs were over 78 million in 1995 and peaked at 95 million in 2003 before falling to 79 million in 2019. FTEs in ‘marine fishing, marine aquaculture and marine fish processing’ were the second largest, reaching a high of 36 million FTE in 2011 before falling to 24 million in 2020.

The onset of Covid-19 provoked declines in FTE employment for all ocean economic activity groups except ‘offshore wind and marine renewables’. FTEs in ‘marine and coastal tourism’ were most severely affected as many countries abandoned a substantial proportion of tourism activities over this period. This phenomenon is illustrated by the fall in FTE from 79 million in 2019 to 51 million in 2020 (a year-on-year decline of 35%).

Figure 3.3. Activity groups that dominate global ocean economic output do not necessarily dominate global ocean economy employment

Global ocean economic activity group real-terms gross value added and full-time equivalents



Note: Global ocean economic activity group gross value added chained volume measures in the years 1995 and 2019. The year 2020 also given to show disruption caused by Covid-19. Note that chained volume measures are not additive (refer to the Reader's Guide for more information).
Source: OECD Ocean Economy Monitor, January 2025.

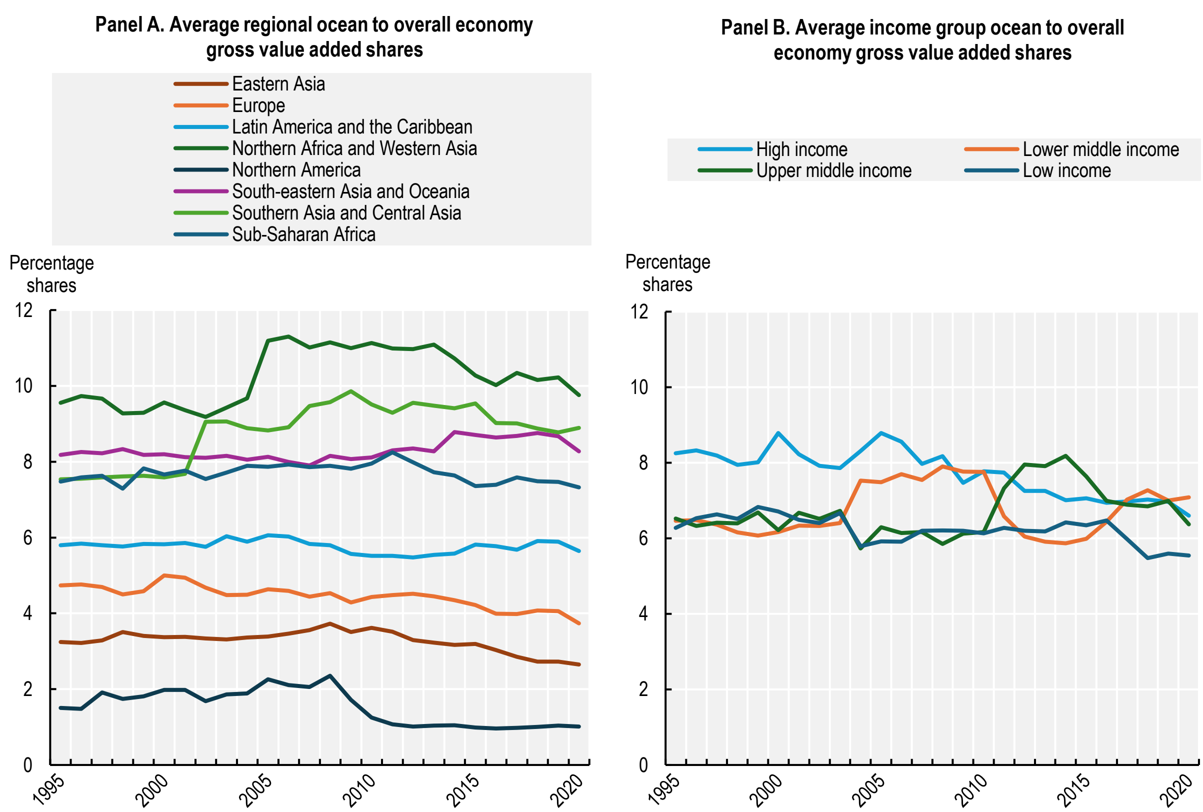
Countries in different regions differ in their reliance on the ocean economy

The ocean economies of countries situated in 'Northern Africa and Western Asia' were, on average, larger as a proportion of their overall economies than countries in other regions (Figure 3.4). In this region, the average ocean to overall economy GVA share ranged from 9% to 11% between 1995 and 2020. This trend is largely due to 'offshore oil and gas and offshore industry' generating substantial national income in several countries. Countries in 'Southern Asia and Central Asia', 'South-eastern Asia and Oceania', and 'Sub-Saharan Africa' also possessed relatively high ocean to overall economy GVA shares. At the other end of the spectrum, the average ocean economy comprised between 1% and 2% of overall economy GVA among countries in North America. These regional trends remained stable across the period, apart from in 'Northern Africa and Western Asia' whose share increased in 2005 as a result of changes in commodity prices.

Marginal differences are observable between average country ocean to overall economy shares at income group level throughout the period. The average share in high income countries was slightly higher than in other income groups before 2010, averaging 8% between 1995 and 2010. However, from 2015 onwards the average share in all income groups converged to between 6% and 7%. This reflects the structure of countries at different stages of development. Primary industries such as agriculture, forestry and fishing contribute a higher share of the overall economy in low-income countries than in higher-income countries. While service-based industries are more predominant in high income countries with more diverse economies. On average, as a result, ocean economic activity in aggregate makes up a similar share of the overall economy across countries at different income levels.

Figure 3.4. Countries in 'Northern Africa and Western Asia' were more reliant on the ocean economy than countries in other regions

Country-level total ocean economy to overall economy gross value added shares averaged by region and income group



Note: Total ocean economy gross value added as a share of overall economy gross value added in each country in each year is calculated and the arithmetic mean of each income group or region taken for each year. Each country within each income group or region is therefore evenly weighted in the average.
Source: OECD Ocean Economy Monitor, January 2025.

At regional level, 'Eastern Asia' and 'Europe' had the largest ocean economies in aggregate GVA terms on average over the period. Their relative strength, however, diminished over the period due to the increase in 'offshore oil and gas extraction and offshore industry' originating from 'Northern Africa and Western Asia'. The proportion of ocean economy GVA stemming from 'Eastern Asia' and 'Europe' fell from 56% in 1995 to 40% in 2020, while that of 'Northern Africa and Western Asia' increased from 10% in 1995 to 18% in 2020 (Table 3.1). Tangentially, the GVA share in 'Southern Asia and Central Asia' more than doubled over the period – rising from 3% in 1995 to 8% in 2019 – while in 'Sub-Saharan Africa' it almost doubled from under 2% to under 4% over the same period.

Concurrently, 'Eastern Asia' employed a higher share of global ocean economy FTEs than any other region at almost one-third throughout the period (Table 3.1). 'Southern Asia and Central Asia' and 'South-eastern Asia and Oceania' each employed around one-fifth of global ocean economy FTEs. 'Europe', on the other hand, employed relatively few FTE (despite generating high levels of aggregate GVA) with its share decreasing from 9% in 1995 to 6% in 2019. Despite the large GVA gains made by 'Northern Africa and Western Asia', its share of FTE fell from 4% in 1995 to just under 2% in 2019. This can be explained by the importance of 'offshore oil and gas extraction and offshore industry' relative to other ocean economic activity groups which employs relatively few FTEs in general.

Table 3.1. Aggregate output in Eastern Asia and Europe was higher than all other regions as a share of the global ocean economy

Total regional ocean economy gross value added and full-time equivalents as a share of global ocean economy gross value added and full-time equivalents

	Eastern Asia	Europe	Latin America and the Caribbean	Northern Africa and Western Asia	Northern America	South-eastern Asia and Oceania	Southern Asia and Central Asia	Sub-Saharan Africa
Gross value added shares								
1995	24.7%	32.3%	9.4%	9.8%	11.5%	7.4%	3.0%	1.9%
2000	20.9%	31.6%	11.7%	11.5%	12.6%	6.2%	3.3%	2.2%
2005	17.2%	31.8%	10.6%	15.3%	10.4%	5.9%	5.4%	3.4%
2010	19.1%	24.4%	10.8%	18.5%	7.4%	7.1%	7.7%	4.9%
2015	22.1%	21.1%	10.7%	17.8%	7.5%	9.5%	7.1%	4.3%
2019	23.0%	20.1%	9.0%	18.3%	7.2%	10.7%	8.1%	3.6%
Full-time equivalents shares								
1995	28.6%	9.0%	10.9%	3.0%	3.9%	17.8%	21.3%	5.5%
2000	28.6%	8.3%	9.8%	2.9%	3.1%	20.6%	20.9%	5.7%
2005	27.5%	6.9%	10.0%	2.9%	2.4%	18.8%	24.4%	7.1%
2010	27.4%	6.4%	9.9%	3.3%	2.1%	18.7%	24.7%	7.6%
2015	29.1%	6.2%	10.3%	3.1%	1.9%	17.6%	24.1%	7.7%
2019	29.5%	6.1%	11.1%	3.6%	1.8%	18.4%	21.6%	7.8%

Note: Total regional gross value added in current price US dollars divided by global ocean economy gross value added in current price US dollars and total regional full-time equivalents divided by global ocean economy full-time equivalents in the years 1995, 2000, 2005, 2010, 2015 and 2019. The year 2019 is used instead of 2020 due to distortions resulting from Covid-19. Shares may not add up to 100% due to rounding.
Source: OECD Ocean Economy Monitor, January 2025.

Ocean economy composition differs across regions with high output ocean economic activity groups not necessarily generating high employment

'Marine and coastal tourism' played a pivotal role in most regional ocean economies, comprising around half of total regional ocean economy GVA for most of the period in 'Eastern Asia', 'Europe', and 'Northern America' (Panel A of Figure 3.5). It also accounted for approximately one-third of GVA in 'Latin America and the Caribbean', 'Southeastern Asia and Oceania', 'Southern Asia and Central Asia', and 'Sub-Saharan Africa'. The only region in which this was not the case was 'Northern Africa and Western Asia', where 'marine and coastal tourism' accounted for roughly one-tenth of total regional ocean economy GVA over the period.

'Offshore oil and gas extraction and offshore industry' was the dominant activity group in 'Northern Africa and Western Asia' and emerged as the largest in 'Latin America and the Caribbean', 'South-eastern Asia and Oceania', and 'Southern Asia and Central Asia' at different points between 1995 and 2019. The increasing share of 'offshore oil and gas extraction and offshore industry' in the total was similar across countries reflecting the importance of commodity price changes in demand for fossil fuels. 'Northern Africa and Western Asia' was particularly dependent on 'offshore oil and gas extraction and offshore industry' with 80% of total regional ocean economy GVA stemming from this activity group in 2019.

In no region did the contribution of 'marine fishing, marine aquaculture, and marine fish processing' to the total regional ocean economy exceed one quarter. Shares in the activity group are particularly low in 'Europe', 'Northern America', and 'Northern Africa and Western Asia'. 'Southeastern Asia and Oceania', which contains countries with large coastal populations as well as many Small Island States, relied most heavily on this activity group representing 17% of the region's total ocean economy in 2019.

'Maritime shipbuilding and maritime equipment manufacturing' and 'maritime ports and maritime transport' collectively contributed around one-quarter of total regional ocean economy GVA in 'Eastern Asia', 'Europe', and 'Northern America'.

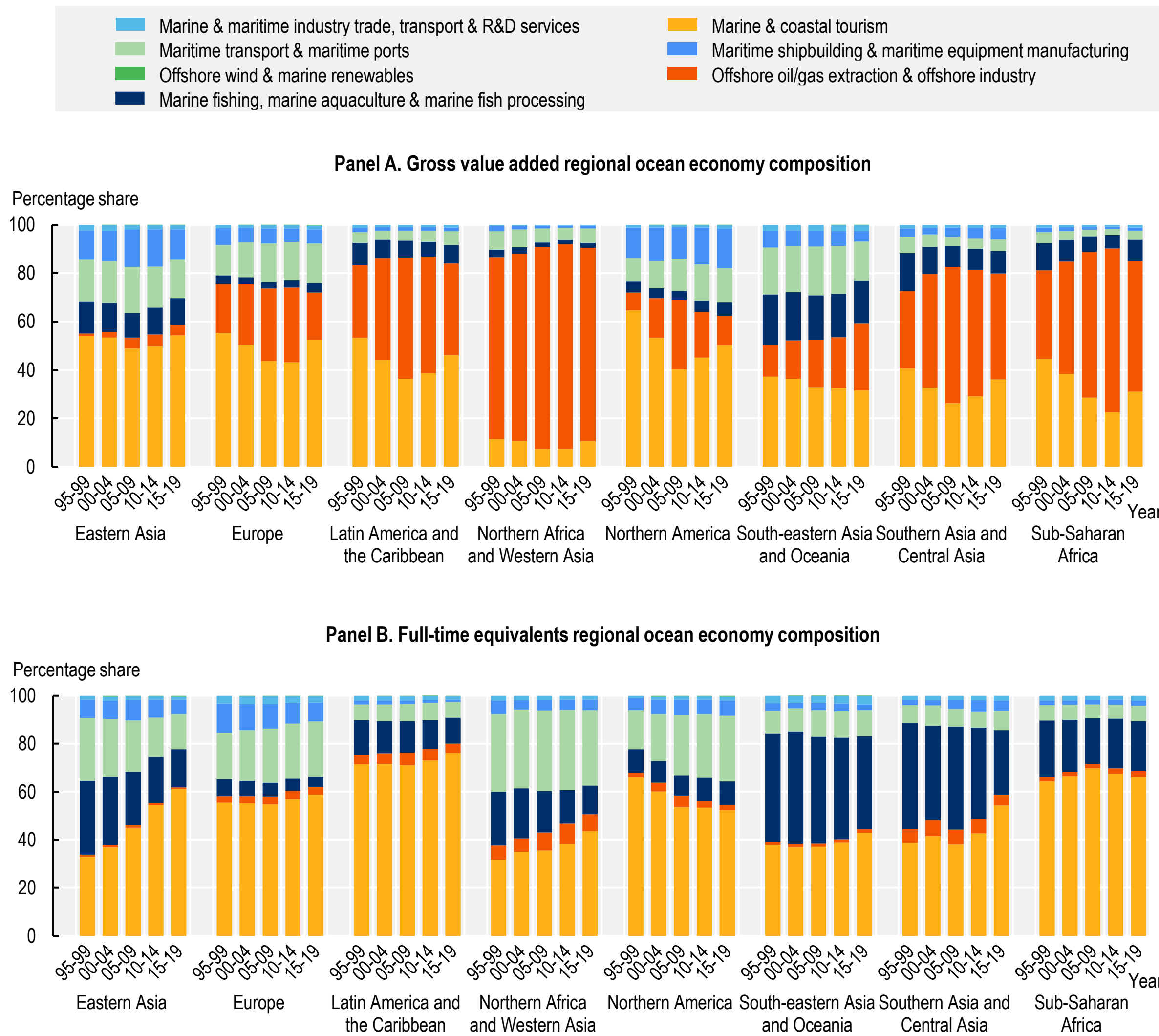
Despite generating high shares of total regional ocean economy GVA, 'offshore oil and gas and offshore industry' employs relatively low shares of total regional FTEs (Figure 3.5). This is particularly notable in 'Northern Africa and Western Asia' where the activity group dominates total regional ocean economy GVA shares but ranks behind 'marine and coastal tourism', 'marine fishing, marine aquaculture, and marine fish processing' in equivalent FTE shares.

'Marine and coastal tourism' contributed the most to total regional FTEs across all regions (Panel B of Figure 3.5). Despite the significant contribution of 'offshore oil and gas extraction and offshore industry' to total regional ocean economy GVA in 'Latin America and the Caribbean', 'Northern Africa and Western Asia', 'Southeastern Asia and Oceania', and 'Southern Asia and Central Asia', FTE shares in this activity group remained consistently low. For example, in 'Northern Africa and Western Asia' its highest contribution to total regional FTEs over the period was just under 9% in 2011.

The share of total regional ocean economy FTEs supported by 'maritime transport and maritime ports' in 'Northern America' rose from 16% in 1995 to 28% in 2019 while from 23% to 15% in 'Eastern Asia' over the same period. Conversely, 'Eastern Asia', 'Northern Africa and Western Asia', and 'Southern Asia and Central Asia' exhibited a gradual fall in the proportion of total regional ocean economy FTEs engaged in 'marine fishing, marine aquaculture, and marine fish processing'. In each of these regions, the FTE share decreased to half its initial value between 1995 and 2019.

Figure 3.5. Different regions are dominated by different ocean economic activity groups in both economic output and employment

Average regional ocean economic activity group gross value added and full-time equivalents as shares of regional ocean economy gross value added and full-time equivalents



Note: Regional ocean economic activity group gross value added in current price US dollars and full-time equivalents as a proportion of regional ocean economy gross value added in current price US dollars and full-time equivalents averaged over each five-year period between 1995 and 2019.
Source: OECD Ocean Economy Monitor, January 2025.

High-income country dominance of the global ocean economy has diminished over time

The share of global ocean economy GVA generated by high-income countries fell from 71% in 1995 to 52% in 2019 (Table 3.2). Upper-middle income countries, however, exhibited an impressive climb, contributing over one-third of global ocean economy GVA in 2019. Only a small share of global ocean economy FTEs was employed in high-income countries. This proportion ranged from 15% in 1995 to 12% in 2019. Just over half of global ocean economy FTEs were employed in upper-middle income countries in 2019, a five-fold increase compared to the share in 1995. A lesser increase was exhibited by lower-middle income countries, whose share increased from 23% in 1995 to 47% in 2005, before falling to 38% in 2019.

'Marine and coastal tourism' and 'offshore oil and gas extraction and offshore industry' were the largest ocean economic activity groups across income groups. In high-income countries, 'marine and costal tourism' accounted for an average of 42% of total income group ocean economy GVA between 1995 and 2020. This share was 38% in upper-middle income countries, 34% in lower-middle income countries, and 40% in low-income countries. 'Offshore oil and gas extraction and offshore industry' comprised 31% of total income group ocean economy GVA between 1995 and 2020, 41% in upper-middle income countries, 20% in lower-middle income countries, and 18% in low-income countries.

Table 3.2. High-income countries share of the global ocean economy weakened over time

Total income group ocean economy gross value added and full-time equivalents as a share of global ocean economy gross value added and full-time equivalents

	High income	Upper middle income	Lower middle income	Low income
Gross value added shares				
1995	71.0%	13.1%	8.8%	7.2%
2000	66.7%	17.6%	9.9%	5.8%
2005	67.4%	10.8%	16.8%	5.1%
2010	59.3%	27.4%	12.6%	0.7%
2015	53.7%	33.6%	12.4%	0.3%
2019	52.0%	35.7%	12.0%	0.3%
Full-time equivalents shares				
1995	15.2%	9.6%	23.1%	52.0%
2000	13.0%	10.5%	36.9%	39.6%
2005	12.2%	7.3%	47.0%	33.4%
2010	12.2%	38.9%	42.2%	6.6%
2015	11.9%	42.3%	44.9%	0.9%
2019	11.8%	50.3%	37.9%	-

Note: Total income group gross value added in current price US dollars divided by global ocean economy gross value added in current price US dollars and total income group full-time equivalents divided by global ocean economy full-time equivalents in the years 1995, 2000, 2005, 2010, 2015 and 2019. The year 2019 is used instead of 2020 due to distortions resulting from Covid-19. Shares may not add up to 100% due to rounding. The dramatic drop in shares from the low-income category occurs for two reasons. Firstly, between 1995 and 2019, the country composition of this group changed dramatically. For example, in 1995, China was a member of this group before moving up to the lower-middle income category in 1997 and the upper-middle income category in 2010. India was also a member of the low-income group until 2007, when it became a lower-middle income country. These two countries each contributed between one-third and half of all full-time equivalents in the low-income group, so their removal led to a substantial reduction in its share of global ocean economy full-time equivalents over time. Secondly, full-time equivalents in the subset of coastal countries remaining in the low-income category in 2019 cannot be calculated due to data limitations.
Source: OECD Ocean Economy Monitor, January 2025.

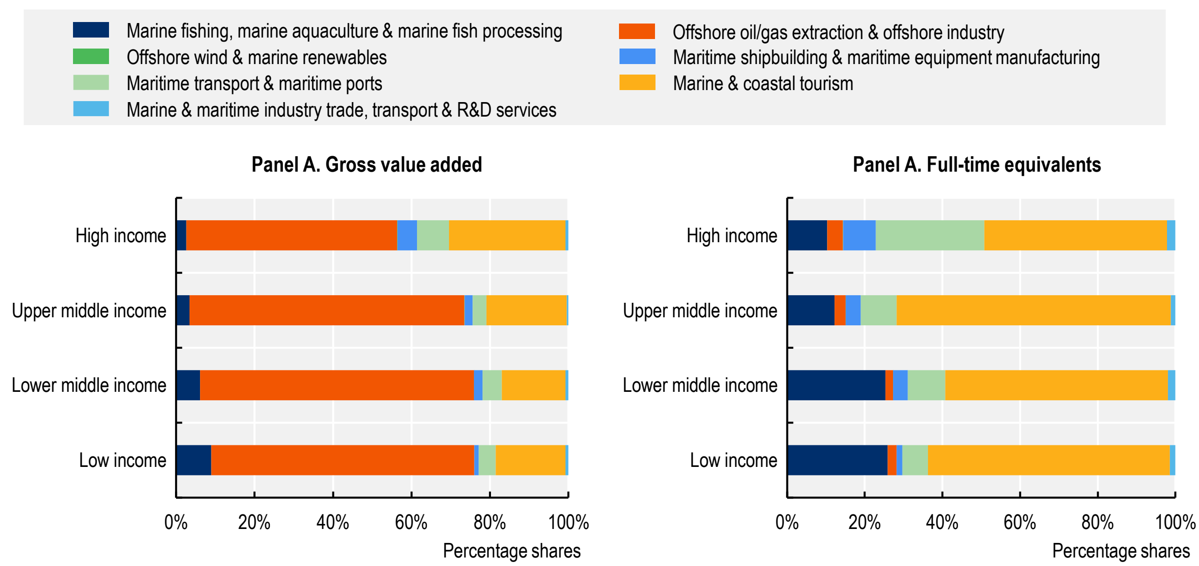
'Marine fishing, marine aquaculture, and marine fish processing' comprised a significantly larger share of GVA in low-income countries relative to their high and upper-middle income counterparts (Table 3.2). In high-income countries it comprised a mere 4% of the ocean economy on average. This increased to 8% for upper-middle income countries, 16% for lower-middle income countries, and 25% for low-income countries.

Total FTEs were dominated by 'marine and coastal tourism' across all income groups. The activity group accounted for 56% of total income group ocean economy FTEs in high-income countries, 66% in upper-middle income countries, 45% in lower-middle income countries, and 44% in low-income countries. The 'marine and coastal tourism' FTE shares were larger than GVA shares across all income groups, with this effect being more pronounced in upper-middle- and high-income countries. Average FTE shares in 'offshore oil and gas extraction and offshore industry' never surpass 4% in any income group across the period.

Shares of 'marine fishing, marine aquaculture, and marine fish processing' in total income group ocean economy FTEs consistently exceeded their GVA contributions, accounting for about one-tenth of total ocean economy FTEs in high- and upper-middle-income countries, and one-third in low- and lower-middle-income countries. Tangentially, FTE shares in 'maritime transport and maritime ports' were largest in high-income countries where it comprised almost one-quarter of total FTE. This share was lower in other income groups – 10% in upper-middle income countries, 14% in lower-middle income, and 12% in low-income.

Figure 3.6. Ocean economic output and employment are dominated by 'offshore oil and gas extraction and off shore industry' and 'marine and coastal tourism' respectively in all income groups

Average ocean economic activity group gross value added and full-time equivalents as shares of total ocean economy gross value added and full-time equivalents averaged over income groups



Note: Income group ocean economic activity group gross value added in current price US dollars and full-time equivalents as a proportion of income group total ocean economy gross value added in current price US dollars and full-time equivalents averaged 1995 and 2019.
Source: OECD Ocean Economy Monitor, January 2025.

On average over the period, high-income countries generated over half the global GVA in all ocean economic activity groups except for 'marine fishing, marine aquaculture, and marine fish processing'. Just over one-third of global GVA in 'marine fishing, aquaculture, and fish processing' was generated in high-income countries, while upper and lower-middle income countries collectively produced just over half. Low-income countries – despite relying more on 'marine fishing, marine aquaculture, and marine fish processing' in the structure of their ocean economies – contributed only 9% of its global GVA.

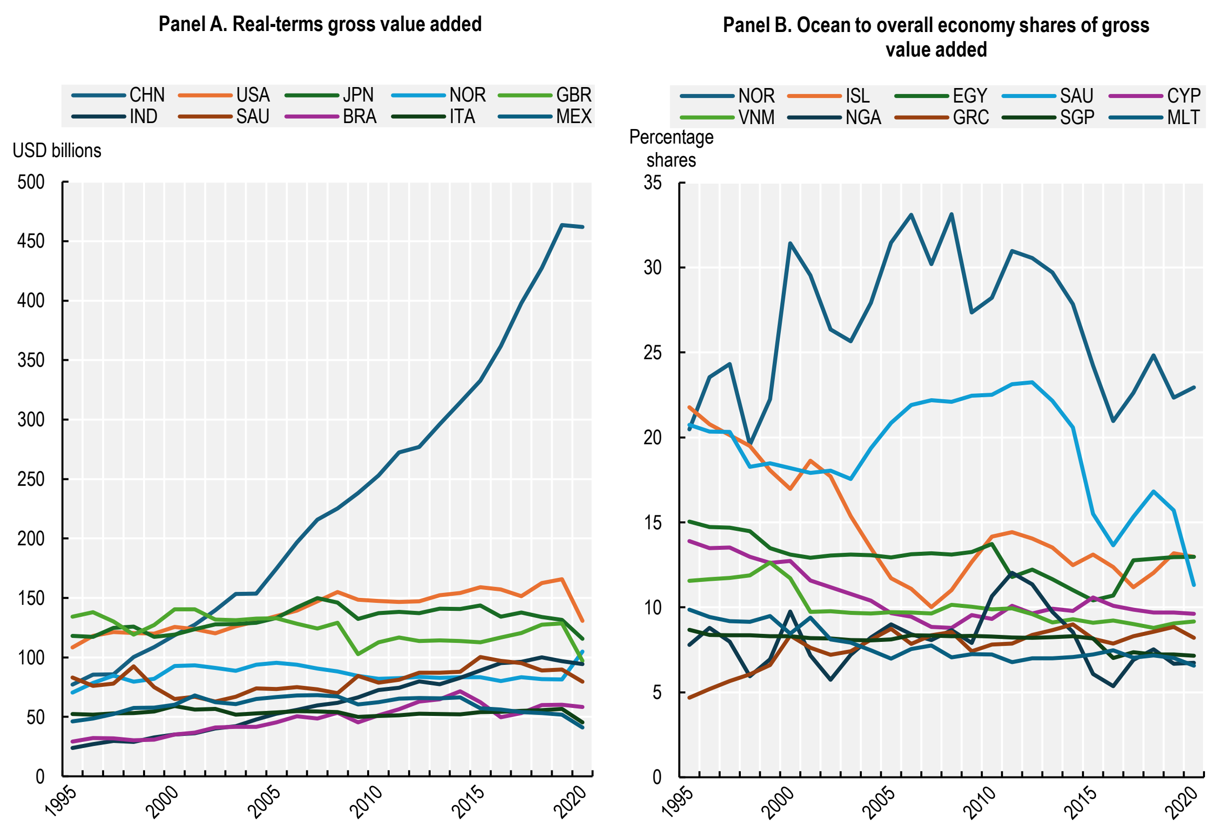
The contribution of high-income countries to global ocean economy FTEs was disproportionately lower than their contribution to global ocean economy GVA across all ocean economic activity groups. Total high-income country FTEs as a share of global ocean economic activity group FTEs were particularly low in 'marine fishing, marine aquaculture and fish processing' (4%), 'maritime industry trade, transport and R&D services' (11%), 'offshore oil and gas extraction and offshore industry' (14%), and 'marine and coastal tourism' (15%). Lower-middle income countries contributed to more than one-third of global FTEs across all ocean economic activity groups. Their contribution was particularly notable in the case of 'offshore oil and gas extraction and offshore industry', where these countries comprised 36% of global FTEs despite generating only 13% of global GVA in the activity group.

China had the largest and fastest growing ocean economy for most of the period

The People's Republic of China (hereafter 'China') had the largest ocean economy in absolute terms at USD 462 billion in 2020 – around a sixth of the global ocean economy – having grown from USD 77 billion in 1995 (Figure 3.7, Panel A). (See the Reader's Guide for the set of individual countries included in this analysis.) China was also the fastest growing ocean economy with an average annual growth rate over the period of just under 8%. All other countries in the top ten followed a relatively stable growth path over the period, accentuating the divergence of the Chinese ocean economy which, by 2020, was valued at over three times that of the US, the second largest ocean economy in the world. Six OECD countries are included in the top ten in terms of real-terms GVA: the United States, Japan, Norway, United Kingdom, Italy, and Mexico. When considering only OECD countries in the ranking, the remaining four in the top ten are Australia, France, Germany, and Spain.

Figure 3.7. China has had the largest ocean economy in absolute terms since 2002 and Norway has the largest ocean economy as a proportion of its overall economy throughout the period

Country-level total ocean economy real-terms gross value added and total ocean to overall economy gross value added shares



Note: Coastal countries appearing in the OECD Inter-Country Input Output database are ranked according to their average total ocean economy real-terms gross value added and their ocean to overall economy current price gross value added shares across the period. Annual real-terms gross value added and ocean to overall economy shares for the top five countries in this ranking are displayed in the charts.
Source: OECD Ocean Economy Monitor, January 2025.

Norway had the largest ocean economy as a share of its overall economy with the ocean to overall economy share hitting a peak of 33% in 2006 before falling to 23% in 2020 (Figure 3.7, Panel B). The remaining countries in the top ten ocean economies in terms of their share of the overall economy were: Saudi Arabia, Iceland, Egypt, Cyprus, Viet Nam, Singapore, Nigeria, Malta, and Greece. The only countries to be included in the top ten for both absolute values and relative shares of GVA are Norway and Saudi Arabia, both of which were heavily reliant on 'offshore oil and gas extraction and offshore industry' throughout the period.

The onset of Covid-19 led to a decline in real-terms GVA for most countries. The sharpest declines were observed in the United States and the United Kingdom, with real-terms GVA falling from USD 166 billion to USD 131 billion (-21%), and USD 129 billion to USD 97 billion (-25%) respectively between 2019 and 2020. Most of this downturn can be attributed to 'marine and coastal tourism'. The resilience of some countries to the disruption caused by Covid-19 can be explained in part by their relatively low levels of 'marine and coastal tourism' as a share of their total ocean economies.

Summary

This analysis presents an overview of the key developments in the global ocean economy between 1995 and 2020, broken down geographically and by ocean economic activity group. Over this period, the ocean economy comprised between 3% and 4% of total global GVA, doubling in real terms from 1.3 trillion USD to 2.6 trillion USD, accruing an annual average growth rate of 2.8%. Employment in the ocean economy reached a peak of 151 million FTE in 2006, gradually falling to 134 million FTE in 2019, and then to 102 million FTE in 2020. 'Marine and coastal tourism' and 'offshore oil and gas extraction and offshore industry' were the ocean economic activity groups that contributed the most GVA to the ocean economy.

'Marine and coastal tourism' was the largest employer by a wide margin, with 'offshore oil and gas extraction and offshore industry' contributing relatively little to employment despite its considerable influence on GVA. This result holds across all regions and income groups. 'Europe' and 'Eastern Asia' generated the highest share of GVA in aggregate across most ocean economic activity groups, while the ratio of FTE employment to GVA was greatest in 'Eastern Asia' and 'Southern Asia and Central Asia'. High income countries generated the highest share of global GVA across all ocean economic activity groups apart from 'marine fishing, marine aquaculture and fish processing', yet comprised a markedly small proportion of global FTEs.

Meanwhile, at country level, China was the largest individual ocean economy and comprised one-sixth of the global ocean economy in 2019. Norway was the largest in relative terms, with the ocean economy representing 23% of its overall economy GVA in 2020.

The above analysis of long-term global and regional developments across the ocean economy and its activities primarily focused on economic output and employment. Their interplay is an important factor in determining productivity levels. The following chapters of the report explore how productivity in the ocean economy evolved since the mid-1990s and the role that current trends could play in its evolution until 2050.

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4 Economic factors underlying global ocean economy performance and its potential futures

This chapter provides an analysis of the drivers of global ocean economy performance over time and uses this information to provide baseline projections into the future. Several measures of productivity in ocean economic activity groups are presented and their potential implications for the future of the ocean economy are summarised. The baseline projections form the basis from which future changes are assessed in later chapters.

Introduction

Building on the OECD's latest estimates of ocean economic activity in Chapter 3, this chapter explores the key economic drivers shaping the ocean economy's past performance and examines how they can inform future projections. Historical trends suggest that real-terms gross value added in ocean economic activity groups has grown at or above average industry growth in the overall economy for much of the 25-year period measured. This chapter investigates the economic factors behind this growth, how important they are relative to each other, and what insights they offer for the future trajectory of the ocean economy.

The OECD has estimated the contributions of economic factor inputs to ocean economy growth according to guidelines commonly employed in the measurement of productivity (OECD, 2001[1]). In particular, growth in gross value added (GVA) is decomposed into contributions from: growth in the services provided by different types of fixed capital assets, growth in labour provided by workers with different levels of education, and growth in multifactor productivity. The estimated GVA production functions are then used in a model that projects future trajectories for the ocean economy to 2050 using historical trends as the basis.

Simple measures of productivity indicate that most ocean economic activity groups performed well compared with the overall economy

One way of understanding the potential for the ocean economy in the future is to compare the ways in which ocean economic activities have converted various economic factors inputs into output in the past. GVA – the difference between gross output and intermediate consumption – is a production metric commonly used in productivity analysis. The growth of GVA produced per labour hour worked is often used for understanding potential changes in standards of living due to its link with increases in wages, salaries and other benefits in the long term. GVA per hour worked in an economic activity is also a useful metric for comparing economic performance across activities (OECD, 2024[2]).

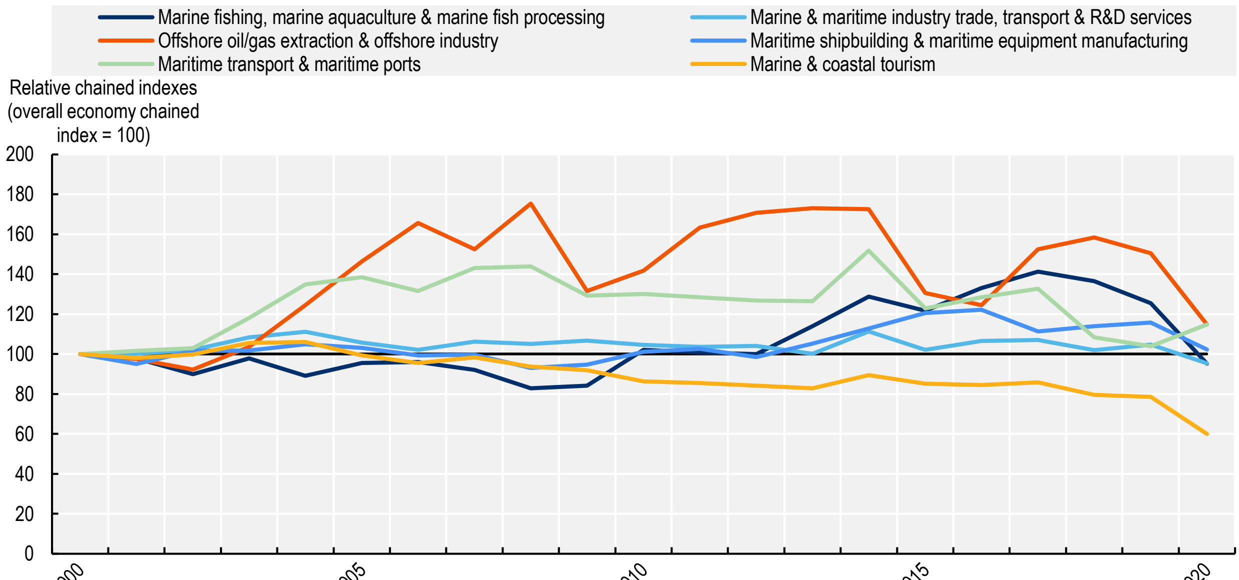
Figure 4.1 displays OECD estimates of GVA per hour worked for each ocean economic activity group relative to a comparable measure for the average industry of the overall economy at the global level. Three of the six ocean economic activity groups – 'maritime transport and maritime ports', 'offshore oil and gas extraction and offshore industry', and 'marine and maritime industry trade, transport and R&D services' – show clear improvements in GVA per hour worked beyond that of the average overall economy industry throughout the entire period between 2000 to 2019.

While the 'marine fishing, marine aquaculture and marine fish processing group' performed well in comparison to the overall economy since 2010, gains in GVA per hour worked dipped below those achieved in the overall economy in all years before 2010. The overall economy consistently outpaces growth in GVA per hour worked in the 'marine and coastal tourism' ocean economic activity group apart from a brief two-year period before 2005.

One ocean economic activity group is not included in the chart – 'offshore wind and marine renewable energy' – due to out of scale increases in GVA per hour worked experienced over the period. In 2000, there was no offshore wind energy production globally. By the late-2010s, the industry was adding over four gigawatts of net capacity additions annually (IEA, 2019[3]). This enormous growth in offshore wind capacity between 2000 and 2020 has led to GVA per hour worked gains that are way off the scale of Figure 4.1. As the activity group matures and capacity additions become less significant in terms of overall installed capacity, measures of GVA per hour worked in 'offshore wind and marine renewables' are likely to become more comparable with other ocean economic activity groups.

Figure 4.1. Gains in gross value added per hour worked in most ocean economic activity groups have outpaced those made in the overall economy

Relative gross value added per hour worked real-terms indexes for ocean economic activity groups and the overall economy



Note: The ‘offshore wind and marine renewables’ ocean economic activity group is not included in the chart due to rapid gross value added per hour worked growth that is largely an artefact of it being a nascent industry. Initial gross value added per hour worked indexes for the overall economy and each ocean economic activity group are calculated as log differences and chained together so that the year 2000 is equal to 100. The relative index is then calculated as the ratio of each ocean economic activity group chained index to the overall economy chained index and setting the overall economy chained index equal to 100.
Source: OECD Ocean Economy Monitor, January 2025.

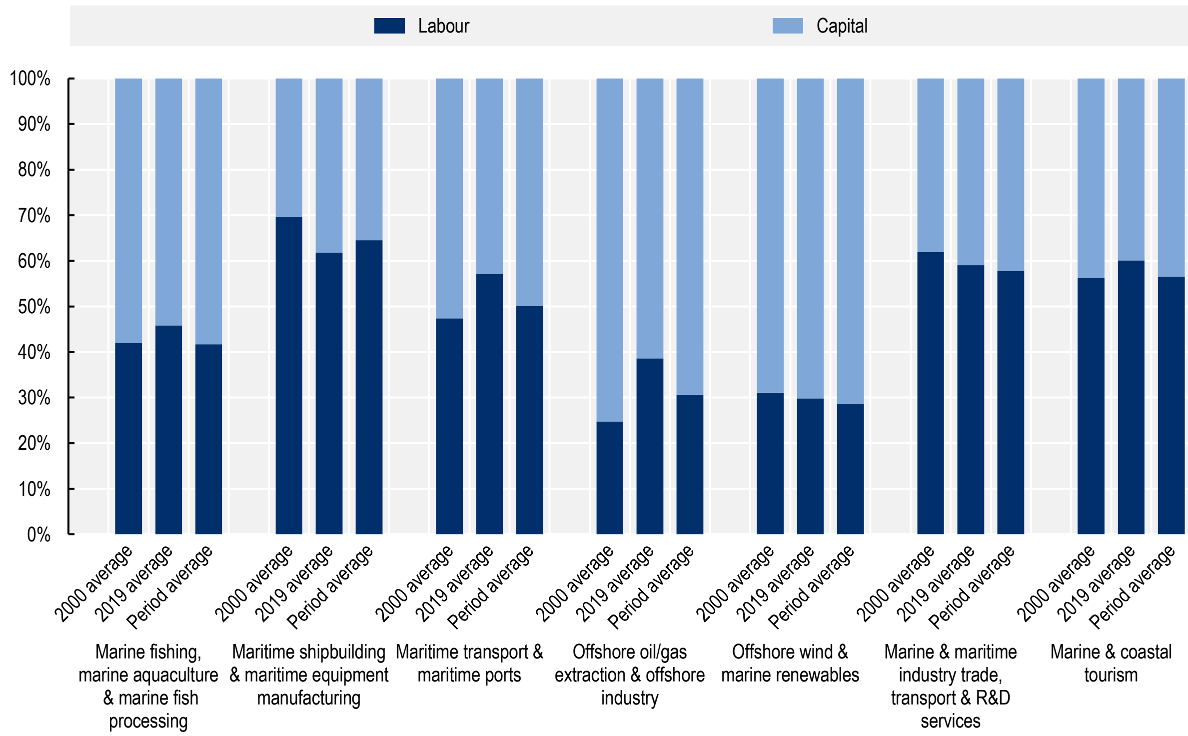
More detailed measures of ocean economic activity group productivity require an understanding of the role of various factors beyond hours worked

Single input factor productivity measures such as GVA per hour worked are useful general indicators, but they capture many of the gains in productivity that are achieved through growth in important economic inputs beyond hours worked. One approach to understanding the relative importance of these other inputs is to compare shares of income that are attributable to them.

Capital and labour input income factor shares can be proxied by estimating the distribution of GVA among the different factors of production. The OECD have estimated capital and labour shares of GVA for each ocean economic activity group (Figure 4.2). The labour share represents the portion of activity group GVA that goes to workers in the form of wages, salaries, and other benefits. A higher labour share indicates that a larger portion of activity group GVA is attributable to labour inputs. A higher capital share – assumed to be the inverse of the labour share – suggests a greater proportion of activity group GVA is attributable to machinery, buildings, and other capital inputs.

Figure 4.2. A larger share of gross value added is on average attributable to capital than labour in roughly half the ocean economic activity groups

Global average input factor shares of gross value added for each ocean economic activity group



Note: Labour shares of gross value added are calculated as compensation of employees over gross value added in each ocean economic activity group in each country. Capital shares are then calculated as the inverse of the labour share in each country. The global average is then weighted by each country's contribution to global gross value added in each ocean economic activity group.
Source: OECD Ocean Economy Monitor, January 2025.

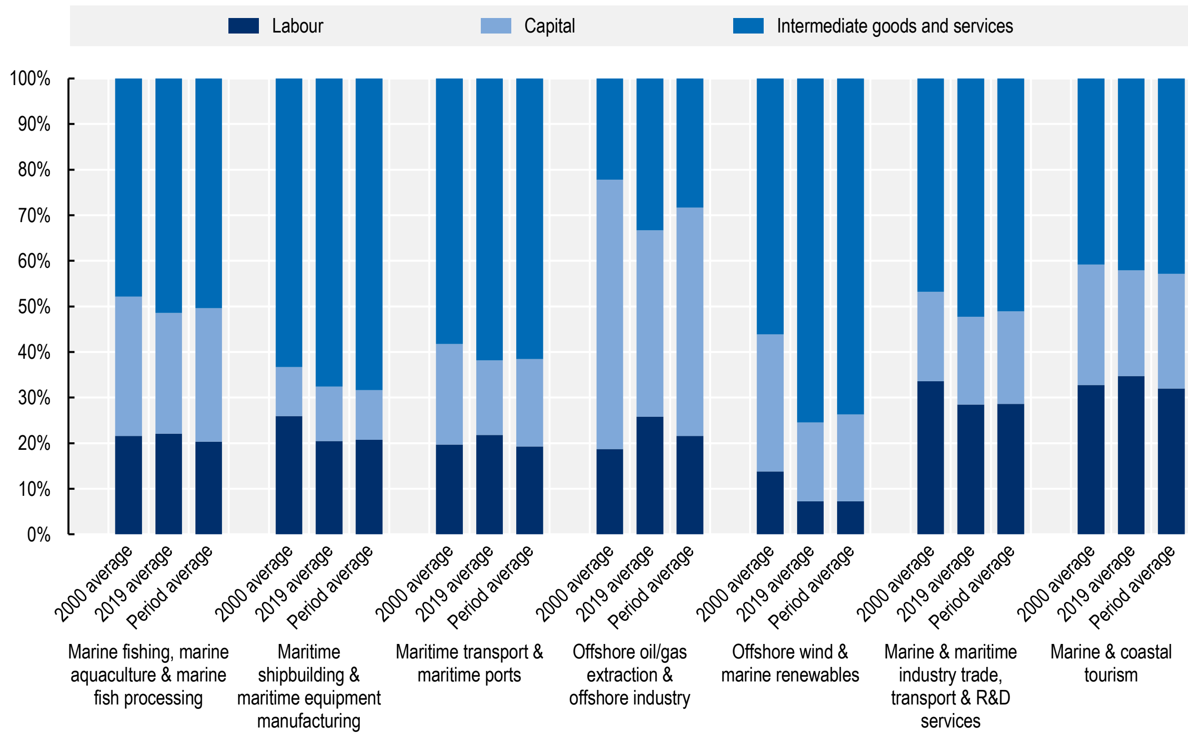
The average estimated capital and labour factor GVA shares displayed in Figure 4.2 vary between ocean economic activity group and over time. On average between 2000 and 2019, capital represents the highest share of GVA in four of the seven ocean economic activity groups: 'marine fishing, marine aquaculture and marine fish processing', 'maritime transport and maritime ports', 'offshore oil and gas extraction and offshore industry', and 'offshore wind and marine renewables'. These ocean economic activity groups could be considered capital intensive in income terms as more units of capital services are used to generate one unit of GVA than labour. The most capital intensive on average is 'offshore wind and marine renewables' with an average share of just over 70% of GVA.

Labour represents the highest share of income on average over the period in three of the seven ocean economic activity groups: 'maritime shipbuilding and maritime equipment manufacturing', 'marine and maritime industry trade, transport and R&D services', and 'marine and coastal tourism'. The most labour intensive ocean economic activity group on average in income terms is 'marine and maritime industry trade, transport and R&D services' with an average share of just over 70% of GVA.

One important input category missing from GVA factor shares is the intermediate goods and services used in all production processes. For each ocean economic activity group, the OECD has also estimated factor shares of gross output – a measure of the monetary value of the goods and services produced during a year – that include intermediate inputs such as energy, materials and services in addition to capital and labour (Figure 4.3).

Figure 4.3. The value of intermediate goods and services represents a higher proportion of gross output than capital and labour in many ocean economic activity groups

Global average input factor shares of gross output for each ocean economic activity group



Note: Labour shares of gross output are calculated as compensation of employees over gross output in each ocean economic activity group in each country. Capital shares of gross output are calculated as the difference between compensation of employees and gross value added over gross output in each ocean economic activity group in each country. Intermediate inputs shares of gross output are calculated as intermediate consumption over gross output in each ocean economic activity group in each country. The global average is then weighted by each country's contribution to global gross value added in each ocean economic activity group.
Source: OECD Ocean Economy Monitor, January 2025.

The results in Figure 4.3 suggest that – with the exception of 'offshore oil and gas extraction and offshore industry' and 'marine and coastal tourism '– the costs of intermediate inputs are on average equivalent to over half of ocean economic activity group gross output. The highest share of intermediate inputs in gross output on average between 2000 and 2019 is around 74% and occurs in 'offshore wind and marine renewables'. In general, with the exception of 'offshore wind and marine renewables', the ocean economic activity groups with the largest average shares of intermediate inputs in gross output are labour intensive in terms of their GVA input factor shares.

Figure 4.3 implies the costs of intermediate inputs dominate the value of both capital and labour inputs in 'maritime shipbuilding and maritime equipment manufacturing' with a period average gross output share of 68%. This is just below separate OECD findings in a more limited number of countries showing intermediate inputs account for roughly 70%-80% of gross output in the shipbuilding industry (Gourdon and Steidl, 2019[4]).

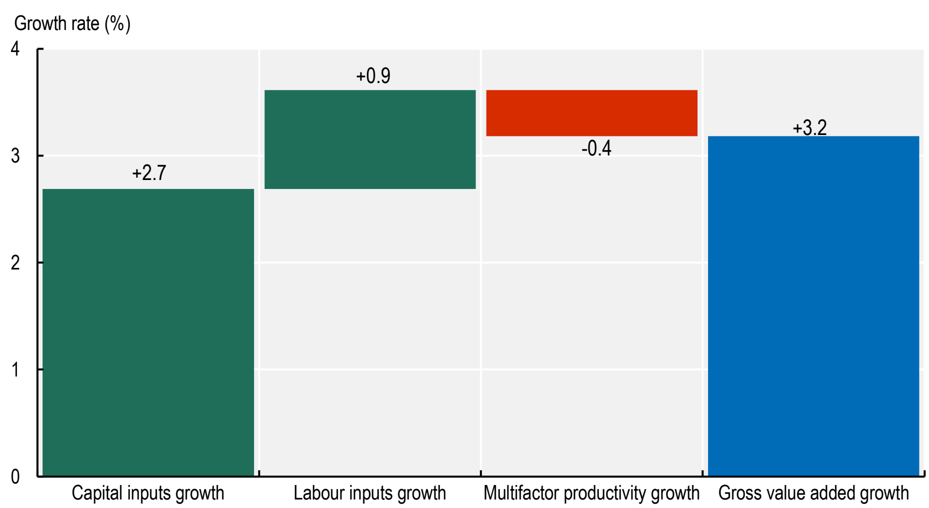
Breaking down the estimates further to the level of individual categories of intermediate inputs reveals that 'maritime shipbuilding' possesses the largest material inputs gross output share of all ocean economic activities (around 60% on average over the period). Energy input costs relative to gross output are largest – at just over 25% averaged over the period – in 'maritime equipment manufacturing' while energy input costs represent only 3% of gross output in 'maritime shipbuilding'. This is suggestive of the interconnectedness of the 'maritime shipbuilding and maritime equipment manufacturing' ocean economic activity group. The 'maritime equipment manufacturing' activity produces the materials used in the materials intense-'maritime shipbuilding' activity and is relatively more energy intense as a result.

Further evidence suggests a decline in multifactor productivity has slowed global ocean economy gross value added growth

Economic growth can be achieved by increasing the efficiency with which inputs are converted to outputs in a production process and/or increasing the level of inputs to a production process. The OECD have used the GVA factor input shares outlined in the previous section to weight growth in capital and labour inputs in a decomposition of annual ocean economy GVA growth. This enables the contribution of each factor input to ocean economic growth to be understood, as well as the productivity growth that is achieved when GVA increases at a higher rate than the factor inputs combined. The latter measure of productivity captures the effects of changes in knowledge, technologies, processes, and other intangibles that improve the combined use of the other inputs to production and is known as multifactor productivity. Multifactor productivity cannot be measured directly and is calculated as the difference between GVA growth and the combined growth contributions of the other factor inputs.

Figure 4.4. The global ocean economy experienced negative growth in multifactor productivity on average over the time period

Average global ocean economy gross value added annual growth rates decomposed into capital, labour and multifactor productivity growth



Note: Arithmetic means of the annual gross value added share-weighted growth rates estimated for each factor input at the level of the global ocean economy between 1995 and 2020.
Source: OECD Ocean Economy Monitor, January 2025.

Global weighted average annual GVA growth in the ocean economy is estimated to stand at around 3.2% over the period as shown by the final column in Figure 4.4. Growth in capital inputs makes the largest contribution to GVA growth with an average of 2.7 percentage points over the period. Labour inputs' contribution equates to roughly a third of capital inputs' at 0.9 percentage points. The red box in column 3 of Figure 4.4 makes up the difference between the contributions of growth in capital and labour inputs and provides an estimate of average multifactor productivity for the global ocean economy. The reported value implies that the average contribution of multifactor productivity growth to GVA growth stood at around negative 0.4 percentage points. This suggests that the global ocean economy as a whole got worse at using intangible factors beyond capital and labour to efficiently convert inputs into outputs over the period.

Much ocean economic activity group growth is derived from capital investments unrelated to drivers of future productivity like information technologies

The OECD has further decomposed the growth accounts estimated and summarised in Figure 4.4 to draw out different components of labour and capital inputs and their contribution to growth in ocean economic activity groups. In Figure 4.5, GVA growth in each ocean economic activity group is split into contributions from growth in hours worked (HOURS), growth in the capital services per hour worked derived from information and communication technologies such as computer hardware/software and telecommunications links (ICT), growth in the capital services per hour worked derived from other forms of capital such as machinery and equipment (NON-ICT), growth in the skills composition of its labour force proxied by increases in education level (LAB-COMP), and multifactor productivity (MFP). In this framework, labour productivity (i.e. the gains in GVA growth achieved in addition to increases in hours worked) is equivalent to the sum of the first four columns in Figure 4.5 (LAB-PROD).

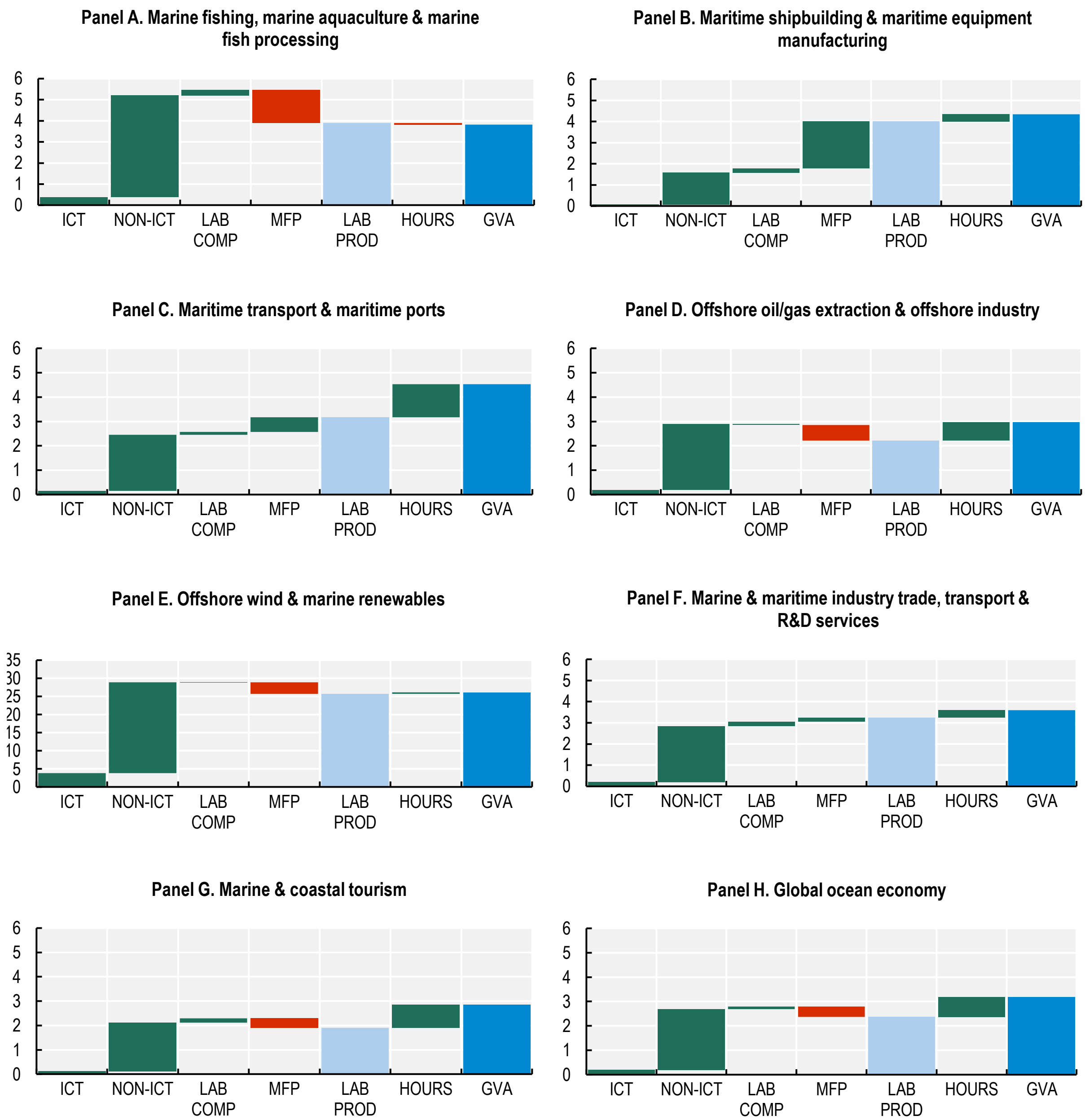
All ocean economic activity groups experienced positive growth in hours worked apart from ‘marine fishing, marine aquaculture, and marine fish processing’ (negative 0.08% on average between 1995 and 2020). Despite this, the contribution of growth in the skills composition of the labour force added 0.25 percentage points to GVA growth in the activity group suggesting that the quality of labour inputs increased over the period. The sum of the two labour contributions equals -0.17% (equivalent to aggregate labour inputs such as the value reported for the global ocean economy in Figure 4.4). This implies that enhancements in workforce quality were not sufficient to offset declines in the quantity of hours worked in ‘marine fishing, marine aquaculture, and marine fish processing’. The contribution of growth in the labour composition was positive in all other ocean economic activity groups apart from ‘offshore oil and gas extraction and offshore industry’ where it reduced GVA growth by 0.39 percentage points.

Three ocean economic activity groups have positive estimated multifactor productivity growth rates in Figure 4.5 – ‘maritime shipbuilding and maritime equipment manufacturing’, ‘maritime transport and maritime ports’, and ‘marine and maritime industry trade, transport and R&D services’. ‘Maritime shipbuilding and maritime equipment manufacturing’ has a particularly high contribution from multifactor productivity growth rate of 2.2% or more than half of the activity group GVA growth rate. In other words, growth in multifactor productivity in ‘maritime shipbuilding and maritime equipment manufacturing’ represents a larger than equivalent share of GVA growth than labour and capital growth combined. The equivalent share is just under a third in ‘maritime transport and maritime ports’ and just under a fifth in ‘marine and maritime industry trade, transport and R&D services’.

In all ocean economic activity groups, contributions from growth in labour productivity outweigh those from growth in hours worked. Labour productivity growth is most significant in ‘marine fishing, marine aquaculture, and marine fish processing’ where it contributes just over 100% of GVA growth (negative contributions from growth in hours worked and multifactor productivity make up the difference). Labour productivity growth is least significant in ‘marine and coastal tourism’ and ‘offshore oil and gas extraction and offshore industry’ at around 65% of GVA growth a piece.

Figure 4.5. Much of the growth in ocean economic activity group labour productivity is reliant on contributions from capital services unrelated to information and communication technology

Average annual contributions to global gross value added growth from various factors for each ocean economic activity group



Note: Arithmetic means of the annual gross value added share-weighted growth rates estimated for each factor input at the level of global ocean economic activity groups between 1995 and 2020.
Source: OECD Ocean Economy Monitor, January 2025.

The largest labour productivity contribution to an ocean economic activity group's GVA growth stands at 25.7 percentage points and was realised in 'offshore wind and marine renewables' where over 90% of GVA growth is attributable to growth in labour productivity. Most of this labour productivity contribution was achieved through increases in non-ICT capital services realised per hour worked (otherwise known as non-ICT capital deepening). ICT capital deepening – increases in ICT capital services per hour worked – was also particularly high in 'offshore wind and marine renewables' with a contribution of 3.7 percentage points or roughly 15% of GVA growth. The share of GVA growth contributed by ICT-capital deepening is lower in all other ocean economic activity groups (from 2% in 'maritime shipbuilding and maritime equipment manufacturing' to 10% in 'marine fishing, marine aquaculture, and marine fish processing').

The estimates in Figure 4.5 suggest non-ICT capital deepening outweighed ICT capital deepening in its contribution to GVA growth on average over the period in all ocean economic activity groups. The ratio of non-ICT capital deepening to ICT capital deepening in ocean economic activity groups other than 'offshore wind and marine renewables' ranges from 12-to-1 in 'marine fishing, marine aquaculture and marine fish processing' to 21-to-1 in 'maritime shipbuilding and maritime equipment manufacturing'. In general, digitalisation and automation enabled by ICTs can drive efficiency gains and enterprises that fail to integrate advancements in the underlying technologies may become less competitive over time (OECD, 2024[5]). An approach to productivity growth that better balances the ICT and non-ICT capital services available to workers may therefore be desirable in certain ocean economic activity groups.

The future ocean economy will be dominated by the same two activity groups that have traditionally held the largest shares should existing trends continue

The estimated contributions of growth in hours worked and each component of growth in labour productivity presented in the previous section have been used to project a baseline trajectory of the ocean economy through to 2050.

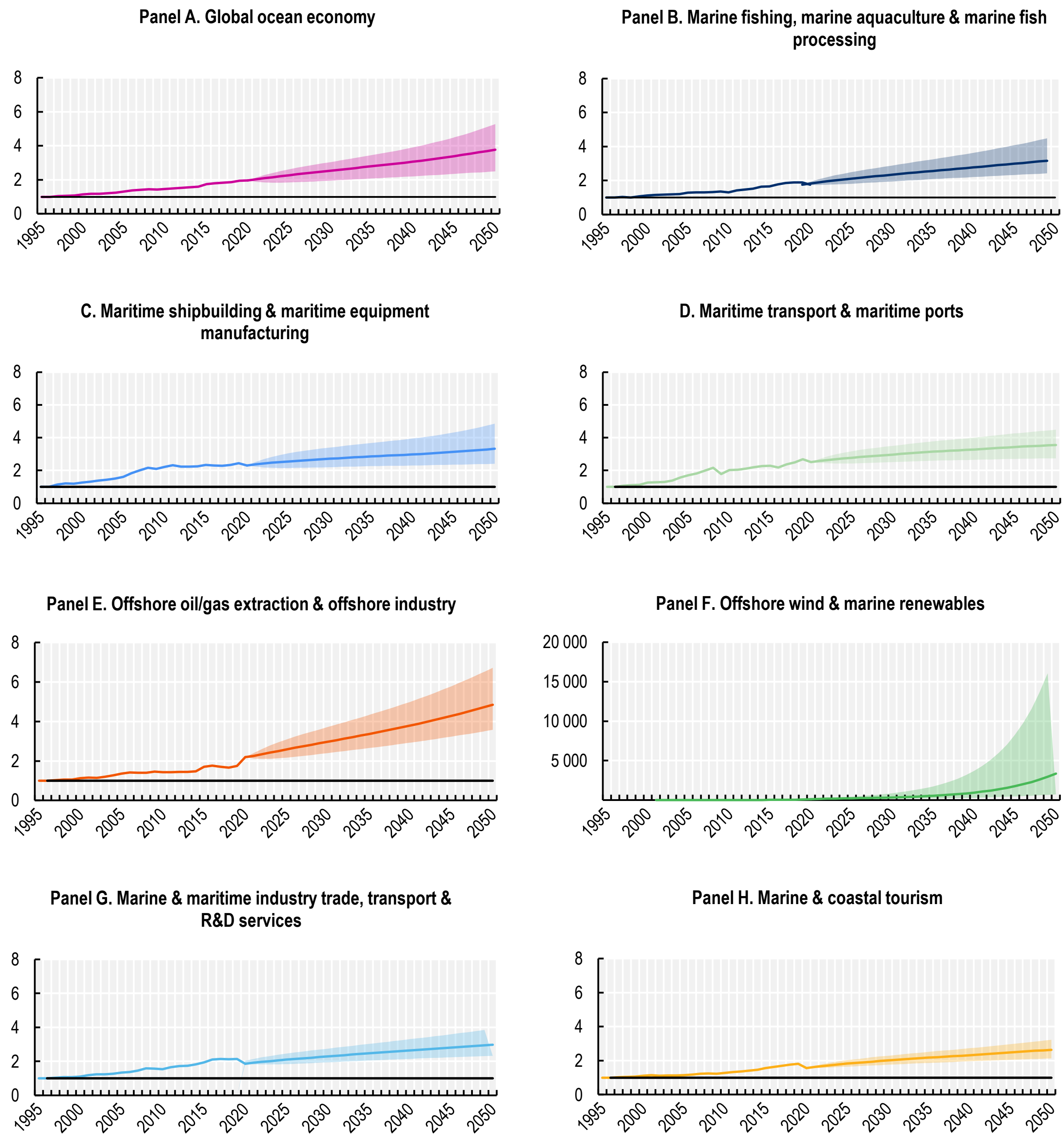
Initially, individual production functions similar to those presented in Figure 4.4 are estimated on an annual basis for all ocean economic activities in all coastal countries. Future labour productivity growth is modelled on the basis of the trends suggested by these detailed production functions and a gradual convergence towards OECD projections of trend labour productivity (Guillemette and Château, 2023[6]). Growth in hours worked is modelled similarly except that individual country growth in hours worked in each ocean economic activity is assumed to converge towards the United Nations' 2024 median projection of country working age population growth (15-64 years) (United Nations, 2024[7]). Future GVA growth is calculated as the sum of the combinations from each component in all future years. The GVA growth results are then used to calculate the level of future GVA in each ocean economic activity in all countries in current prices and in real terms and aggregated to form global and regional estimates.

The baseline projection presented here is based on historical trends and is designed to provide a reasonable starting point from which potential future changes can be assessed. However, economies evolve according to regulatory and technology changes, environmental factors, consumer behaviour shifts and many other influences. Past trends can only go so far in helping to understand the future of the ocean economy. The next chapter – Chapter 5 – details powerful changes in broader forces that shape ocean economy production and productivity and are expected to affect ocean economic growth in the coming decades. Chapter 6 then explores two possible scenarios based on these shaping forces.

The baseline projection for the ocean economy based on historical trends suggests all ocean economic activity groups are set to grow in real terms from 2020 until the end of the period in 2050. Figure 4.6 displays chained volume indexes for each ocean economic activity group globally as well as the global ocean economy estimated through the procedure summarised above. The darkest line in each panel represents a chained volume index of GVA growth calculated by summing the baseline projections of growth in hours worked and growth in labour productivity in each ocean economic activity in each country.

Figure 4.6. Projections based on historical trends suggest production in most ocean economic activity groups may more than triple in real terms between 1995 and 2050

Historical and projected global ocean economic activity group gross value added chained volume indexes



Note: Gross value added chained volume indexes created from mean projected hours worked growth and mean projected labour productivity growth given by dark line. Projection intervals calculated using the upper and lower bounds of the 80% confidence intervals in hours worked growth and labour productivity growth given by shaded area.
Source: OECD Ocean Economy Monitor, January 2025.

The baseline projection reaches above three by 2050 (i.e. a tripling of real GVA since 1995) in all ocean economic activity groups apart from 'marine and coastal tourism' which hits 2.98 in 2050. The highest level in chained volume terms is reached by 'offshore wind and marine renewables' which grows exponentially at times to reach a level 3 365 times larger in real terms in the baseline projection than it was in 2000 when the first commercial projects began. Otherwise, the highest volume level is achieved by 'offshore oil and gas and offshore industry' which overcomes a period of stagnant growth in the mid-2010s to a baseline projection high of 4.85 in 2050.

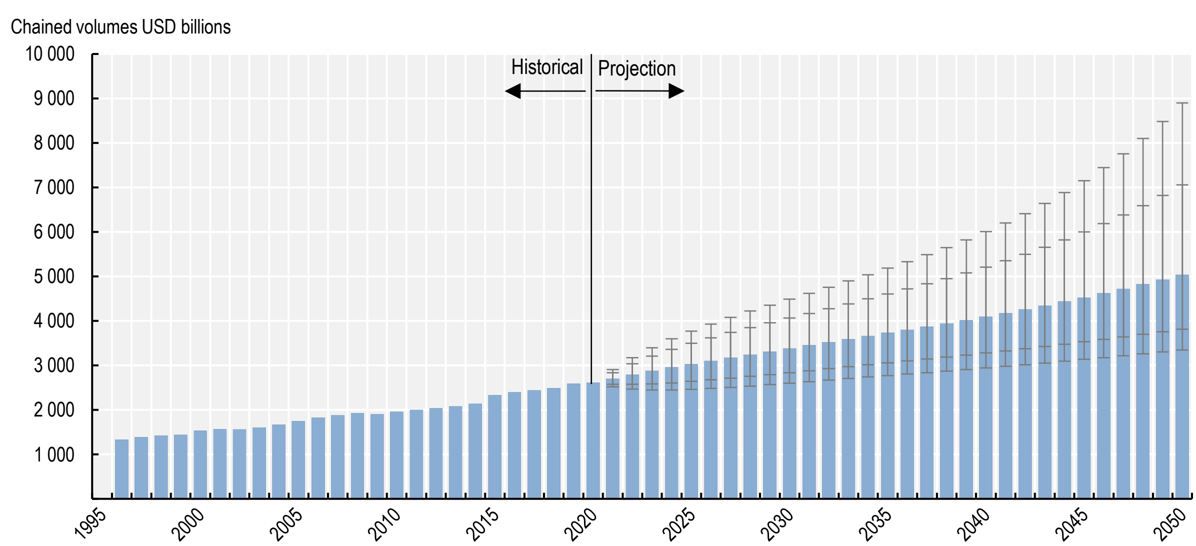
The chained volume indexes in Figure 4.6 can be used as the basis for estimating gross value added in real terms. It is assumed that prices in each ocean economic activity group in each country grow at their average rate between 1995 and 2020 in all future years. This allows the annual growth rates projected by the model in volume terms to first be converted to current price and previous year price estimates in future years and subsequently into chained volume measures in monetary terms (with a reference year of 2015).

Figure 4.7 provides the historical and future aggregates of all ocean economic activities globally in real terms. The baseline projection suggests that global ocean economy GVA could grow from around USD 2.6 trillion in 2020 to USD 3.4 trillion then to USD 4.1 trillion in 2040 and finally USD 5.1 trillion in 2050 if historical trends were to continue. This represents roughly a doubling of global ocean economy GVA between 2020 and 2050. Figure 4.7 displays real terms projections along with an indicator of 80 and 95 per cent projection intervals. The projection intervals are calculated from the hours worked and labour productivity models. This suggests the global ocean economy has an 80% chance of being worth between USD 3.8 and 7.1 trillion – and a 95% chance of being between USD 3.3 trillion and USD 9.8 trillion – should previously held trends in hours and labour productivity growth continue in each ocean economic activity.

The real terms growth in aggregate global ocean economy GVA in Figure 4.7 is driven by growth in individual ocean economic activities. Figure 4.8 displays shares of the total ocean economy in each global region attributable to each ocean economic activity group historically and projected into the future.

Figure 4.7. Historical trends reflected in the baseline projection suggest the ocean economy could add USD 2.5 trillion more to the economy in 2050 than it did in 2020

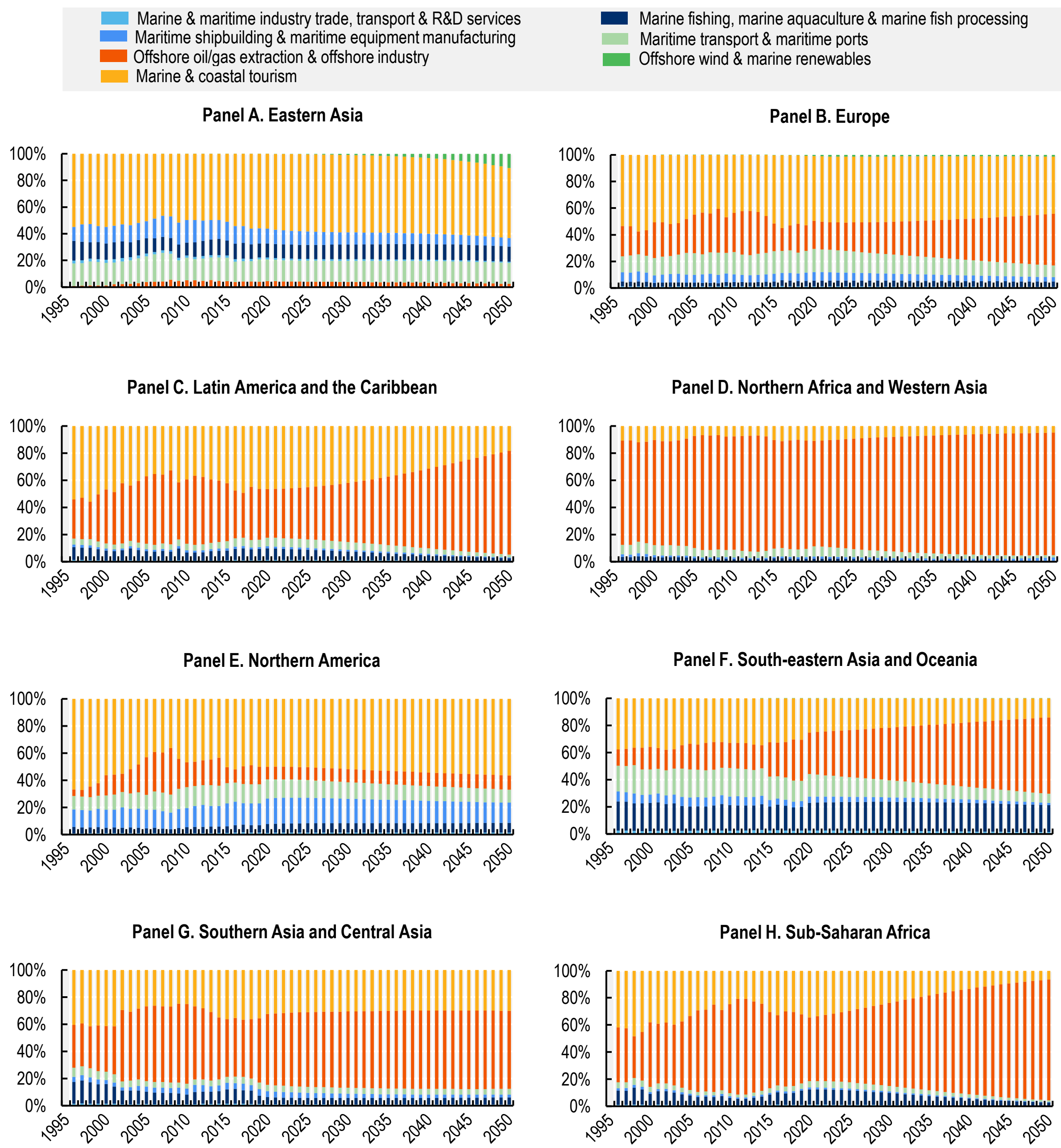
Historical and projected global ocean economy gross value added in chained volume measures



Note: Chained volumes measures estimated from mean projected hours worked growth and mean projected labour productivity growth and converted to US dollars by referencing the value in 2015. Projection intervals calculated using the upper and lower bounds of the 80% and 95% confidence intervals in hours worked growth and labour productivity growth given by line on each bar.
Source: OECD Ocean Economy Monitor, January 2025.

Figure 4.8. Marine and coastal tourism or offshore oil/gas extraction and offshore industry continue to dominate the ocean economies in all regions in the world in the baseline scenario

Historical and projected regional ocean economic activity group current price gross value added as a share of total regional ocean economy gross value added



Note: Historical and projected ocean economic activity group shares of regional ocean economy gross value added in current price US dollars.
Source: OECD Ocean Economy Monitor, January 2025.

'Marine and coastal tourism' remains the largest ocean economic activity group as a share of regional ocean economies in 'Eastern Asia' (Panel A in Figure 4.8), 'Europe' (Panel B), and 'Northern America' (Panel E). By far the largest region in terms of the importance of 'marine and coastal tourism' is 'Northern

America' where its share of the regional ocean economy grows from 50% in 2020 to 56% in 2050. The other significant 'Northern American' ocean economic activity groups are 'maritime shipbuilding and maritime equipment manufacturing' (19% in 2020 falling to 15% by 2050) and 'maritime transport and maritime ports' (14% in 2020 falling to 10% by 2050).

In 'Eastern Asia', 'marine and coastal' tourism makes up at least 50% of the total ocean economy for the entire projection period hitting a peak of 58% in 2030 before gradually declining to 52% in 2050. In 'Europe', the activity group is largest in terms of the share of the regional ocean economy in 2019 at 52% (48% in 2020). 'Marine and coastal tourism' then begins to lose share to 'offshore oil and gas and offshore industry' around 2025 which at that point has a share of 22%. By 2050, 'marine and coastal tourism' represents 48% of the European ocean economy and 'offshore oil and gas extraction and offshore industry' has increased its share to 39%.

Otherwise, in all other regions, GVA in 'offshore oil and gas extraction and offshore industry' dominates the ocean economy. This is particularly pronounced in 'Northern Africa and Western Asia' (Panel D in Figure 4.8) where the activity group never drops below 73% of the ocean economy (1998) and hits a peak of 91% in 2050. 'Offshore oil and gas extraction and offshore industry' also reaches around 90% in 2050 in 'Sub-Saharan Africa' (Panel H) having grown from just under 50% in 2020. 'Marine and coastal tourism' in 'Sub-Saharan Africa' begins the projection period at 33% of the regional ocean economy before being squeezed through to 2050 by expansion in 'offshore oil and gas and offshore industry' when it makes up just 1% of the ocean economy.

In 'Southern Asia and Central Asia' (Panel F in Figure 4.8), the share of 'offshore oil and gas extraction and offshore industry' GVA in the regional ocean economy grows from 52% in 2020 to 56% in 2030 and remains at roughly that level until 2050. The share held by 'marine and coastal tourism' in the region falls slightly from 32% in 2020 to 30% in 2030 where it remains for the rest of the projection period. 'Marine and coastal tourism' and 'offshore oil and gas extraction and offshore industry' therefore grow in line with each other in the region from 2030 onwards.

Despite experiencing enormous growth in some countries from the turn of the millennium until the end of the historical period in 2020, 'offshore wind and marine renewables' does not grow to a considerable size in the baseline projection. The activity group's largest gain in terms of the share of regional ocean economy GVA was in 'Eastern Asia' as shown by the increase in size of the dark green bars towards the end of projection period in Panel A in Figure 4.8. Otherwise, 'offshore wind and marine renewables' have no major effect on the size of the ocean economy in any other region.

Summary

Growth in ocean economic activity groups often surpassed that of the average industry in the overall economy between 1995 and 2020 (Chapter 3). This Chapter 4 has examined the trends in productivity across various economic factor inputs that helped shape this performance.

- **Simple measures of productivity indicate that most ocean economic activity groups performed well compared with the average industry in the overall economy between 1995 and 2020**. A straightforward measure – growth in gross value added (GVA) per hour worked— indicates that productivity gains relative to the average industry were most notable in 'offshore oil and gas extraction and offshore industry' and 'maritime transport and maritime ports'.
- **More detailed productivity measures suggest that more than half of the ocean economic activity groups experienced a decline in multifactor productivity over the period**. The contribution of various input factors – ICT capital services, non-ICT capital services, and the education composition of the labour force – to GVA growth and how effectively these inputs are combined through multifactor productivity are estimated. The results suggest that most of the

ocean economic activity groups are not leveraging more intangible advancements and improvements in processes that lead to more efficient uses of economic inputs.

- **Detailed decompositions of the types of capital services that contribute towards GVA growth point towards a lack of readiness for an increasingly digital and automated future.** Growth in GVA is primarily driven by capital investments unrelated to information and communication technologies in all ocean economic activity groups. Low contributions to GVA growth from ICT capital services per hour worked in all ocean economic activity groups point towards missed potential GVA growth and raise concerns about the global ocean economy's preparedness for a digital and automated future
- **Should historical trends persist, real-terms GVA in most ocean economic activity groups could triple between 2020 and 2050. However, there is little reason to believe they will.** The productivity analysis developed in this chapter serves as the foundation for a baseline projection of the future ocean economy through to 2050. However, the future of the ocean economy will of course be shaped by evolving technologies, policy changes, and shifting economic and environmental conditions outlined in Chapters 5 and 6.

The baseline projection using historical trends is used as the basis from which potential future changes are assessed in the remaining chapters. The following chapters dive into these issues by presenting major global shaping forces and their potential effects on the ocean economy's future trajectory.

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5 The future ocean economy: A significant departure from historical trends

This chapter examines global forces shaping potential developments in the ocean economy. Factors such as population growth, climate change and environmental pressures, trade and globalisation, the energy transition, technological advancements, and geopolitical dynamics – along with their interactions – are affecting ocean economic activities and the state of ocean health. The magnitude and direction of the effects of some of these shaping forces have been modelled in isolation of each other to compare how they may affect ocean economic growth and result in divergences from historical patterns.

Introduction

The previous chapters set out the historical trends in ocean economy since the mid-1990s as captured by new OECD statistics as well as a baseline projection of the ocean economy to 2050 that assumes historical trends in labour productivity continue.

A key question for the future is whether the ocean economy and its components will continue along the same trajectory as their historical trends would suggest to 2050. Global developments over the last decade and assessments of short-, medium- and long-term prospects suggests this is unlikely.

This chapter reviews current and emerging changes in the forces shaping the global economic, environmental, and political context. The effects of several of these drivers on future ocean economic growth have been modelled independently from each other under the assumption that all else remains equal in order to compare their magnitude and direction. Namely result from recent literature have been used to alter the trajectories of the economic factors underlying growth in ocean economy activity groups as described in Chapter 4. This modelling suggests certain drivers have more substantial effects than others on future ocean economy trajectories relative to the baseline projection where historical patterns continue.

Global forces shaping the long-term outlook for the ocean economy

Several drivers affecting the trajectory of the ocean economy in past decades stand out as particularly influential. These drivers have tended to evolve slowly over time:

- ***World population*** continues to grow but its rate of expansion is slowing markedly; the share of the working-age population is declining; population ageing is progressing at ever faster rates; urbanisation looks set to increase more quickly than previously expected; and the regional distribution of population growth to 2050 is shifting with almost all of it due to take place in emerging market and developing economies (United Nations Department of Economic and Social Affairs, 2024[1]).
- ***Climate change***. Temperatures have risen by about 1.1C since 1880 but the bulk of that warming has taken place since 1975 and the last decade saw the fastest rise on record. Moreover, disturbingly rapid deteriorations have been occurring in key climate indicators such as ocean temperatures, ice cover, sea levels, and ocean acidification. Recent assessments suggest that several key climate tipping points could occur sooner than originally estimated (Armstrong McKay et al., 2022[2]; OECD, 2022[3]; Heuzé and Jahn, 2024[4]).
- ***World trade*** expanded swiftly between the turn of the century and the advent of Covid-19. However, while it grew twice as fast as global output over the period 1990-2011 (at an average rate of around 3%) it has slowed considerably since (Ohnsorge and Quiglietta, 2023[5]). In parallel, trade has undergone significant structural changes too with a strong rise in services exports (D'Andrea and et al., 2024[6]). Moreover, developments in global trade agreements have stalled. After decades of reduction in trade barriers, negotiations have grown in complexity and partial agreements have multiplied non-tariff barriers to trade and other import restrictions have also risen (World Trade Organization, 2024[7]).
- ***Productivity growth***. Growth in global labour productivity has slowed markedly in the last 15 years or so. Aggregate labour productivity growth rates declined from a peak of 2.7 % in 2007, just ahead of the global financial crisis, to a low of 1.5 percent in 2016, recovering slightly to less than 2% p.a. in the two years that followed (Dieppe, 2021[8]). The slowdown was most severe in emerging market economies, where the pace of convergence towards levels in the advanced economies slackened.

At the same time, other major drivers are embarked on structural change of a magnitude that is better described as systemic:

- The ***world energy system*** has started a process of transformation driven first and foremost by concern about climate change. In recent years, the move to a more sustainable global energy future has gathered pace (International Energy Agency, 2021[9]). Significant declines in the relative shares of all fossil fuels; a sustained surge in renewable energy (on-shore and off-shore wind, solar, batteries, biofuels) and low-carbon energy (e.g. hydrogen); and major investments in innovation, energy efficiency improvements, and carbon capture are all expected.
- ***Metals and minerals*** are important for the energy transition and the industry will be called upon in the coming years to meet the widely expected surge in demand. High prices for scarce resources could result in technological innovation and resource substitution. This is very likely only achievable with deep structural shifts in both the demand for and supply of critical inputs. Increased investment, production and processing volumes, diversification of sources of supply, including recycling of existing metals, and improved rates of innovation will be required.
- The ***global food system*** is struggling to address multiple urgent objectives – reducing hunger and malnutrition to zero, vastly improving efficiency of production, storage and distribution, lowering its environmental footprint, safeguarding biodiversity, and adapting to climate change (FAO, 2020[10]).
- The speed of change in ***science and technology*** worldwide has been remarkable in recent years. Rapid advances have been made in fields ranging from genetics and biotechnology, new materials, and robotics, to digitalisation, visualisation, computer science, and Artificial Intelligence (AI) (OECD, 2019[11]). They have been enabled by fundamental changes in funding, organisation and availability of infrastructure for scientific research and international advances. ICT and digitalisation show gradual, steady advances on some indicators, and explosive development on others (Stevens, Jolly and Jolliffe, 2021[12]). For example, numbers of internet users worldwide have more than doubled over the last decade; more than three-quarters of the world's population now own a mobile phone; and 95% of the global population are now covered by at least a 3G network (OECD, 2024[13]). Artificial Intelligence has experienced rapid growth in recent years, assisted by government funding of AI-related R&D which has grown at spectacular rates over a period of under two decades (Yamashita et al., 2021[14]). And the landscape of the space sector has changed almost beyond recognition in recent years, providing new means to monitor ocean economic activities and selected ocean processes from space (OECD, 2023[15])
- Finally, ***the geopolitical landscape*** appears to be headed for further disruption. While some of the fundamental trends, challenges and risks characterising its contours twenty years ago are still very present, others have intensified and/or have taken on a new dimension. The decline in the number of armed conflicts around the world since the early 1990s went into reverse around 2013-14, notably in Africa, Asia, Middle East and Europe, reaching a record high in 2020 (Davies, Pettersson and Öberg, 2022[16]). Russia's war of aggression in Ukraine, mounting tensions in crucial sea corridors and armed combat have considerably darkened the prospects of a return to a more peaceful era. Moreover, analysis suggests that several factors are combining to bring about a deterioration in the quality of democracy, while a decline has also been observed in the effectiveness of conflict resolution mechanisms. The same period has reportedly seen regime changes, fuelling concerns about the prospect of a new era of geopolitical block-building (Hartmann and Thiery, 2022[17]). New drivers now also appear to be at work which foreshadow the opening of new fronts in geopolitical competition and/or confrontation. In particular, the spotlight has turned on the growing vulnerabilities of supplies of energy, food, metals, and minerals critical to the global energy transition. Added to this are growing geoeconomic trends in many parts of the world driven by countries' search for greater autonomy in key sectors, reduction of supply-chain vulnerabilities, and reshoring of industries.

In sum, the global policy environment is heading towards a more uncertain and more challenging future. As long-term prospects undergo change, so too do those of the ocean economy.

The potential effects of a changing global context on the ocean economy

The future ocean economy will be influenced by shifts in demand and productivity affecting all sectors and through direct activity-specific impacts. Five major forces shaping the future ocean economy are presented in more detail below– world population trends, the climate and environment, geopolitics, the transformation of the energy system, and technology and digitalisation. The likely long-term changes occurring in each of them will vary in pace and probable impact. They result in projections that differ from the baseline projection in Chapter 4 that is based on historical trends. The effects of possible future scenarios will be explored further in Chapter 6.

World population trends

Slowing global population growth, higher rates of urbanisation, the growing share of the elderly, and the concentration of the new additions (1.9 billion by 2050) to the world population in emerging market and developing economies (United Nations Department of Economic and Social Affairs, 2024[1]) can be expected to affect all domains of the ocean economy.

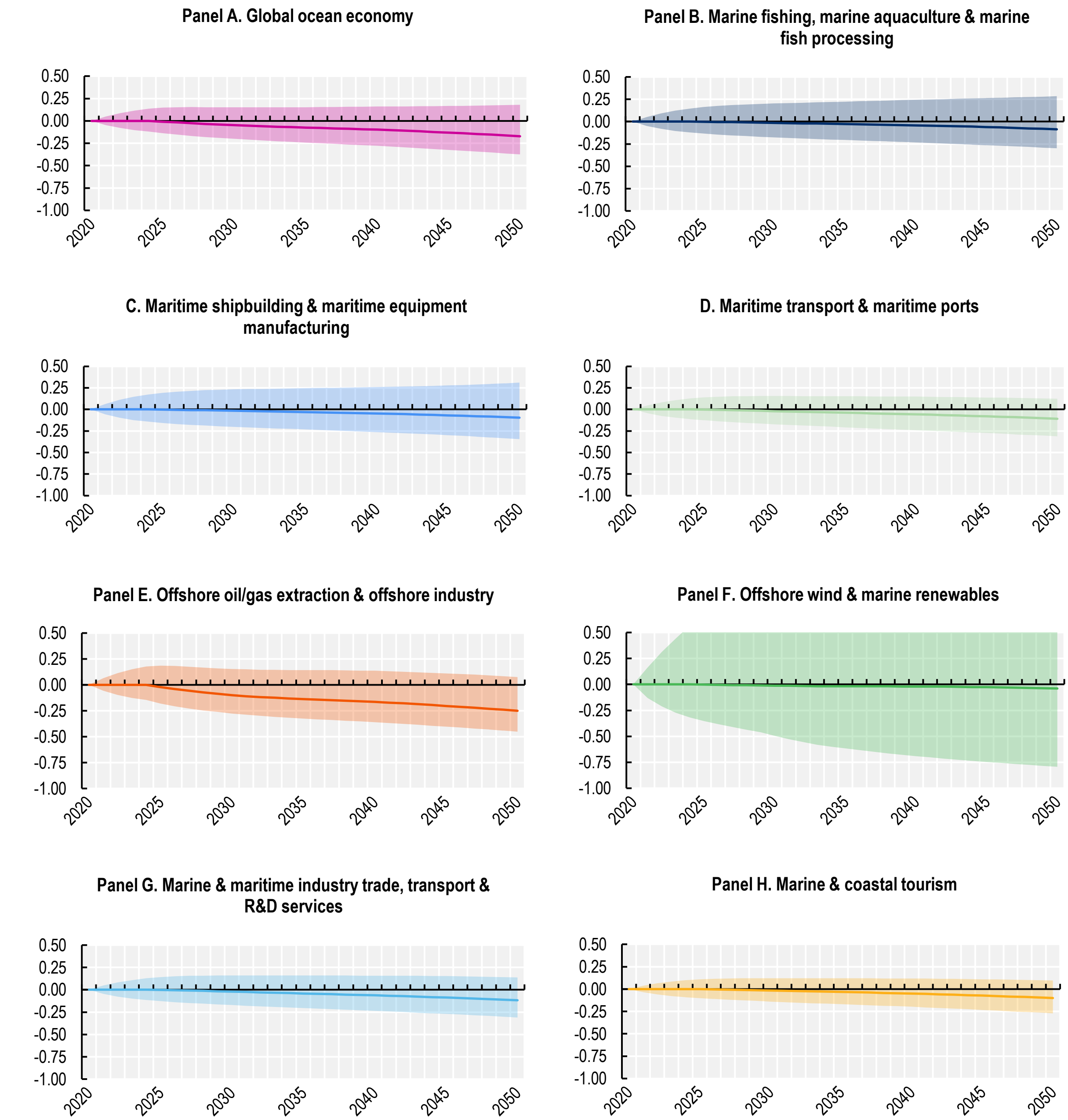
Population ageing is a global phenomenon. Almost every country in the world is experiencing growth in the size and share of older persons in their population. The proportion of the global population aged 65 and older is projected to rise from 9.7 per cent in 2022 to 16.4 per cent in 2050. Between 2000 and 2020 the global elderly population grew by 72%; the projection for 2020 to 2040 points to an increase of 80% (UN DESA, 2020[18]).

Urbanisation too is expected to increase at a faster rate than projected ten years ago. The UN estimates of total urban population growth by 2030 and by 2050 have been revised upwards: from 4,984 million to 5,167 million, and from 6,252 million to 6,680, respectively (UN DESA, 2018[19]). The rate of urbanisation worldwide has also continued to increase over the period under review here – from 51.6% in 2010 to 56.2% in 2020. The share of people living in urban settings by 2050, estimated at around 66% in 2015, is now projected to reach 68.4% (UNCTAD, 2021[20]). Almost all that growth will take place in the developing world, with the number of urban dwellers in poor countries likely to rise by 1.0 billion to more than 2.5 billion by 2040. Sub-Saharan Africa and South Asia will account for close to half and one-third respectively of the additions.

The possible effects of lower population growth on ocean economy production through to 2050 have been modelled. The baseline projection (Chapter 4) assumes that growth in hours worked in each ocean economic activity in each country converges towards the United Nations' median working-age (15 years to 64 years) population projection for each country through to 2050. The UN also produces lower plausible estimates of working-age population growth which can be used instead of the median. Figure 5.1 compares the results of using the UN's lower country-level working-age population growth estimates to the results from historical trends. The chained volume index from the projection is set as the baseline at zero so that each line in Figure 5.1 represents how the chained volume index calculated using the UN's lower population projection deviates from the same metric estimated using the UN median population projection. A negative value therefore implies that real terms growth in gross value added is lower than in the baseline projection and does not imply negative growth rates. The shaded areas give the 80% projection interval estimated by the model. Under the assumption of lower population growth, real terms gross value added in the global ocean economy finishes the projection period on average 17% lower than it would do under the higher population growth rate assumption inherent to the baseline projection, using historical trends (Panel A). 'Offshore oil and gas extraction and offshore industry' is expected to deviate the most from the baseline projection, averaging a 25% reduction by 2050 (Panel E). This implies that the global gross value added for this sector would reach only three-quarters of the real-term level projected under the scenario of higher population growth. All other globally aggregated ocean economic activity groups do not substantially deviate from the baseline projection – ranging from negative 4% by 2050 in 'offshore wind and marine renewables' (Panel F) to negative 11% in 'marine and maritime industry trade, transport and R&D services' (Panel G).

Figure 5.1. Assuming lower population growth creates small deviations from the baseline projection in most ocean economic activity groups

Global ocean economic activity group gross value added chained volume indexes under lower population projections relative to baseline projection chained volume indexes



Note: Gross value added chained volume indexes for the overall economy and each ocean economic activity group are calculated under the lower UN population projection. The relative index is then calculated as the ratio of each chained volume index to the baseline projection chained volume indexes setting the baseline projection chained volume indexes equal to 0. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity. The shaded areas represent the 80% projection interval estimated by aggregating the lower and upper bounds of the estimated prediction intervals in growth in hours worked and the components of labour productivity growth by ocean economic activity in each country.
Source: OECD Ocean Economy Monitor, January 2025.

Climate and environment

Extreme weather and slower onset transformations like sea-level rise and global warming are increasingly threatening communities worldwide with the economic toll projected to intensify over the next decades.

In 2024, the ocean experienced its warmest year on record with an annual mean temperature of 20.95°C for the global ocean (Mercator, 2025[21]). Globally, sea ice volume hit a record low with the Arctic's winter sea ice extent ranking among the lowest in the past 30 years and the Antarctic recording its second-lowest maximum extent ever observed. Regionally, the North Atlantic Ocean and the Mediterranean Sea saw their highest sea surface temperatures since 1991. Nearly the entire Mediterranean and North Atlantic are affected by marine heatwave events (Plan Bleu, 2025[22]).

Global greenhouse gas (GHG) emissions continue to rise and current Nationally Determined Contributions fall far short of keeping temperature increases within limits set in international agreements (OECD, 2024[23]). While 105 countries have pledged net-zero targets covering over 80% of global emissions, most are not legally binding, and substantial ambition gaps remain (OECD, 2024[23]). Recent OECD analysis of IPCC Sixth Assessment Report scenarios shows that to limit warming to 1.5°C, GHG emissions should peak before 2025 and reach net zero between 2050 and 2100. To meet the Paris Agreement goals, emissions would have to drop by 14% and 42% by 2030 to align with 2°C and 1.5°C targets respectively. Even with full implementation, current Nationally Determined Contributions place the world on a path toward temperature rises of 2.5°C to 2.9°C above pre-industrial levels by century's end. Average global temperatures over a decade have already risen more than 1°C above pre-industrial levels. This change is substantial, as it takes immense heat to warm the ocean, atmosphere, and land. Historically, a 1°C –2°C drop triggered the Little Ice Age (NASA, 2024[24]).

The economic impacts of climate change are expected to escalate from 2030 through 2050 (IPCC, 2021[25]) with the most severe effects anticipated in developing countries and vulnerable regions (IPCC, 2022[26]). Risks that are irreversible as temperature rises include species extinction, coral reef degradation, and loss of small islands and coastal settlements due to sea level rise. Small Island Developing States face existential threats from sea-level rise and extreme weather events, leading to eventual displacement of communities. Urban populations in low elevation coastal zones has been growing faster than other zones, leaving 14% of urban populations vulnerable to rising sea levels and storm surges (OECD/European Commission, 2020[27]). The propagation of economic disruptions due to weather extremes along supply chains will lead to supply shortages and increased prices in all countries (Quante et al., 2024[28]; Cevik and Gwon, 2024[29]). However, those in tropical regions are expected to be disproportionately affected and face greater economic challenges. Developing countries, particularly in Africa, Asia, and South America, are expected to incur economic damages from disasters ranging from USD 290 billion to USD 580 billion annually by 2030 (Markandya and González-Eguino, 2019[30]).

It is not possible to consider all the possible effects of climate change on the ocean economy in this report. However, recent literature on the economic effects of temperature and precipitation variability can be used to infer the potential consequences of climate change on ocean economic growth (Waidelich et al., 2024[31]; Kotz, Levermann and Wenz, 2024[32]; Callahan and Mankin, 2022[33]).

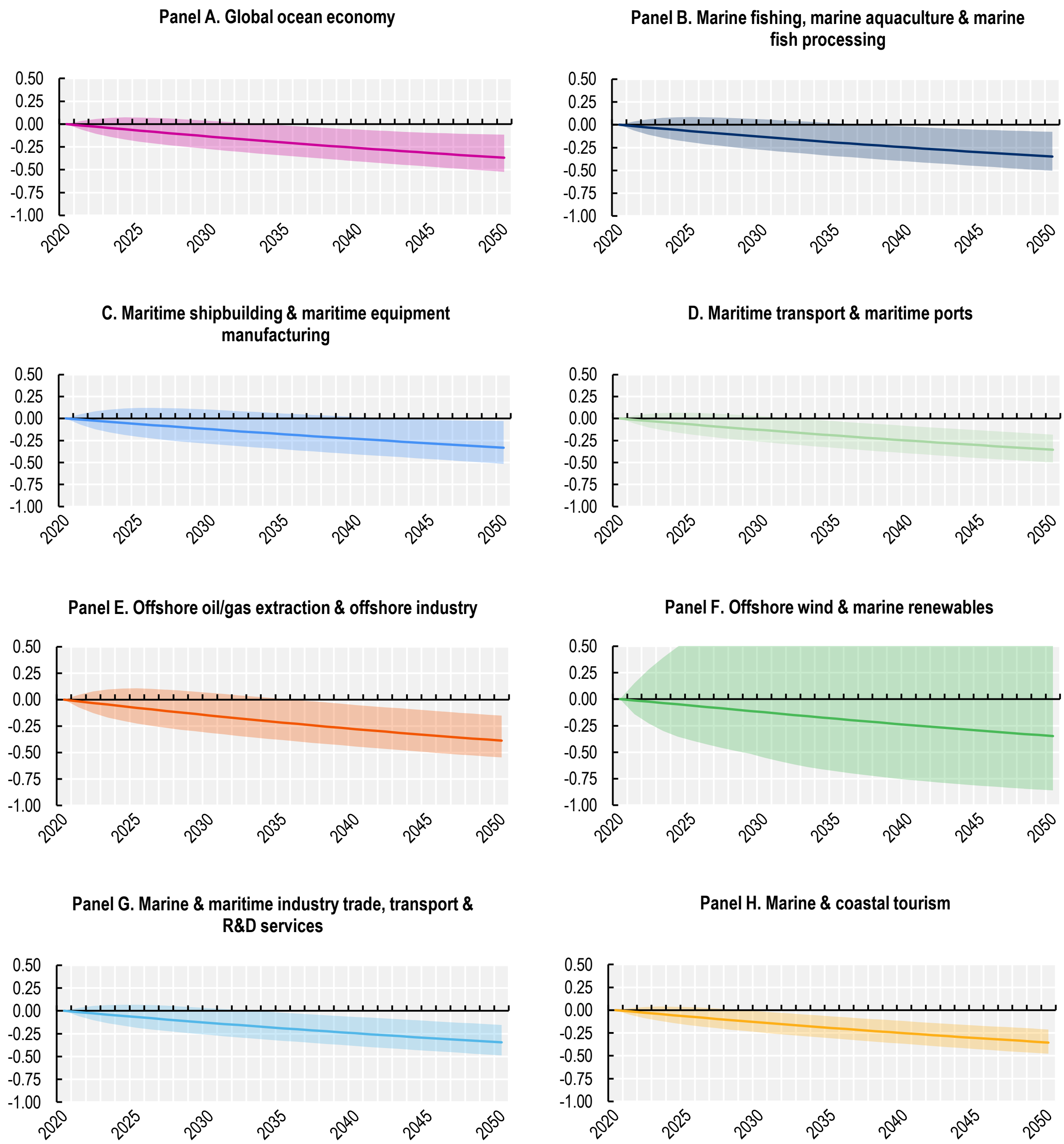
Kotz, Levermann and Wenz (2024[32]) estimate that climate change could reduce average global incomes by 2050 by approximately 19% (population-weighted average),independent of future emission choices. This equates to around USD 38 trillion in annual damages in comparison with a baseline without climate-change impacts (with a likely range of 11%–29% or USD 19–59 trillion). This would constitute a permanent income reduction globally. The estimates do not consider sea-level rise and make no attempt to value assets that are not currently measured in gross domestic product such as non-market ecosystem services. More analysis is detailed in Chapter 6.

To gauge the potential effects on the performance of the ocean economy, the OECD has used estimates of expected changes in income resulting from certain consequences of climate change as suggested in the literature. In particular, mean percentage changes in regional income per capita in 2050 under a 2°C emissions pathway suggested by Kotz et al. (2024[32]) are adjusted for population growth and converted to an annual average. They are then applied to the gross value added (GVA) growth rates estimated through the hours worked and labour productivity growth models outlined in Chapter 4. The results from this exercise are compared to the results from the baseline projection through to 2050 in Figure 5.2.

Should the regional income effects of climate in Kotz et al. (2024[32]) prove accurate across all ocean economic activity groups, the global ocean economy will on average finish the projection period 37% lower in real terms GVA than the baseline projection would suggest (Panel A). All ocean economic activity groups experience substantial declines in real terms GVA on average relative to the baseline projection. The range is from a 34% reduction in ‘maritime shipbuilding and maritime equipment manufacturing’ (Panel C) to a 38% reduction in ‘offshore oil and gas and offshore industry’ (Panel E).

Figure 5.2. Should the effects of climate change suggested by recent literature be realised then all ocean economic activity groups will be negatively affected relative to the baseline projection

Global ocean economic activity group gross value added chained volume indexes adjusted for climate change effects estimated in other literature relative to baseline projection chained volume indexes



Note: Gross value added chained volume indexes for the overall economy and each ocean economic activity group are calculated under the assumption that regional climate effects are in-line with those estimated by Kotz et al. (2024). The relative index is then calculated as the ratio of each chained volume index to the baseline projection chained volume indexes setting the baseline projection chained volume indexes equal to 0. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity. The shaded areas represent the 80% projection interval estimated by aggregating the lower and upper bounds of the estimated prediction intervals in growth in hours worked and the components of labour productivity growth by ocean economic activity in each country.
Source: OECD Ocean Economy Monitor, January 2025.

Geopolitical landscape

Recent trends in the geopolitical landscape point towards a more contested world and less effective international collaboration on future global issues. Potential implications for the ocean economy could be considerable.

Recent geopolitical upheavals have contributed to disruption in numerous ocean economic activities. Among the most directly concerned by the Russian war of aggression in Ukraine are the marine seafood industries, maritime trade and maritime ports, and oil and gas companies disengaging from Russia. Given the scale of the disruptions, international production and supply strategies are being reassessed. Moves to strengthen self-sufficiency are increasingly evident among some of the major players in key areas of the ocean economy. Impacts on trade flows and trade composition are to be expected, with knock-on effects for maritime transport and maritime ports.

Many critical metals and minerals – crucial for the expansion of renewable energy sources and energy infrastructures – are highly dependent on a small number of major producing and processing countries (IEA, 2024[34]). Such geographic concentration of sources of essential raw materials exposes supplies to risks of disruption. The planned roll-out of offshore wind and expansion of other marine renewables is especially exposed to the risk of such supply disruption. Market forces can also pose a threat in cases where demand is out of kilter with supply by a large margin. These issues and their impacts on seabed mining are discussed further in Chapter 6.

Finally, despite several recent successes, global governance in general is being challenged by ever greater complexity and, in recent years, by a mixed record on effectiveness. This also applies to ocean economy governance as outlined in Chapter 2. Negotiations around agreements of major import for ocean health and the ocean economy – e.g. the global plastics treaty – are somewhat delayed. Some, though signed – such as the High Seas Agreements – still require ratification by signatory countries and remain short on the specifics of implementation, threatening their entry into force. Long-established international accords such as the Arctic Treaty are experiencing operational difficulties. The lack of enforcement and management of many MPAs and the absence of any biodiversity protection in many cases calls into question the effectiveness of the recent accord to protect 30% of total marine space by 2030 (Pike et al., 2024[35]).

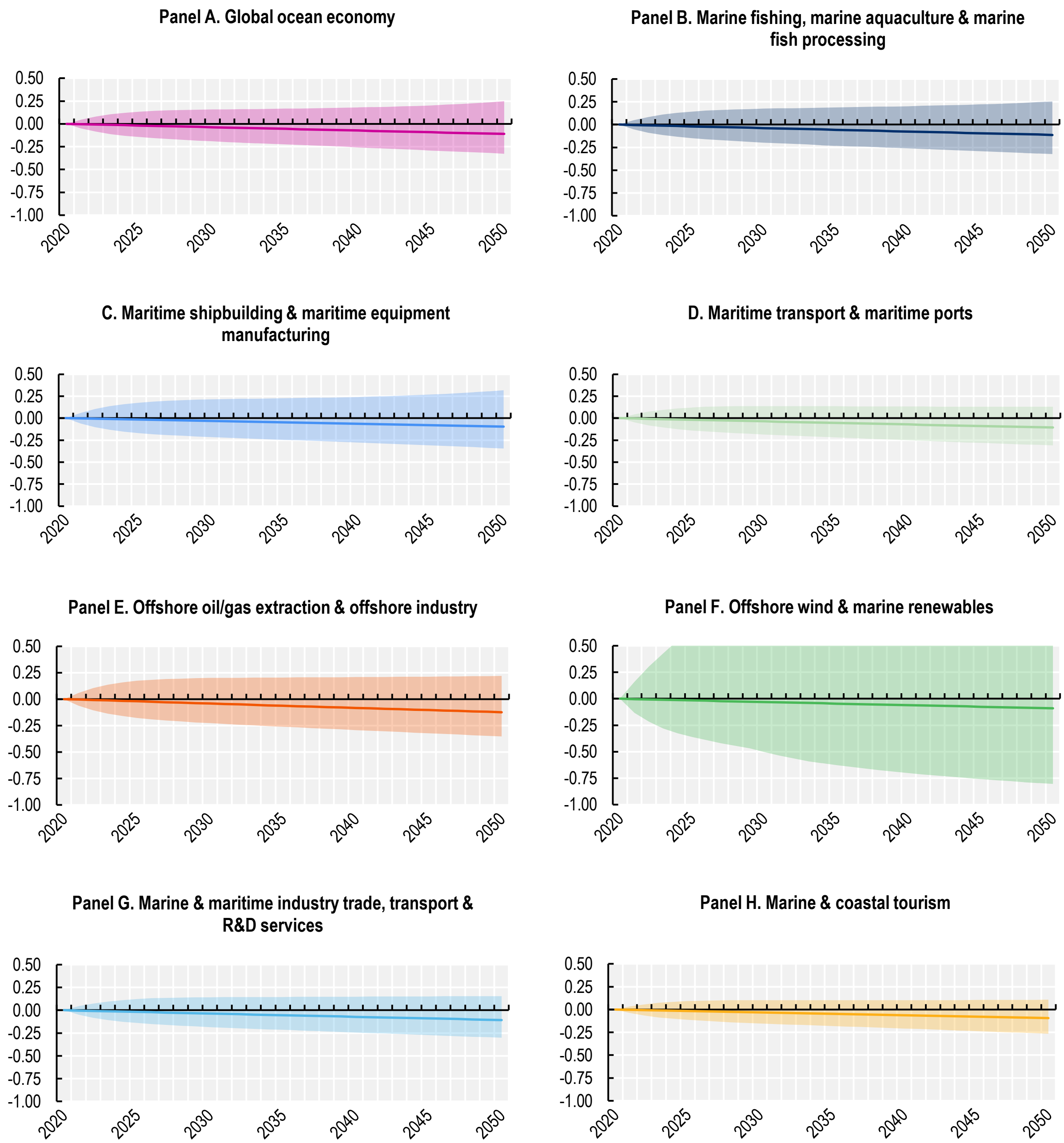
The stakes for ocean health and the ocean economy are high. Safeguarding and restoring the future health and resilience of the marine environment will depend on the effective functioning of international cooperation and collaboration.

Geopolitical tensions can have very broad economic impacts, such as disruption in national production processes, as well as radical changes in the scale and the composition of demand. To understand the potential ramifications of one particular aspect of geopolitical conflicts on the performance of the ocean economy, expected changes in income resulting from the implementation of bilateral trade barriers suggested in the wider literature have been used. In particular, the cumulative percentage changes in regional real income suggested by Góes and Bekkers (2022[36]) are converted to an annual average before being applied to the GVA growth rates estimated through the hours worked and labour productivity growth models outlined in Chapter 4. The results from this exercise are compared to the results from the baseline projection through to 2050 in Figure 5.3.

Should the regional income effects of the implementation of bilateral tariffs estimated by Góes and Bekkers (2022[36]) prove accurate, the global ocean economy would on average finish the projection period 11% lower in real terms gross value added than the baseline projection would suggest (Panel A). No ocean economic activity group experiences substantial average declines in real terms gross value added relative to the baseline projection. The largest reduction compared to the baseline projection occurs in 'offshore oil and gas extraction and offshore industry' at 12% (Panel E). The lowest reduction is experienced by 'marine and coastal tourism' with a 9% reduction on average (Panel H).

Figure 5.3. Trade disruptions caused by geopolitical tensions estimated in the wider literature and applied to the ocean economy result in relatively small deviations from the baseline projection in most ocean economy activity groups

Global ocean economic activity group gross value added chained volume indexes under bilateral tariff regimes relative to baseline projection chained volume indexes



Note: Gross value added chained volume indexes for the overall economy and each ocean economic activity group are calculated under the assumption that the effects of bilateral tariff barriers on regional income suggested by Góes and Bekkers (2022[36]) are realised. The relative index is then calculated as the ratio of each chained volume index to the baseline projection chained volume indexes setting the baseline projection chained volume indexes equal to 0. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity. The shaded areas represent the 80% projection interval estimated by aggregating the lower and upper bounds of the estimated prediction intervals in growth in hours worked and the components of labour productivity growth by ocean economic activity in each country.
Source: OECD Ocean Economy Monitor, January 2025.

Global energy system

Recent years have proved an eventful time in the energy sector and the coming decades hold out the prospect of fundamental change to the global energy system.

Limiting global warming requires major changes to energy systems with cuts in fossil fuel consumption, greater use of low- and zero-carbon energy, more electricity and alternative fuel carriers, and less investment in fossil fuel infrastructures. Multiple energy supply options and technologies that are alternative to fossil fuels are available or are expected to contribute to the energy system in the future. They include wind, solar, nuclear power, hydropower, bioenergy, and carbon capture and storage. The combination of a growing momentum behind clean energy technologies and structural economic shifts around the world has important repercussions for fossil fuel industries. In the IEA's Stated Policies Scenario (STEPS), designed to provide a sense of the prevailing direction of energy system progression, the share of fossil fuels in global energy supply, which has been fluctuating for decades around 80-85%, declines to 73% by 2030 (IEA, 2023[37]).

The prospect of systemic change in global energy has far-reaching implications for the world economy and the ocean economy. The effects will work directly for some ocean economic activities through changes in demand and supply patterns, for others indirectly through knock-on effects, and for all through the pressing need to use energy more efficiently.

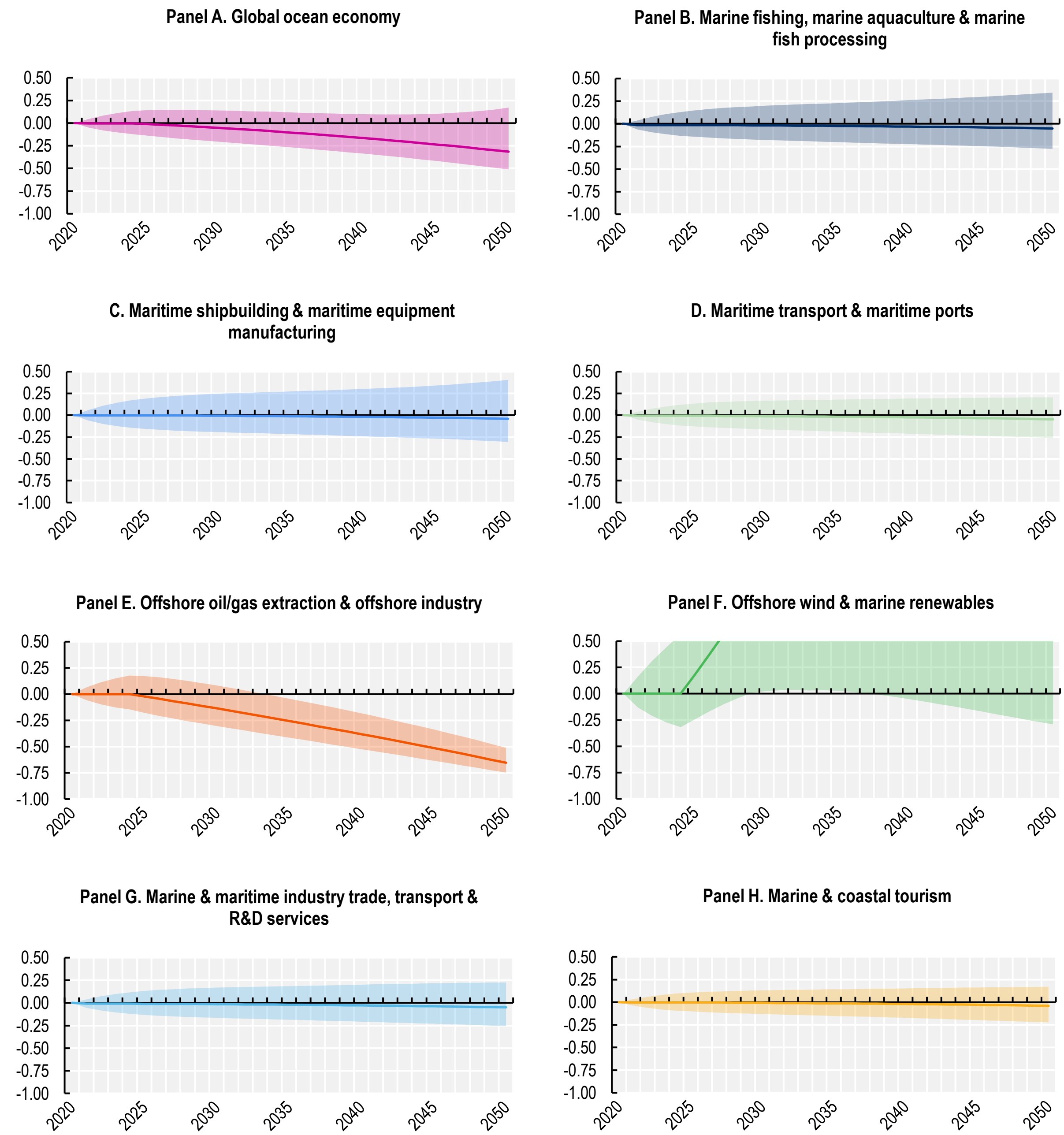
The potential changes in future ocean economic performance caused by a global energy transformation has been explored through two channels. The first converges countries towards the net-zero labour productivity growth path suggested by the OECD's latest long-term projections (OECD, 2023[38]). The second adjusts the gross value added growth rates for the 'offshore oil and gas extraction' and 'offshore wind' activities to account for their future expected shares of the energy mix in countries under the same net-zero scenario. Figure 5.4 displays the results of this exercise. In general, most ocean economic activity groups are not substantially affected by the change in labour productivity suggested by the OECD's net-zero scenario. This is mainly because the aggregate expected effects of the transition on labour productivity as compared to the baseline are small in magnitude. Adjusting the baseline projection GVA growth rates to recognise shifts in the energy mix on 'offshore oil and gas extraction and offshore industry' (Panel E) and 'offshore wind and marine renewables' (Panel F) has much more substantial effects however.

By 2050, when the OECD long-term scenario assumes net-zero is achieved, real-terms GVA is reduced by 66% on average from the baseline projection in 'offshore oil and gas extraction and offshore industry'. This is the largest average reduction from the baseline projection experienced by an individual ocean economic activity group of any of the shaping forces modelled in this chapter by a factor of two. The largest average increase over the baseline projection is also generated by this shaping force and occurs in 'offshore wind and marine renewables'. On average, adjusting baseline projection GVA growth for the increase of wind electricity generation in the energy mix results in a 2.2-fold increase in real-terms GVA in 'offshore wind and marine renewables' by 2050.

On balance, the effect on the global ocean economy is negative due to the relative levels of GVA in the affected ocean economic activity groups. The global ocean economy would on average finish the projection period 32% lower in real terms GVA than the baseline projection based on historical trends would suggest should these labour productivity and energy mix effects be realised (Panel A).

Figure 5.4. Introducing a global energy transition drives major changes from the baseline projection in energy-related ocean economic activity groups

Global ocean economic activity group gross value added chained volume indexes under a net zero energy system relative to baseline projection chained volume indexes



Note: Gross value added chained volume indexes for the overall economy and each ocean economic activity group are calculated under the assumption that the effects of net-zero labour productivity growth and changes to the energy mix are realised. The relative index is then calculated as the ratio of each chained volume index to the baseline projection chained volume indexes setting the baseline projection chained volume indexes equal to 0. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity. The shaded areas represent the 80% projection interval estimated by aggregating the lower and upper bounds of the estimated prediction intervals in growth in hours worked and the components of labour productivity growth by ocean economic activity in each country.
Source: OECD Ocean Economy Monitor, January 2025.

Technology and digitalisation

The contribution of science and advances in technology to ocean economic development depends on the ability of individual activities to adopt and integrate technological changes into their operations. Much also depends on the fundamental nature of the technologies themselves. The broadening of infrastructure for digital technologies and satellite observation systems and the pace of innovation in ocean economy applications has accelerated in recent years. Ocean economic activities are reaping the benefits of the remarkable surge in global internet coverage and access to broadband. Similarly, the recent rapid expansion of in-orbit satellite infrastructure has enhanced the capabilities and services offered while at the same time increasing their availability to new groups of ocean users. Such improvements in satellite capacity are strengthening the availability of satellite communications and earth observation, as well as navigation, remote sensing and precision location (Stevens, Jolly and Jolliffe, 2021[12]).

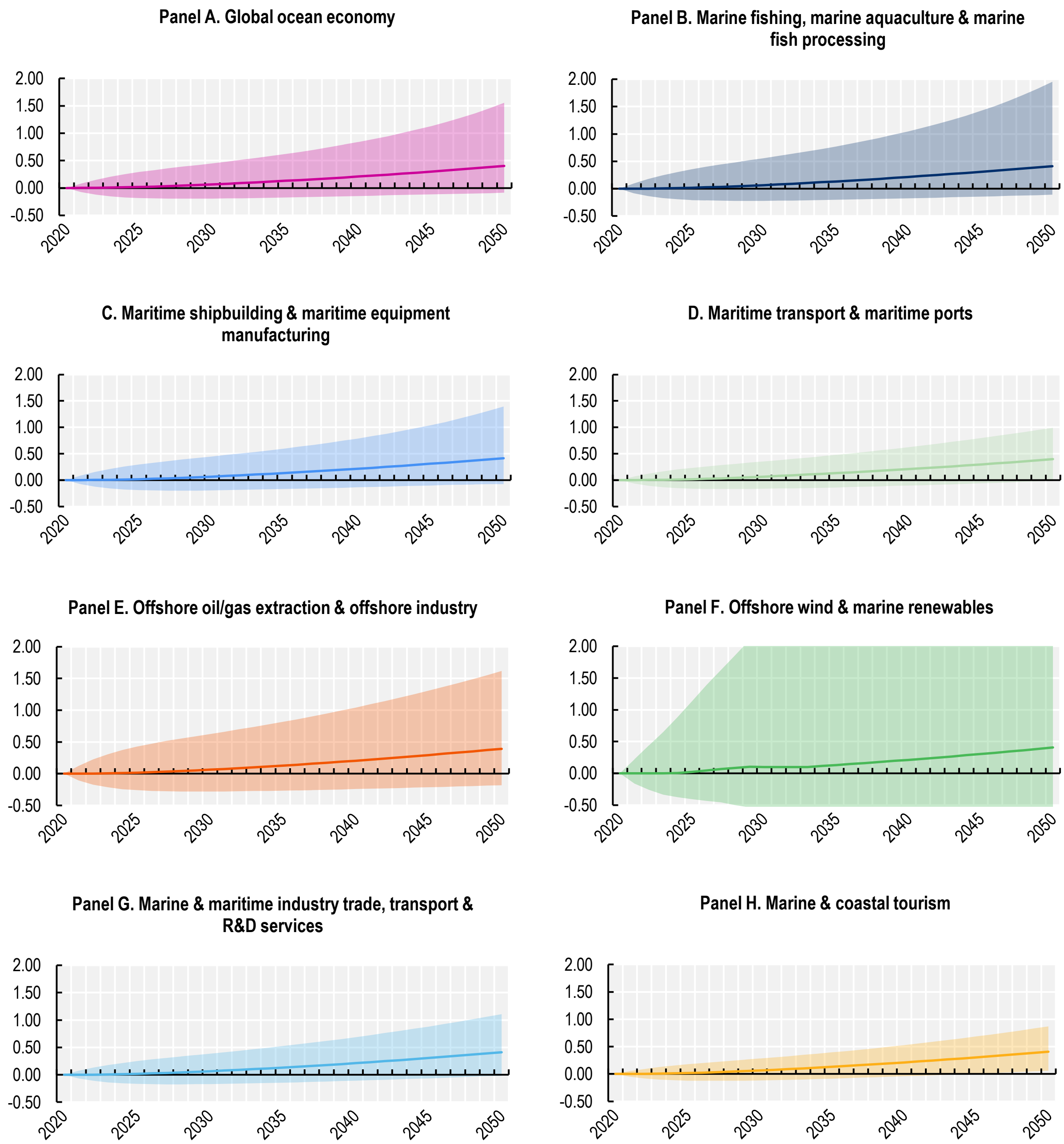
The development and diffusion of marine sensing and imaging has resulted in new smart sensors, processes and techniques that are producing major improvements in sensitivity, accuracy, stability, and resistance to harsh ocean conditions (Stevens, Jolly and Jolliffe, 2021[12]). The development of fixed and mobile multifunctional sensing and imaging platforms is progressing in tandem, as researchers bring to market new systems (Ireland Marine Institute, 2023[39]). Autonomous surface vessels such as gliders are following suit and, more recently, airborne drones are adding to the range of vehicles available. Larger autonomous vessels such as ships are now also emerging. Artificial intelligence is just beginning to permeate all areas of the ocean economy. Its growth is particularly pronounced in ocean exploration, science and research, but it is also gaining ground in subsea operations using autonomous and semi-autonomous devices.

To proxy for the adoption of more efficient technologies on ocean economic performance through to 2050, the OECD has modelled an increase in the contribution to GVA growth from growth in capital services per hour worked. Projections of productive capital stock, trend employment and working age population from the OECD's long-term baseline projections are used to estimate future productive capital stock per hour worked – the benchmark towards which all ocean economic activities in all countries converge. Chapter 4 suggests that the contribution of growth in information and communication technology (ICT) capital services to GVA growth is low relative to non-ICT capital services in ocean economic activities. Forcing convergence towards the growth rates suggested by the OECD's long-term baseline productive capital stock therefore represents a substantial increase in the productivity of the ocean economy capital stock.

All ocean economic activity groups experience a substantial increase in real-terms GVA relative to the baseline projection (Figure 5.5). At the lower end of the range are 'maritime transport and maritime ports' and 'offshore oil and gas and offshore industry' which finish the period around 39% higher on average that they would do in the baseline projection. The largest effect – at 42% in 2050 – occurs in 'maritime shipbuilding and maritime equipment manufacturing' and represents the largest positive average effect on ocean economic performance of any of the shaping forces. As a result, the global ocean economy reaches 2050 40% higher than it would do without the catch-up productivity growth.

Figure 5.5. Catch-up investment in productive capital stock would have large positive effects on ocean economic activity groups relative to the baseline projection

Global ocean economic activity group gross value added in chained volume indexes under capital services input growth prioritisation referenced to 2015 relative to baseline projection chained volume indexes



Note: Gross value added chained volume indexes for the overall economy and each ocean economic activity group are calculated under the assumption that contribution of capital services growth converges with the growth rate of productive capital stocks implied by the OECD's long-term baseline projections. The relative index is then calculated as the ratio of each chained volume index to the baseline projection chained volume indexes setting the baseline projection chained volume indexes equal to 0. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity. The shaded areas represent the 80% projection interval estimated by aggregating the lower and upper bounds of the estimated prediction intervals in growth in hours worked and the components of labour productivity growth by ocean economic activity in each country.
Source: OECD Ocean Economy Monitor, January 2025.

Summary

The ocean economy is facing a range of disruptive changes over the coming decades which imply a significant departure from its previous trajectory.

The magnitude and the direction of the effects of various shaping forces on ocean economy growth were modelled in order to be able to compare their severity. This suggests that different ocean economic activity groups will be affected in different ways and to varying degrees. Particularly exposed to impending changes are the offshore energy activities including 'offshore oil and gas extraction' and 'offshore wind and renewables'.

Combining qualitative information with quantitative projections of the potential effects of the various global forces shaping the ocean economy's future suggest that the isolated effects of climate change, the global energy transition, and science, technology and innovation are particularly influential.

The next chapter – Chapter 6 – presents two alternative scenarios which place the main focus on the three most influential drivers identified above.

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6 Alternative scenarios for possible futures of the ocean economy

This chapter examines how global shaping forces may impact selected areas of the ocean economy over the coming decades. It then presents two possible scenarios for the future ocean economy based on different energy transition pathways – one rapid and one gradual – through to 2050. These scenarios highlight differences in trajectories and emphasise the crucial role of energy policies and technological advances in shaping the future ocean economy.

Introduction

The foresight exercise in this report presents a set of possible future ocean economies. The aim is to inform policy decisions targeting the development of the ocean economy while conserving, sustainably using, and restoring marine ecosystems into the future.

The preceding chapters have examined the evolving governance of an ocean economy facing mounting challenges (Chapter 2), evolutions in ocean economic activity groups in the past (Chapter 3), and projections of their potential growth to 2050 under the assumption that historical trends persist (Chapter 4). However, the continuation of historical trends is improbable given the profound effects key global drivers – including demographic shifts, climate change, geopolitical uncertainties, and the energy transition to name a few – are likely to have on the broader economic landscape in the coming decades. These global forces are analysed individually in the previous chapter (Chapter 5).

This chapter builds on that foundation by first considering how global shaping forces could impact selected industries – offshore oil and gas and marine renewable energy, marine and coastal tourism, maritime transport and shipbuilding, marine fishing and aquaculture, and seabed mining. A second section presents two plausible scenarios for the ocean economy centred on different trajectories for the global energy transition. One scenario envisions a more rapid transition, while the other assumes a more gradual shift to 2050. The resulting scenarios illustrate substantial differences in both the overall trajectory of the ocean economy and the composition of its activities, highlighting the critical role of energy policies and technological developments in shaping its future evolution.

Likely impacts of combined shaping forces on key areas of the ocean economy over the next decades

Drawing on scientific research and industry outlooks, the interplay of key global drivers—demographic trends, climate change, geopolitical tensions, and the energy transition will impact key ocean economic activities, amplifying both opportunities and challenges in the next decades. And given the interconnected nature of the ocean economy, developments in one area would be expected to have ripple effects across others. Potential future developments are explored for selected activities, including offshore oil and gas and renewable energy, marine and coastal tourism, maritime transport and maritime shipbuilding, marine fishing and marine aquaculture, as well as seabed mining. Some of these can be found in the ocean economic activity groups modelled in later sections.

Offshore oil and gas and renewable energy

The evolution of offshore oil and gas production will be shaped by multiple factors, including market dynamics, global energy policies, technological advancements, and the pace of the transition to low-carbon energy sources. The sector is expected to remain a key contributor to the ocean economy for the foreseeable future. However, its growth prospects are increasingly challenged by the expansion of renewable energy industries, driven by strategic energy autonomy objectives, climate policies, and rising demand for clean energy solutions.

Several governments in OECD and partner countries are implementing greenhouse gas emission limits, carbon pricing, and stricter environmental policies targeting offshore oil and gas operations (IEA, 2024[1]). While deepwater projects remain among the most cost-competitive sources of oil supply, they face mounting financial pressures due to supply chain disruptions and inflationary trends (Erlingsen and Busby, 2024[2]). Achieving a 50% reduction in emissions intensity across oil and gas operations by 2030 would require approximately USD 600 billion in upfront investment, equivalent to 15% of the sector's windfall net income in 2022 (International Energy Agency, 2023[3]). However, many emissions-reducing measures could generate new revenue streams, allowing operators to recover their investments by minimizing gas flaring and optimizing resource utilization. Some large energy companies are reallocating some capital toward offshore wind, green hydrogen, and carbon capture projects while maintaining oil and gas exploration in profitable deepwater regions (IEA, 2024[1]). Meanwhile, aging infrastructure, particularly in shallow-water fields such as the North Sea, is facing early decommissioning due to rising maintenance costs and stricter environmental requirements (Norges Bank Investment Management, 2018[4]).

Major ocean economy actors, particularly in the Middle East, are already accelerating economic diversification plans, in an effort to balance their oil dependence. Initiatives such as Saudi Arabia's Vision 2030 and the UAE's Energy Strategy 2050 aim to expand investments in renewables, hydrogen, and tourism (Guillemette and Château, 2023[5]). While demand for oil could decline in key markets in the decades to come, natural gas production should continue to expand in the foreseeable future, reinforcing its role as a transitional energy source to meet global demand for lower-carbon fuels. Additionally, governments and companies are increasingly investing in emissions-reducing technologies such as carbon capture and storage, despite ongoing uncertainties regarding their long-term environmental implications (International Energy Agency, 2021[6]).

Among the various ocean-based industries, offshore wind energy stands to benefit most from the accelerated transition toward renewables. Even without factoring in geopolitical disruptions, such as the Russian war of aggression against Ukraine, projections indicate strong growth in offshore wind capacity over the next decade. For 2030, IEA (2019[7]) estimates total global installed capacity to reach between 165 GW (in its Stated Policies Scenario) and 225 GW (in its Sustainable Development Scenario); GWEC (2022[8]) expects total global offshore capacity to reach 370 GW by the end of 2031; and IRENA (2021[9]) foresees 380 GW installed by 2030 . The latter estimates would be equivalent to a more than ten-fold increase over 2020.

By 2040, advancements in energy storage technologies could further enhance grid reliability by mitigating the intermittent nature of renewables. As these storage solutions become more cost-effective and widely adopted, they will play a central role in accelerating the transition to a low-carbon energy system. Additionally, hybrid offshore energy platforms integrating offshore wind, green hydrogen production, and new carbon capture technologies could emerge, enabling oil and gas operators to decarbonize operations while maintaining a level of economic viability. Several offshore regions—including the North Sea, Gulf of Mexico, and offshore fields in Asia—could as well witness increased efforts to restore marine habitats to enhance blue carbon. Some decommissioned oil fields are being repurposed into marine protected areas, supporting ecosystem recovery after decades of resource extraction (IPCC, 2021[10]).

As climate change intensifies and energy systems increasingly incorporate emissions-reducing innovations, global demand for fossil fuels could decline, although not disappear over the period. Future offshore oil and gas platforms could become increasingly automated, managed remotely, and optimized through AI-driven efficiency systems.

Marine and coastal tourism

Marine and coastal tourism, particularly eco-tourism, could continue growing by 2030, driven by rising demand from the expanding middle class in emerging economies and aging populations in Europe and North America seeking eco-friendly travel options (OECD, 2021[11]; World Travel and Tourism Council, 2020[12]).

Shorter-haul and regional tourism are expected to increase due to higher air travel costs and environmental awareness. Domestic demand in many emerging economies, where demography continues to rise, would expand as well leading to increased environmental externalities in already heavily populated costal zones (Northrop and et al., 2022[13]). As an example, an estimated 6.1 million tonnes of plastic waste enter aquatic ecosystems annually, with 1.7 million tonnes ultimately reaching the ocean. Without the implementation of more ambitious policies, mismanaged plastic waste could rise by 47%, leading to a 50% increase in plastic leakage into the environment by 2040, compared to 2020 levels (OECD, 2024[14]).

Climate risks such as extreme weather, coral bleaching, and rising sea levels are expected to pose increasing vulnerabilities, especially in tropical and coastal regions reducing tourism appeal in some destinations (Scott, Hall and Gössling, 2019[15]; IPCC, 2023[16]). The Caribbean experienced already an 85% increase in extreme weather events from 2001 to 2020 compared to 1980-2000, and the trends are expected to accelerate. These events have caused significant socio-economic costs, averaging 2.13% of GDP annually between 1980 and 2020 and affecting 24 million people during that time (OECD/IDB, 2024[17]). In the state of Queensland, Australia, the bleaching of the Great Barrier Reef could cause the loss of 1 million visitors to the region each year, equivalent to at least 1 billion Australian Dollars in tourism spending and 10 000 jobs (Australian Climate Council, 2017[18]). An increasing number of touristic destinations would require to invest with development assistance funding and philanthropy support in adaptation measures like coastal defences, resilient infrastructure, and marine restoration, though efforts could be limited by funding, particularly in low-income regions (eco-union, 2019[19]). Sustainable tourism practices, including green certification programmes, gain traction in high-income and some emerging destinations. If plastic production and consumption were reduced, they would directly contribute to these more positive developments (OECD, 2024[14]).

Beyond climate risks, environmental stressors originating on land and in freshwater affect the ocean economy, calling for a whole-of-water approach that links freshwater and marine ecosystems with the surrounding human settlements and their accompanying activities and structures (OECD, 2024[20]). For instance, the socio-economic gains of reducing pollution in the Guanabara Bay in the state of Rio de Janeiro, through the universalisation of sanitation systems have been estimated at 25.4 billion Brazilian Reals between 2016 and 2046, by increasing tourism revenue and the value of real estate along the bay's shores, reducing public health costs of waterborne diseases, and increasing income through improved health and productivity (OECD, 2024[21]).

By 2040, rising temperatures could expand the tourist season in temperate coastal regions, including parts of Northern Europe and Canada (IPCC, 2023[16]). Destinations traditionally considered summer-only start attracting visitors in spring and fall, shifting tourism flows northward and reducing demand for tropical destinations during hotter months (IPCC, 2021[10]). In fifteen years or so, continuing sea-level rise could however lead to significant coastal erosion, damaging beaches, resorts, and infrastructure in many low-lying areas. Some tourist areas in the Caribbean, Southeast Asia, and the Indian Ocean would require extensive coastal defences (elevated buildings, seawalls, and flood-resistant designs) or face abandonment (OECD, 2021[22]). To protect tourism-dependent ecosystems, several countries could designate new MPAs beyond their 30x30 objectives, and invest further in habitat restoration, such as rebuilding mangroves (OECD, 2021[11]).

Despite adaptation efforts, some islands and coastal areas could be no longer be viable tourism destinations by 2050 or earlier. These regions would face long-term economic challenges and need alternative income sources (IPCC, 2023[16]). Virtual tourism technologies could as well provide immersive experiences of marine life and coastal sites, offering limited revenue for climate-impacted regions, though they cannot fully replace physical tourism income (Northrop and et al., 2022[13]).

Box 6.1. Extreme weather and biodiversity loss will increasingly impact coastlines and coastal settlements

Trends in extreme weather and biodiversity loss – mangroves, corals reefs – are increasingly threatening coastal regions and cities in coastal countries in various parts of the world, especially those with long coastlines and dense coastal populations, facing significant threats from rising sea levels and coastal erosion (Armstrong McKay et al., 2022[23]; OECD, 2025[24]).

These challenges could render some areas uninhabitable, and many unsuitable for business activities, while also causing extensive damage to existing infrastructure. As an illustration, over 20% of Indonesia's coastline is at risk of being impacted by a 1-meter rise in sea level. And although projections for sea-level rise by 2100 vary (from 0.2 meters to as much as 2 meters), submersion occurs now regularly, and adaptive measures and sustainable coastal management are already underway with the move of the capital Jakarta to a new capital in a higher-elevation area (OECD, 2024[25]). The Mediterranean region as well is experiencing climate shifts at a pace exceeding global averages, with rapid warming of ocean temperatures observed across all seasons. These changes are having profound impacts on local populations, leading to more frequent and severe droughts, water shortages, reduced agricultural yields, natural disasters, and rising sea levels This combined with increased ocean economic activities imposes significant stress on ecosystems, leading to the depletion of natural resources and widespread environmental degradation (Plan Bleu, 2025[26]).

Coastal cities and regions play and important role in mitigating these trends due to their policy prerogatives and investment responsibilities. Subnational governments often have competencies for urban and regional planning, water and sanitation, waste management and climate resilience that affect freshwater and saltwater environments and ecosystems (OECD, 2024[20]). For example, in the state of Rio de Janeiro, the socio-economic gains of reducing pollution in the Guanabara Bay through the universalisation of sanitation systems have been estimated at BRL 25.4 billion between 2016 and 2046, by increasing tourism revenue and the value of real estate along the bay’s shores, reducing public health costs of waterborne diseases, and increasing income through improved health and productivity (OECD, 2024[20]). Local and regional governments also play a central role in enhancing resilience to extreme events exacerbated climate change, accounting for 63% of total climate-significant public expenditure and 69% of climate-significant public investment across 33 OECD and European Union countries in 2019. More regions are working with national governments in setting up marine protected areas along their coastlines (Maestro, Chica-Ruiz and Pérez-Cayeiro, 2020[27]). A large “Ocean Rise & Coastal Resilience Coalition” will meet for the first time at the next United Nations Ocean Conference, held in June 2025 in Nice, France.

Maritime transport and shipbuilding

Maritime transport driven by international trade is among the ocean economic activities directly impacted by key shaping forces, from demography, the geopolitical situation, and energy systems’ transformation to climate change, which are expected to drive significant changes in freight composition and potentially alter shipping routes.

Maritime trade could rise substantially through to 2050 (ITF, 2021[28]) (DNV, 2021[29]) (DNV, 2021[29]). Higher rates of growth in food consumption and in demand for infrastructure act as a lever on maritime trade in food products, livestock and cereals, iron and steel, etc. while the faster rate of urbanisation can lead to greater demand for trade in commodities. That in turn translates ultimately into increased business for maritime shipbuilding, where growth in newbuilding demand can be expected in bulkers, container ships and general cargo vessels (Daniel, Adachi and Lee, 2022[30]). However, significant declines in the share of trade carried by crude oil tankers and oil products tankers could occur, with a significant increase in the share of gas carriers (DNV, 2021[29]). At the same time, a combination of regulatory pressures on emission levels and possibly higher fossil fuel prices, as well as ports adaptations (see Box 6.2), could see carriers step up the search for alternative fuels and energy (i.e. biofuels, LNG, electricity and hybrid propulsion, ammonia, hydrogen, fuel cells, wind assistance) which could produce significant emissions reductions (Halim et al., 2018[31]).

Safe and cost-effective ship recycling would remain a pressing challenge in the decade to come for many coastal communities in the leading ship-breaking countries, primarily concentrated in South Asia. (e.g., Bangladesh, India, and Pakistan), as new generations of cleaner ships increasingly replace old fleets (Gourdon, 2019[32]). The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships will enter into force in June 2025, and should contribute to ensure that ships at the end of their operational lives are recycled safely, minimising risks to both human health and the environment (IMO, 2024[33]). However, with most large shipyards located in low lying areas, increased risks of extreme weather and sea-level rise will complicate the management of industrial pollutions (see Box 6.1).

Large companies could also adopt increasingly energy efficiency measures to meet IMO targets, employing speed reductions, optimized routing, and limited retrofitting (International Maritime Organization, 2023[34]). Although shipping companies will in the foreseeable future need to adapt constantly to new routes, as seen in Chapter 2, to avoid geopolitical flashpoints, such as parts of the Red Sea and the Black Sea, as well as managing climate-change related closures (e.g. droughts causing issues in the Panama and Suez canals).

Reverberations of these trends would inevitably be felt by maritime shipbuilding and the maritime equipment manufacturing. In the OECD's latest projections, demand for new maritime ships is set to grow through to 2030 for all main categories– bulkers, tankers, container and general cargo vessels (Daniel, Adachi and Lee, 2022[30]). Thereafter, the impact of various factors (e.g. growing regionalisation of trade, global energy system change) could become more noticeable.

In its 2023 strategy on greenhouse gas (GHG) emissions from ships, the International Maritime Organization (IMO) aims by 2030 for a 40% reduction in carbon intensity compared to 2008. The IMO also targets to reach net-zero GHG emissions "by or around, i.e. close to 2050" (International Maritime Organization, 2023[34]). In addition, national and regional policy measures could contribute to accelerate reductions, such as the recent inclusion of shipping in European Union Emissions Trading System since 2024 and the FuelEU Maritime Regulation since 2025 (OECD, 2025[35]).

These international, regional and national policy measures could push the commercial shipbuilding sector to adopt technologies like liquefied natural gas and biofuel propulsion, while R&D on hydrogen, methanol and ammonia systems accelerates, though these remain largely experimental (International Maritime Organization, 2023[34]). Shipyards in South Korea, Japan, and China could lead in integrating advanced technologies, including automation and AI-driven systems for enhanced efficiency and safety, while North American and European shipbuilders focus on modular designs for easier retrofitting with low-emission technologies (Daniel, Lee and Spieth, 2021[36]). Meanwhile, the current orderbook for alternative fuel–capable ships is predominantly held by Chinese and Korean yards, with European firms focusing on the development of low- and zero-emission propulsion engines (OECD, 2025[35]). Demand would grow in any case for lighter, durable materials like advanced composites to improve fuel efficiency.

Box 6.2. Possible trends for maritime ports

Maritime ports could see significant changes in their functions in the decade to come as many become hubs for electricity generation and begin to produce hydrogen as energy for carriers (DNV, 2021[29]). They will need to adjust both to the changing composition of freight throughput and to the demand for new energy supplies and services that vessels will require in-port to support their transformation away from fossil fuel energy sources (International Maritime Organization, 2023[34]). They also need to adapt to more extreme weather. Ports in developed regions would have likely begun transitioning to renewable energy sources and electric infrastructure for loading and unloading vessels by 2030, this would include increased use of shore power systems to reduce emissions from docked ships (Daniel, Lee and Spieth, 2021[36]). Leading ports in Europe and Asia, such as Rotterdam and Singapore, are already starting to build bunkering infrastructure for LNG and biofuels, although adoption is likely to be limited by high costs and low demand to start with. Investments in ammonia and hydrogen infrastructure are still exploratory (International Chamber of Shipping, 2020[37]).

The digital transformation of many ports is also ongoing, with further uses of the Internet of Things (IoT), artificial intelligence and predictive logistics technologies to streamline cargo handling, reducing turnaround times and optimizing energy use (Hoffmann and Hoffmann, 2020[38]). Current and future investments will increasingly change ports operations with the uses of automated cranes and smart tracking systems to improve efficiency, reducing labour needs, and optimising multi-modal operations within across the wider port areas. As shown in chapter 2, maritime transport is linked to many types of illegal activities, so with the rise in global trade, ports will certainly be strengthening security protocols to safeguard against threats such as cyber-attacks and smuggling. The maritime port security market alone is projected to reach USD 33.3 billion by 2030 (Frost & Sullivan, 2024[39]).

Ports in vulnerable coastal regions and in low-lying areas, especially in Asia and the Caribbean, are likely to have begun by 2040 to invest further in climate-resilient infrastructure, including seawalls, raised terminals, and flood-resistant designs to counter rising sea levels and storm surges (IPCC, 2023[40]). Of the world’s 3 800 ports, approximately one-third are situated within a tropical zone highly exposed to the most severe impacts of climate change (Economist Impact, 2023[41]). Automated cargo handling, AI-powered logistics, and predictive maintenance could become more widespread, significantly reducing labour dependency and operational costs.

Port authorities often lead or take part as well in initiatives to restore ecosystems surrounding ports and enhance their resilience to climate change (OECD, 2024[20]). For example, the Port of Seattle is using nature-based solutions to restore coastal ecosystems and capture carbon emissions from its operations. As part of a consortium of four partners, the Port of Vigo in Spain is hosting the Living Ports project, which aims to shift away from grey infrastructure in ports, including through seawalls with innovative concrete that fosters the regeneration of local marine biodiversity. Through its 15-year environmental plan Cáyoli initiated in 2016, the French Port of Guadeloupe aims to protect and restore the mangroves, coral reefs and seagrass ecosystems present in the port, including through the development of mangrove and coral nurseries, the restoration of nesting areas for different species, and awareness-raising campaigns with local students.

Marine fishing and aquaculture

Marine fisheries and aquaculture will be increasingly affected by the combination of the different shaping forces. They stand to benefit from the population changes described in Chapter 4, as demand for their products increases over time. Also important is the projected acceleration of changes in population composition and structure. Marine fish and seafood consumption tends to be higher among the elderly, urban dwellers, and in the advanced economies, and likely to positively affect demand.

A warming ocean and increasing acidification will however impact increasingly species distribution, driving some species poleward or into deeper waters (IPCC, 2021[10]). Ocean conditions will need to be increasingly monitored with ocean observing systems, like the U.S. Integrated Ocean Observing System systems, which are already providing critical data to support US fisheries in particular (Rayner, Jolly and Gouldman, 2019[42]; Rayner, Gouldman and Willis, 2019[43]). The long-term decline in the productivity of global fisheries is likely to be most pronounced in tropical and sub-tropical regions while gains may be made elsewhere to the extent that species will drift towards the polar regions. The migration of commercially valuable fish species to colder waters would place pressure on high-latitude ecosystems and would increase fishing activities in the Arctic and Antarctic regions (FAO, 2022[44]). In the long run, Arctic and Antarctic fisheries will face rising pressure as high-latitude ecosystems become new centres for fishing activity, while the Protocol on Environmental Protection to the Antarctic Treaty and its provisions is not due for review until 2048 (50 years from its entry into force) (Antarctic Treaty Secretariat, 2024[45]). Finally, by 2030, 23% of transboundary stocks are expected to shift, impacting 75% of the world's economic exclusive zones placing pressure on existing co-management arrangements and creating the need for new ones (Palacios-Abrantes et al., 2022[46]).

Should the World Trade Organization (WTO)'s Agreement on Fisheries Subsidies begin to take effect, some developed countries will be implementing initial reductions in subsidies, particularly those linked to Illegal, Unreported, Unregulated fishing and overfished stocks. Developing countries, especially those heavily reliant on artisanal fisheries in Southeast Asia and West Africa, would likely receive some flexibility in subsidy reduction to protect local economies (OECD, 2021[47]). Ongoing reforms to fisheries support may that presents a risk of overfishing and Illegal, Unreported, Unregulated fishing in the absence of effective management will have implications for the activity and structure of the global fishing fleet (OECD, 2025[48]), which will be bolstered should the WTO Agreement on Fisheries Subsidies begin to take effect. The impacts could become more pronounced if the second round of negotiations, disciplining subsidies to overfished stocks, concludes successfully, but the extent to which this will impact fishing activity and production by 2050 is hard to predict.

More monitoring of industrial fishing fleets in the high seas could be on the horizon, thanks to technological advances. In higher-income regions, advances in digital monitoring, satellite tracking, and vessel tracking could improve further fisheries management and enforcement (Wright et al., 2018[49]). Ecosystem-based fisheries management (EBFM) used by regional fisheries management organisations would contribute as well better yields for some species, while increasing oversight at sea to counter IUU fishing. However, EBFM is complicated and resource intensive so many countries, especially those with limited financial resources, would still struggle to implement these practices effectively (Cohen et al., 2019[50]).

With respect to marine aquaculture, the potential for global expansion exists (Gentry et al., 2017[51]). Part of that future expansion could come from aquaculture intensification, but also partly from extensification including siting of operations offshore, with automation of operations (OECD, 2019[52]). Both strategies should increase the industry's energy demand in the decade to come, and its necessity for addressing the emissions from support vessels through deployment of electric propulsion and use of hydrogen if possible (UN Global Compact and WWF, 2022[53]). Farming operations advances could include the shift to more electrification and application of hydrogen as well as other renewable energy sources. They will, for example, foster an expansion in suitable habitats for finfish aquaculture in some regions – at least for the next decade. However, as ocean warming and acidification increase, the resilience of marine species to be farmed are projected to vary (IPCC, 2023[16]). A decline in suitable habitats for the cultivation of crustaceans and seaweeds could occur in many parts of the world (IPCC, 2021[10]). Beyond this, and as the ocean continues warming overall, rates of growth in aquaculture output are unlikely to match those of previous periods.

Seabed mining

As both the digitalisation and energy transformation gather speed in the next decades, increases in demand are expected for rare earth elements (REEs) but also for minerals used in structural materials, because of continuing urbanisation, rising investment in infrastructure and housing around the world. In the International Energy Agency's Net Zero Emissions Scenario, the total market value of critical energy transition minerals—copper, lithium, nickel, cobalt, graphite, and rare earth elements—is projected to more than double to USD 770 billion by 2040 (IEA, 2024[54]).

While there is significant potential in the reprocessing of some metals, the challenges are important, not least that of stepping up investment in research and recycling capacities, and efforts to find substitute materials (IEA, 2020[55]). However, recycling already contributes to develop second markets (i.e. the market value of recycled battery metals experienced nearly 11-fold growth between 2015 and 2023), and a successful scale-up of recycling could lower the need for new mining activity by 25-40% by 2050 (IEA, 2024[56]). For offshore wind energy for example, recycling could possibly enhance global supplies of critical metals at a rate of around 12% by 2040 and supplies of REEs by as much 21% for the industry (Li et al., 2022[57]).

In terms of supply chain issues, China and Russia currently play dominant roles in the critical minerals sector. China controls a significant share of global mining, processing, and refining capacity, particularly for rare earth elements, lithium, and cobalt, while Russia is a major supplier of key minerals like nickel, palladium, and titanium (IEA, 2024[54]). Their influence raises concerns over export restrictions and geopolitical leverage for other countries reliant on these resources for technology, defence, and clean energy. A diversification could take shape in the next decade, as countries in Africa, Latin America and Asia as well as Australia, emerge as hubs for critical minerals (Brahab, 2022[58]; Purdy and Castillo, 2022[59]).

In this context, interest has been growing in the ocean as an additional potential source of metals and minerals, even if vast areas of the ocean are still unexplored and under-surveyed (Mayer et al., 2018[60]). Seabed mining operations refer to the extraction of minerals and resources from the ocean floor. It involves the recovery of valuable metals and minerals from three primary types of seabed deposits: polymetallic nodules, polymetallic sulphides, and cobalt-rich ferromanganese crusts. Although seabed mining operations have been underway for some years now in national (shallow) waters for sand and diamond notably. Mining at depths exceeding 200 meters has been conducted mainly for demonstration so far. Mining deep-sea minerals in the high seas is still on hold as exploration, research and negotiations on a mining code continue, as mentioned as well in Chapter 2 (International Seabed Authority, 2022[61]).

To date, a severe lack of information and data about the size of mineral deposits, their geographical distribution and composition has prevented a proper global assessment of deep-sea resources from being conducted (Hannington, Petersen and Krätschell, 2017[62]). There is need for improved, updated geological surveys, especially for developing economies. Open data sources are few and far between – the USGS is currently the only open data source for mineral resources with global coverage. The International Seabed Authority has a mandate over 54% of the world's ocean seabed, and its current contractors are exploring regions corresponding to around 1% of the seabed, delineating mineral deposits and resources, through drilling core samples and multibeam echosounder. A few have published results of their research so far (Knobloch et al., 2017[63]; Kuhn and Rühlemann, 2021[64]) and some are sharing their bathymetric data to advance global seabed mapping efforts led by the International Hydrographic Organisation, but this is not a general practice yet. The true extent of land-based deposits of critical minerals is also unknown, and so it is unclear whether they would be sufficient to meet future demand or not.

While the pressure to open deep-sea deposits for exploitation is likely to mount, there remain many open issues and knowledge gaps relating as well to the magnitude of potential economic gains, technological feasibility and the serious impacts on the ocean's ecosystems of mining operations. Despite high demand for minerals, the economic case for seabed mining, particularly deep seabed mining, is not evident in view of the strong volatility of prices. In recent years, the critical minerals market has experienced extreme volatility in with prices soaring in 2021-2022 before plunging sharply. Since 2023, lithium prices have dropped by over 80% after surging eightfold in the previous two years, while nickel, cobalt, and graphite have lost half their value over the same period (IEA, 2025[65]). This explains why the mining of rare minerals is already subsidised in most parts of the world.

Although strategic access to resources comes into play in a context of geopolitical tensions, the extra costs of mining and processing rare earth elements from the deep ocean may not be making economic sense in the foreseeable future, considering technological limitations, operational costs and high uncertainty on the impacts on the marine environment, with possible implications as well for other sectors (e.g. fisheries, aquaculture, defence) (Miller et al., 2018[66]; Leal Filho et al., 2021[67]). Some of the consequences of seafloor mining may also be unforeseeable since – despite considerable progress in acquiring knowledge of deep-sea ecosystems - there is still a significant lack of information and data on deep-sea biodiversity and ecological connectivity, functions and services (Levin, 2021[68]; Hauton et al., 2017[69]). In light of the knowledge gaps and given the risk of irreversible damage to deep-sea ecosystems,, it is considered by many experts still not possible to arrive at a conclusive risk assessment of the impact of large-scale seabed mining (Amon et al., 2022[70]; Niner et al., 2018[71]; Levin, Amon and Lily, 2020[72]). Precautionary approaches should be applied by all to avoid irreversible damage to the ocean environment, as discussions continue within the International Seabed Authority membership.

Box 6.3. Advances in ocean science and technologies on the horizon

Over the next two decades, ocean science is poised to undergo significant transformations, driven by technological advancements that will support both improved ocean stewardship and ocean industries productivity. As seen in Chapter 2, the United Nations Decade of Ocean Science for Sustainable Development (2021–2030) is catalysing global efforts to enhance understanding of marine ecosystems and their role in climate regulation (IOC-UNESCO, 2024[73]). More integrated research should occur to build the scientific foundations to address complex challenges such as pollution, overfishing, and biodiversity loss, fostering a more holistic approach to ocean management. Technological innovation will be at the forefront of this evolution in the next decades:

- The deployment of advanced ocean observation systems, including new drones and underwater vehicles, are expected to revolutionise data collection, enabling continuous and cheaper monitoring of oceanic processes with unprecedented precision (OECD, 2019[52]; European Marine Board, 2021[74]).
- Advanced seabed mapping should also come to fruition, with ongoing efforts such as the General Bathymetric Chart of the Oceans (GEBCO) - Seabed 2030 Project aiming to map the entire seafloor by 2030 (Mayer et al., 2018[60]; Nippon Foundation-GEBCO, 2022[75]). Based on key standards from the International Hydrographic Organization. Sophisticated seabed image processing techniques will as well enhance capacities to study previously inaccessible ocean depths. These advancements will facilitate detailed mapping of the seafloor and comprehensive assessments of marine biodiversity.
- Genomic research is also anticipated to lead to breakthroughs in understanding marine biodiversity and its implications for human biology and planetary health. The Ocean Genome Atlas Project, for instance, focuses on sequencing the DNA of plankton and making data available (Vernette et al., 2022[76]). This endeavour aims to catalogue these microscopic organisms, which play pivotal roles in marine food webs and global biogeochemical cycles.
- In the realm of ocean modelling, the emergence of AI-driven systems promises to transform predictive capabilities, such as the AI-Driven Global Ocean Modelling System (AI-GOMS) or the many ocean digital twins being constructed, such as the effort of Mercator Ocean (Mercator, 2025[77]; European Marine Board, 2021[74]).
- More research on Carbon Dioxide Removal technologies (CDR), such as ocean alkalinity enhancement, electrochemical carbon capture, or artificial ocean fertilisation to increase carbon sequestration,will be crucial to assess their feasibility, scalability, and environmental impacts to effectively mitigate atmospheric CO_2 levels (Oschlies et al., 2025[78]).

Collaborative international research efforts will remain essential in addressing the multifaceted challenges facing the ocean and the ocean economy, with science data policies that promote common FAIR standards (Tanhua et al., 2019[79]; Pendleton et al., 2019[80]). These projects underscore the necessity of multidisciplinary collaboration and co-design, particularly in vulnerable coastal regions and some Small Island Developing States.

Exploration of two possible scenarios for the ocean economy shaped by the pace of the global energy transition

Possible alternative trajectories for the future of the ocean economy are too numerous to be addressed in this report. Hence, for the purposes of illustration, this final section offers two plausible scenarios exploring how some of the likely global changes identified in previous chapters might combine to impact the ocean economy of the future. Using combinations of global shaping forces as a backdrop, they are centred on the pace of the global energy transition, with one outlining a faster transition and the other a slower one, over three decades – 2030, 2040 and 2050.

Each scenario envisions, albeit following different pathways, a transformation that supports economic goals while addressing climate change and biodiversity loss. Each transition pathway presents both opportunities and challenges that will largely determine the ocean economy's future growth and composition.

The scenarios presented here focus on the possible evolutions of the global ocean economy and shifts in its composition, with some examples of likely implications for specific ocean industries. The scenarios and modelling focus on global-level impacts. They do not get into detailed analysis of national and regional situations and provide only a few illustrations. However national and regional impacts can be a very important aspect. They could be explored in more granular detail as part of future foresight activities of the OECD Ocean Economy Monitor programme.

Scenario 1. Acceleration of the global energy shift

This is a scenario in which the global energy transition, despite a difficult initial period, succeeds in speeding up in the subsequent two decades. The acceleration is driven mainly by two major shaping factors: an improving global economic and political context favourable to the wider diffusion of renewable energy; and greatly increased efforts especially in many parts of the ocean economy to adopt and make use of digital technologies. Although ultimately failing to hit global emission-reduction targets by 2050, the gap is at least significantly narrowed by a big expansion of the share of renewables in world energy production and a corresponding decline in the share of fossil fuels, notably oil.

Describing the scenario

The short-term prospects for a faster transition to 2030 are not very promising. Geopolitical tensions around the globe coupled with mounting trade frictions between major trading countries as well as slowing world economic growth and concerns about public deficits and debt levels, create an overall context of uncertainty for economic actors, notably businesses and investors. As a result, there is a weakening of national and international resolve to accelerate the transition process, aggravated by narrowing margins of manoeuvre with respect to financial resources. Prospects pick up however as the world moves into the 2030s.

The internal political dynamics of nations evolves, geopolitical tensions and trade frictions ease, and debt/public sector deficits become more manageable. International co-operation on tackling emissions and climate change gathers momentum. Meanwhile, in many parts of the global economy, and not least in the ocean economy, national efforts have been underway to exploit the growing potential offered by digitalisation. Growing skill shortages in the first part of the 2020s have led countries to step up on a major scale education and training, especially in digital science and technology. This has helped create the basis for a more qualified workforce to support the anticipated wave of new technologies in the coming years.

Pressure for transparency is also rising over the period, as policy makers and regulatory bodies demand more comprehensive reporting and monitoring of commercial and institutional operations to ensure alignment with national and international goals. This is the case for many established and emerging industries, from emissions of shipping to fisheries and marine carbon dioxide removal projects, irrespective of their scale, requiring thorough monitoring, reporting, and independent verification.

As the uncertainties weighing on the prospects for the world economy recede, the investment climate has much improved. Spending particularly on innovative technologies has begun to expand rapidly both in the advanced and emerging market economies. More breathing space becomes available for investment in renewables, for technology transfers, and for financial transfers to developing economies to assist them with their transition efforts. The climate for technology transfers becomes more favourable, and the progress to faster transition is able to spread more widely to emerging economies and developing nations. As a result, productivity growth recovers strongly, especially in those sectors (including some ocean economy activities) that have previously lagged behind overall productivity trends.

The pace of global transition accelerates further during the 2040s. However, it proves hard to make up for the ground lost in the latter half of the 2020s and early 2030s. Consequently emission-reduction targets for 2050 are not fully met, but the gap narrows considerably.

Implications for the global ocean economy

The modelling of an accelerated transition scenario suggests that global ocean economy real-terms gross value added could grow at a lower rate through to 2050 than in the baseline projection, which assumes historical trends largely continue.

An illustration of the effects on the global ocean economy of a combination of shaping forces that are roughly consistent with an accelerated transition scenario is provided in (Figure 6.1). The following assumptions are relied upon to construct this projection and compare it to the baseline projection outlined in Chapter 4:

- Contributions to GVA growth from labour composition and multifactor productivity converge towards labour efficiency trends from the OECD's long-term baseline projections energy transition scenario (Guillemette and Château, 2023[81])
- All other components of GVA growth in the offshore wind and marine renewables ocean economic activity group continue at the growth trajectory modelled based on historical trends in Chapter 4
- Projected GVA growth in offshore oil and gas extraction is adjusted for the decline in the share of oil and gas in the energy mix according to the OECD's long-term baseline projections energy transition scenario
- Contributions to GVA growth from ICT and non-ICT capital services per hour converge towards growth in productive capital stock per hour worked in the OECD's long-term baseline productive energy transition scenario
- Income effects from climate change are expected to occur uniformly across ocean economic activity groups in each region at the lower bound of Kotz et al.'s (2024[82]) 10% confidence interval as described in Chapter 5

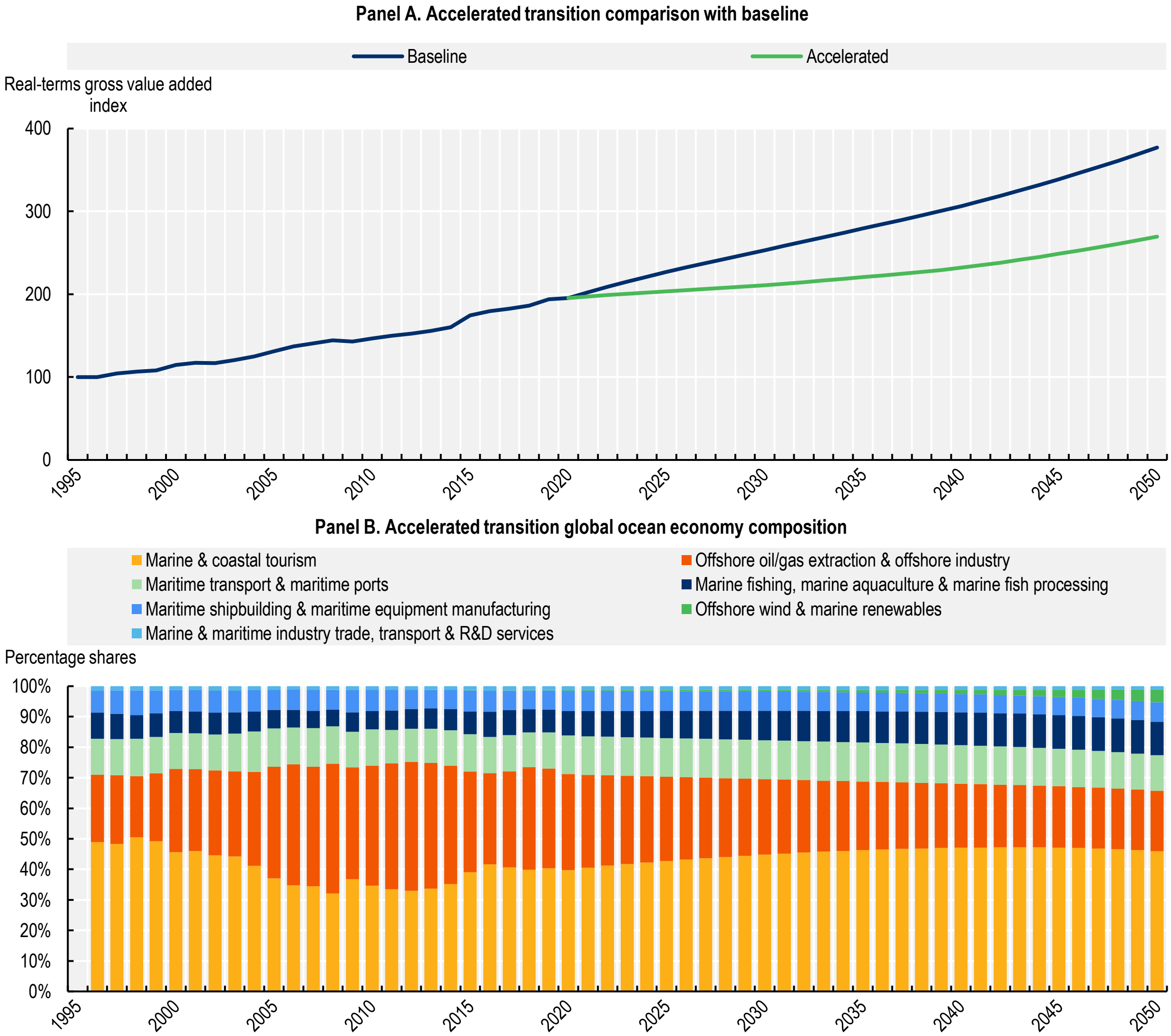
The accelerated transition scenario assumptions listed above result in a global ocean economy that is 40% higher in real-times GVA than it was in 2020 (Figure 6.1, Panel A). This indicates the likely growth slowdown that is likely to take place in the global ocean economy relative to the baseline projection which assumes historical trends continue.

The key driver of this reduction is a drop in offshore oil and gas extraction that broadly follows fossil fuels' decline in projected energy-mixes aligned with net-zero greenhouse gas emissions by 2050 (IEA, 2024[1]). The offshore oil and gas and offshore industry activity group was the second largest globally in 2020 coming in just behind marine and coastal tourism (which has a history of slower productivity growth than other activity groups). The baseline projections outlined in Chapter 4 suggest that, should historical trends persist, offshore oil and gas and offshore industry is set to become the dominant ocean economic activity group during the projection period. Curtailing the growth in offshore oil and gas in a scenario where the energy transition is realised, removes much of the future value added generated by the otherwise largest ocean economic activity group. The assumption concerning raising capital services per hour worked – which has the effect of increasing GVA growth rates in all ocean economic activity groups – is not powerful enough to override the loss of economic activity in offshore oil and gas extraction. The benefits to preserve long term growth for the ocean economy and a healthy ocean remain though important economic and policy drivers for supporting the energy transition pathway.

This evolution is largely underscored by the results in (Figure 6.1, Panel B). All ocean economic activity groups finish the projection period with higher real-terms GVA than at the beginning of the period, but the composition of the ocean economy changes substantially according to differences in activity group growth rates. Global GVA in offshore oil and gas extraction and offshore industry, for example, drops as a share of GVA in the global ocean economy from 31% in 2020 to 20% in 2050. Marine and coastal tourism, which starts the period with 41%, increases its share to 46% by 2050. Most other ocean economic activity groups maintain their share throughout the projection period. The exception is offshore wind and marine renewables which ends the projection period with a share 21 times larger than it was at the beginning (0.2% in 2021 to 4.2% in 2050).

Figure 6.1. Global ocean economic growth is likely to slow down in an accelerated transition scenario

Global ocean economy real-terms gross value added index in an accelerated transition scenario relative to the baseline projection and consequent global ocean economic activity group shares of global ocean economy gross value added



Note: In panel A, a gross value added chained volume index for the global ocean economy is calculated under the assumptions outlined in the text. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity under each scenario. In panel B, the projected ocean economic activity group indexes under the same assumptions are used to estimate global gross value added in each ocean economic activity group in future current price US dollars and the shares calculated from this measure.
Source: OECD Ocean Economy Monitor, January 2025.

Scenario 2. The Energy Transition Stalls

This is a scenario in which the economic and political context surrounding the transition process worsens in the second half of the 2020s, struggles to improve fundamentally in the 2030s, but gets back on track in the 2040s as the global climate deteriorates towards mid-century. This triggers a re-set of global emission-reduction targets, a flurry of international climate-related accords, and major efforts at national level to make up for lost time. This is however too late to make significant in-roads into global emission reductions by mid-century and 2050-targets are missed by a large margin. Over the 25-year span, progress towards expanding the share of renewables in the global energy mix slows, and the share of fossil fuels falls only gradually, as they are required to fill the energy demand gap left by the slower than anticipated roll-out of renewable energy. Over long periods, opportunities have been missed in many countries to harness the potential of advanced technologies to efforts aimed at accelerating the energy transition. Slow progress in adoption of renewable energy and in reducing the share of fossil fuels lead to only patchy energy-related technology advances in ocean economy activities.

Describing the scenario

The unfavourable global context of the second half of the 2020s and much of the 2030s is shaped largely by rising geopolitical tensions, the threat of trade wars, worsening conditions for international collaboration on climate change and energy transition issues, a darkening economic outlook for much of the world economy and shrinking fiscal headroom for government investment initiatives. Rather than bringing respite, much of the 2030s see prolongation of these unfavourable conditions, which tend to distract attention from critical long-term matters such as the energy transition in favour of resolving shorter-term issues. These latter issues include amongst others escalating trade disputes, and inadequate control over rising levels of public and private sector debt.

Consequently, in many countries insufficient attention and resources are devoted to preparing for the future. This concerns two important domains: gearing up education and training especially in science and technology to equip the workforce and society more generally with the skills necessary to navigate the digital era; and the necessary investment in advanced technologies and innovations to enable emerging opportunities to be fully exploited.

The ocean economy, with its rather poor record in productivity growth in several of its activities as well as neglect of investment in new technologies, is particularly disadvantaged in a race to respond to the challenges of a digital age. In a world of trade and investment barriers affecting large parts of the global trading system as well as limited room for financial and technology transfers, the geographic spread of the energy transition is considerably hampered. One important implication of this lack of dynamism is both to slow the growth in the share of renewable energy in world energy demand and production and to enable fossil fuels to maintain a key position in the global energy mix. By the early 2040s, geopolitical tensions begin to ease, trade barriers begin to weaken, and a broad improvement in international relations evolves not least in collaboration on climate change and the energy transition. But emission-reduction targets for 2050 have long since slipped out of reach, despite rapid progress in speeding up the energy transition during the 2040s, necessitating a huge global effort in the post-2050 period to restrain a further significant deterioration in the world's climate and biodiversity loss.

Implications for the global ocean economy

The modelling of a stalled transition suggests that this scenario may lead to a larger negative deviation from the baseline projection than the reduction projected in an accelerated transition scenario. The reduction from the baseline is such that global ocean economy real-terms GVA would not continue to grow under a stalled energy transition scenario and would finish the projection period at a lower level than it begins it.

An illustration of the effects on the global ocean economy of a combination of shaping forces that are roughly consistent with a stalled transition scenario is provided in (Figure 6.1). The following assumptions are relied upon to construct this projection and compare it to the baseline projection outlined in Chapter 4:

- Contributions to GVA growth from labour composition and multifactor productivity converge towards labour efficiency trends from the OECD's long-term baseline projections baseline scenario (Guillemette and Château, 2023[81])

- All other components of GVA growth in the offshore wind and marine renewables ocean economic activity group continue at 50% of the growth trajectory modelled based on historical trends in Chapter 4
- All other components of GVA growth in the offshore oil and gas ocean economic activity continue at the growth trajectory modelled based on historical trends in Chapter 4
- Trade disruption effects from bilateral tariffs are expected to occur uniformly across ocean economic activity groups in each region according to Góes and Bekkers's (2022[83]) regional estimates as described in Chapter 5
- Income effects from climate change are expected to occur uniformly across ocean economic activity groups in each region at the upper bound of Kotz et al.'s (2024[82]) regional 10% confidence intervals as described in Chapter 5

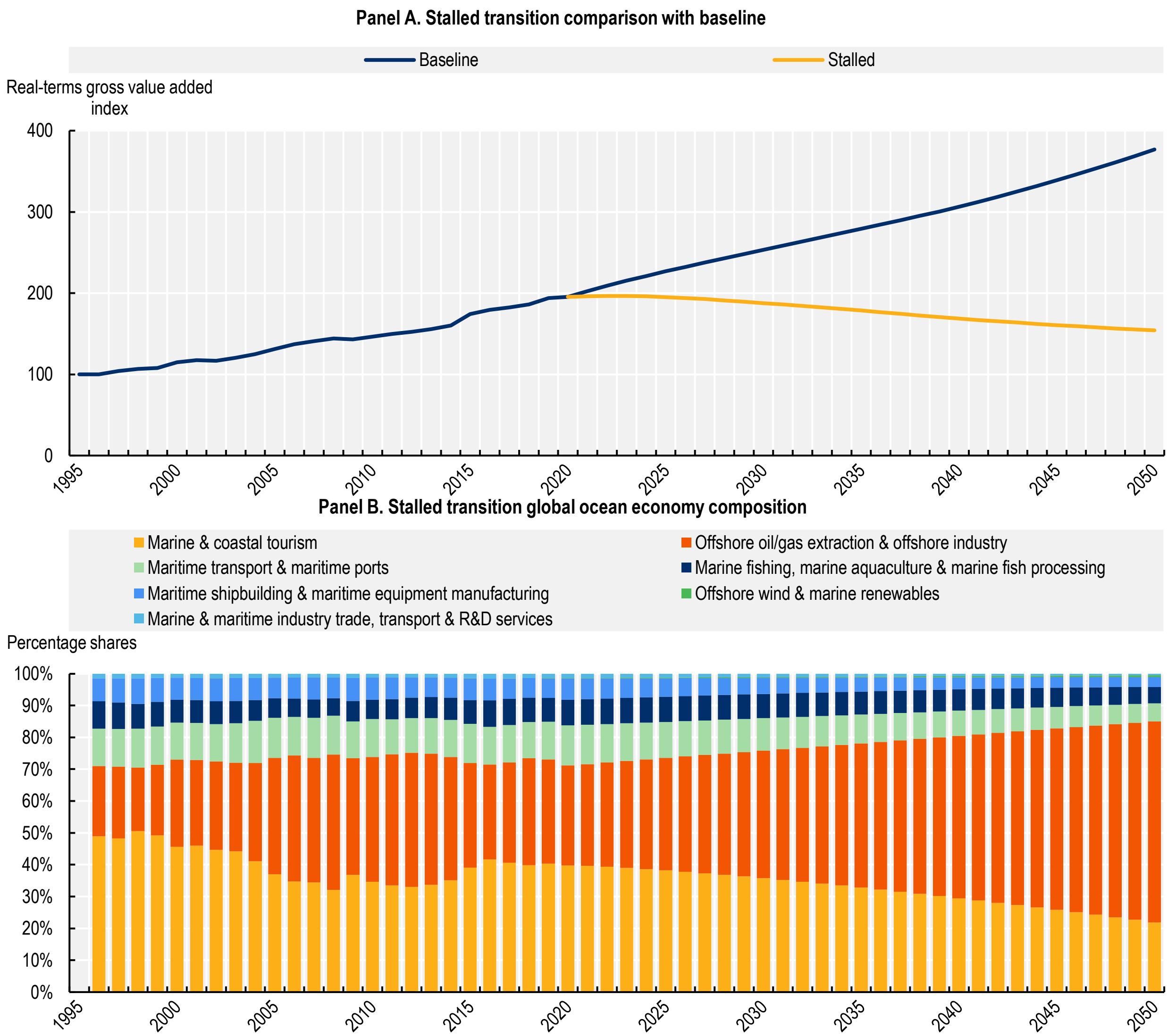
The stalled transition scenario assumptions listed above result in a reduction in global ocean economy real-terms GVA below 2020 levels of over 20% (Figure 6.2, Panel A). This suggests that a stalled transition would have far greater consequences for the global ocean economy than an accelerated transition and may lead to a period of contraction relative to the recent historical record.

The main difference between the scenarios that causes this result is a lack of catch-up growth in capital services per hour worked in the stalled transition scenario. The positive effect of the relevant assumption on all ocean economic activity groups in the accelerated transition scenario partially counterbalance the negative effect of the decline in offshore oil and gas extraction due to net-zero objectives. In the stalled transition scenario, there is no comparable positive force and the negative effects from climate change and trade disruptions push global ocean economy real-terms GVA far below the baseline projections premised on historical trends persisting.

As in the accelerated transition scenario, ocean economic activity groups grow at different rates. The resulting composition of the ocean economy in the stalled transition scenario is revealed in Figure 6.2, Panel B. Global GVA in offshore oil and gas extraction and offshore industry increases its share of GVA in the global ocean economy from 31% in 2020 to 63% in 2050. This is largely due to high projected growth rates in offshore oil and gas extraction in Western Asia. The share of the global ocean economy attributable to marine and coastal tourism is cut almost in half from 41% in 2020 to 22% by 2050 as climate change and trade disruptions take their affect. Most other ocean economic activity groups experience a roughly similar halving of their shares over the projection period. The exception, as in the accelerated transition scenario, is offshore wind and marine renewables which begins the projection period at 0.2% of the global ocean economy and ends it at 0.6%. In other words, as opposed to a 21-fold increase in the accelerated transition scenario, offshore wind and marine renewables only triples its share between 2020 and 2050 in a stalled transition scenario.

Figure 6.2. The global ocean economy growth slowdown would be even more pronounced in a stalled energy transition scenario and could lead to a period of contraction

Global ocean economy real-terms gross value added index in a stalled transition scenario relative to the baseline projection and consequent global ocean economic activity group shares of global ocean economy gross value added



Note: In panel A, a gross value added chained volume index for the global ocean economy is calculated under the assumptions outlined in the text. The lines represent the mean projected gross value added chained volume indexes calculated from the sum of projected growth in hours worked and the components of labour productivity under each scenario. In panel B, the projected ocean economic activity group indexes under the same assumptions are used to estimate global gross value added in each ocean economic activity group in future current price US dollars and the shares calculated from this measure.
Source: OECD Ocean Economy Monitor, January 2025.

Summary

This Chapter 6 has examined how different global forces, notably demographic shifts, climate change, geopolitical dynamics, and the ongoing energy transition may shape key ocean economic activities — offshore oil and gas extraction and marine renewables, tourism, transport, shipbuilding, fishing, aquaculture, and seabed mining—over the next decades. All these activities would benefit from better use of ocean science and technology to improve management and sustainability.

It then presented two possible scenarios for the future ocean economy based on different global energy transition pathways: one accelerating rapidly, the other progressing more gradually to 2050. These scenarios highlight contrasting trajectories, emphasising the pivotal role of energy policies and technological advances in shaping future economic outcomes.

In both scenarios, global ocean economy real-terms GVA underperforms over the next decades relative to a baseline constructed using historical trends. This reduction from the baseline is more pronounced in the stalled energy transition scenario than in the accelerated transition scenario. The global ocean economy continues to grow in the accelerated transition scenario, albeit at a slower rate than in the baseline projection. However, the stalled transition scenario results in a period of economic decline relative to the global ocean economy's historical record.

- In the accelerated transition scenario, the ocean economy experiences continued growth but at slower pace. While innovation and efficiency improvements support some ocean economic activity groups, they are insufficient to fully compensate for the loss of economic activity in the fossil fuel sector. The ocean economy shifts away from offshore oil and gas extraction, reducing its share of total global ocean economy GVA from a third in 2020 to one-fifth in 2050. Offshore wind and marine renewables expand substantially, with a share 21 times larger than at the start of the period. Marine and coastal tourism remains the dominant ocean economic activity group, growing its share to just under 50% of the global ocean economy by 2050. Most other ocean economic activity groups maintain their share throughout the projection period.
- In the stalled transition scenario, most areas of the ocean economy experience a substantial slowdown due to the economic effects of climate change and trade disruptions. Offshore oil and gas extraction retains its dominance. Largely driven by fossil fuel expansion in regions such as Western Asia, its share of the global ocean economy increases over the period, but not bringing enough global value added to compensate for losses. Marine and coastal tourism's share declines substantially, while offshore wind and marine renewables grows only modestly as a share of the global ocean economy compared to the accelerated transition. A lack of technological innovation and investment in renewables prevents a meaningful diversification of the ocean economy.

The findings from this foresight exercise underscore how long-term pressures such as climate change, evolving trade patterns, and policy decisions, such as the transition towards low-carbon energy systems, are likely to drive significant changes in both the overall level of the future ocean economy and its composition.

Policymakers will need to make choices on how they wish to steer the ocean economy, working with different stakeholders in the private sector and the scientific community. A decision to steer the ocean economy towards more environmentally sustainable practices while reducing greenhouse gas emissions will require sustained public and private investments. that should bring important benefits in the long run to preserve long term growth for the ocean economy and a healthy ocean. Adequate policy frameworks (from marine spatial planning to tax mechanisms, and marine protected areas) and monitoring and enforcement mechanisms will need to be put in place as well to encourage both continued ocean economic activity and the conservation and restoration of crucial marine ecosystems. Building on the analysis presented in this report, a summary of the major findings and recommendations for decision-makers are proposed in Chapter 1.

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The Ocean Economy to 2050

The ocean economy has long been a powerful driver of global growth, creating jobs, fuelling development, and ensuring food security for millions worldwide. If the ocean economy were a country, it would be the fifth largest economy in the world. However, climate change, environmental degradation, lagging productivity, and slow digital transformation are intensifying pressures on marine ecosystems and economic potential. Tackling these challenges requires bold, co-ordinated action, not only to safeguard marine ecosystems but to sustain the ocean economy as a source of prosperity for future generations.

The OECD report *The Ocean Economy to 2050* provides groundbreaking data, analysis, and insights to support policymakers in fostering a sustainable and resilient ocean economy. It explores potential pathways for the sector's development through 2050, emphasising the urgent need for science-based decision-making and improved ocean governance. The report underscores the need to phase out harmful practices and combat illicit activities—the so-called "dark ocean economy." It also highlights the critical role of transitioning to cleaner energy and harnessing digital technologies to mitigate environmental impacts, address climate change, and enhance the productivity of ocean industries.

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