



BLUE ECONOMY

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According to the World Bank, the blue economy is defined as the sustainable development of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean ecosystem. The blue economy emphasises the integration of the development of the ocean economy with social inclusion and environmental sustainability, combined with innovative business models. Oceans are considered future growth engines, even with the changing climate and other anthropogenic pressures. The blue economy is thus positioned as a core dimension for national growth, reflecting India's commitment to sustainable development and responsible use of ocean resources. Striking the right balance between economic development and environmental preservation is crucial.

The oceans and seas cover over 70% of the planet, supporting our life source and that of every other organism on earth. The ocean works as a huge reservoir of heat and plays an important role in moderating the weather and climate. The ocean is responsible for almost half of the oxygen that is inhaled and also plays a pivotal role in the carbon cycle. It is home to most of the earth's biodiversity

and is the main source of protein for more than a billion people around the world. With at least 3-5% of global GDP derived from oceans, the blue economy, through sustainable use of oceans, has great potential for boosting economic growth by providing opportunities for income generation, jobs, etc. The United Nations has promulgated the period 2021-2030 as the 'UN Decade of Ocean Science for Sustainable Development'. The

emerging blue economy seeks to drive economic growth and social inclusion while at the same time preserving marine and coastal areas from exploitation and environmental degradation. The decade seeks to encourage integrated and interdisciplinary approaches to sustainable ocean management through the collaboration of scientists, policymakers, local communities, industry, and civil society.

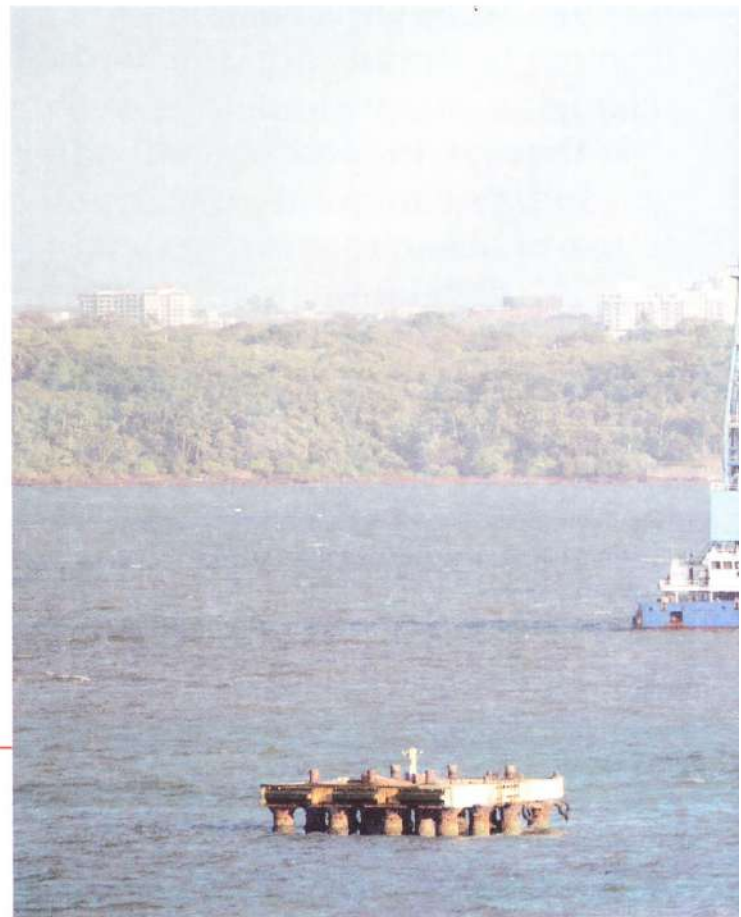
India has a coastline of more than 7500 km and an Exclusive Economic Zone (EEZ) of more than 2.2 million sq km. Nine of India's states have access to the coastline. India comprises 200 ports, of which 12 are major ports that handled 541.76 million tonnes in FY21, the highest being Mormugao Port, located in Goa, which handled 62.6% of the total traffic. The coastal economy sustains over 4 million fishermen and coastal towns. India is the second-largest fish-producing nation in the world and has a fleet of 2,50,000 fishing boats. The blue economy of India is a subdivision of the national economy that includes the complete ocean resources system as well as human-made economic infrastructure in the country's legal jurisdiction in marine, maritime, and onshore coastal zones. India's Blue Economy concept is multi-faceted and plays an important role in the country's economic growth because of its enormous maritime interests. India's blue economy accounts for roughly 4% of the GDP and is estimated to increase once the mechanism is improved.

Various agricultural revolutions have occurred in India and have marked the beginning of a completely new era in the agricultural field. Next, India's service revolution has shown that industrialisation is not the only route to rapid economic development. A majority of FDI inflows into India are concentrated in the service sector. Thanks to the 3Ts — tradability, technological innovation, and transport—services can be unbundled, splintered in a value chain just like goods, and electronically transported globally. Recently, after the success of the Chandrayaan-3 Mission, the Indian space technology sector has shown significant growth and development over the past few decades, with the Indian Space Research Organisation (ISRO) at the forefront of the country's space program. Now the next step is to focus on the ocean economy. Over the past decade, India has built expertise and facilities in the field of ocean scene and technology and is part of many

international bodies in developing global policies, and this contribution is well appreciated globally.

The concept of the blue economy was introduced by Gunter Pauli in his 2010 book – 'The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs'. According to the World Bank, the blue economy is defined as the sustainable development of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean ecosystem. The Blue Economy emphasises the integration of the development of the ocean economy with social inclusion and environmental sustainability, combined with innovative business models. Oceans are considered future growth engines, even with the changing climate and other anthropogenic pressures. Sectors like fisheries and aquaculture, coastal and beach tourism, offshore wind installations, shipping and ports, coastal agriculture, etc., will drive this growth. These sectors are important globally, particularly to developing countries, in the context of sustainable development, poverty eradication, and energy, food, and nutrition security. According to research commissioned by the high-level panel for a sustainable ocean economy, USD 1 invested in key ocean activities yields five times, i.e., USD 5 in return, often more.

The blue economy encompasses a diverse range of activities that are critical for sustainable development. Some are listed below:



1. **Renewable Energy:** Sustainable marine energy, such as offshore wind and wave energy, plays a vital role in promoting social and economic development while reducing reliance on non-renewable energy sources.
2. **Fisheries:** Sustainable fisheries management is essential for generating more revenue, ensuring a continuous supply of fish, and contributing to the restoration of fish stocks, thus supporting both economic and environmental goals.
3. **Maritime Transport:** With over 80% of international goods being transported by sea, maritime transport is a cornerstone of the global economy, connecting nations and facilitating trade.
4. **Tourism:** Ocean and coastal tourism not only offer recreational opportunities but also contribute to job creation and economic growth, making it a key component of the blue economy.
5. **Climate Change:** Oceans act as crucial carbon sinks, absorbing and storing carbon dioxide, a phenomenon known as 'blue carbon.' This role helps mitigate climate change by reducing greenhouse gas concentrations in the atmosphere.
6. **Waste Management:** Effective waste management on land is integral to the health of oceans. Proper waste disposal practices prevent pollution, marine debris, and environmental degradation, fostering ocean recovery.

The interconnected nature of these activities highlights the holistic approach needed for the sustainable development of the blue economy. By addressing renewable energy, fisheries, maritime transport, tourism, climate change mitigation, and waste management collectively, nations can harness the economic potential of the oceans while safeguarding their health and resilience.

Underlying the importance and relevance of the blue economy for India, the following discussion is divided into five parts, namely

1. Ocean resources (Living and Non-living)
2. Ports, Shipping, and Marine Tourism
3. Ocean Science and Services
4. Niche areas: Coastal and Marine Spatial Planning and Ocean Accounting
5. Sources of Employment in the Blue Economy

Ocean Resources

The ocean and its EEZ offer great economic opportunities, having both living and non-living resources.

Fisheries and aquaculture: Fisheries can be sub-categorised into two categories: marine fisheries and inland fisheries. Fisheries have contributed Rs. 46,663 crore to the economy through exports in 2019-20. In the past decade, aquaculture production has evidenced tremendous growth. In 1950-51, fish production amounted to 0.75 MMT (million metric tonnes), and in 2019-20, it was 14.2 MMT. Out of 14.2 MMT production, marine fish production was 3.7 MMT, and inland fish production was 10.4 MMT (Annual Report of the Ministry of Fisheries, Animal Husbandry and Dairying, 2021). There is a fear of depletion of the natural reserve of major fish species due to growing demand for consumption and increased capture due to technological advancements.

Minerals: The continental margins of India congregate an extensive variety of terrigenous, biogenous, and homogenous mineral deposits, and heavy minerals like ilmenite, magnetite, monazite, zircon, and rutile were reported from the beaches of Indian coastal states. Biogenous sediments are reported from shallow offshore areas of the Laccadive Islands, the Gulf of Kutch, the outer shelf of Mumbai, and the backwaters of Kerala. Homogenous deposits like phosphorites



are reported from the southwestern and western continental shelves manganese crust is found in the Andaman Islands. Evidence has been found of reserves of Manganese, cobalt, and hydrothermal sulphides in the deep ocean in the Central Indian Ocean Basin (CIOB). Also, marine gypsum is found in salt pans during the processing of common salt in the coastal regions of Gujarat and Tamil Nadu. Ocean also contains huge rare earth minerals. These minerals are crucial raw materials for manufacturing electronic chips for industries like electronics, automotive, etc.

Hydrocarbons: The sea beds are the major source of hydrocarbons. India has 26 sedimentary basins, spread across a total area of 3.4 million square kilometres. Of the total sedimentary area, 49% is located inland, 12% is in shallow water with depths up to 400 metres, and 39% is in the deepwater area extending farther up to the Exclusive Economic Zone. There are 16 inland basins, seven located both inland and offshore, and 3 completely offshore. India hosts about 34 MMT of oil and 33 BCM of gas production (Directorate General of Hydrocarbons Annual Report 2021). The current annual oil and natural gas consumption is about 1.3 billion barrels and 65 billion cubic metres, which is not met with internal resources, raising dependence on imports.

Renewable Energy: Renewable energy includes energy from natural phenomena like sunlight, Onshore wind, Offshore wind, hydroelectric, tides, waves, etc. The generation of oceanic renewable energy has tremendous scope. Commercialisation of tidal energy has gained momentum in the past few years. Technologies like tidal lagoons, tidal reefs, tidal fences, and tidal barrages are used for tidal energy generation. Renewable energy in offshore regions has tremendous potential in the form of offshore wind, waves, ocean currents, including tidal currents, and thermal energy. Out of all the different renewable energies generated from oceans, the offshore wind energy industry is the most developed.

Ports, Shipping, and Marine Tourism

Services India has a network of 12 major ports and 187 non-major ports. The Indian maritime industry plays a crucial role in the logistics sector. Approximately 95% of the country's trade by volume and 68% by value is moved through maritime transport (EAC report: India's Blue Economy, 2020).

The Indian Maritime Sector comprises ports, shipping, marine biotechnology, shipbuilding and repair, and inland water transport systems. Other riparian industries, namely fishing, aquaculture, tourism, net manufacturing, and aquaculture technology, contribute to the country's economy. Other marine services include marine insurance. The shipping sector is also one of the key livelihood providers in the blue economy, as India has one of the largest merchant shipping fleets among the developing countries and ranks 17th in the world. Marine tourism is the fastest growing globally, and in India, coastal tourism has contributed largely to both the state economies and livelihood creation. Tourism has certain potential as a source of income for the local community, but tourism on a large scale can have an adverse impact on the marine ecosystem.

Ocean Science and Services

Observations, data, and information services: Ocean and coastal observations, data, and information services are of paramount importance for all Blue Economy stakeholders. Operational services such as Marine Fishery Advisories, Ocean State Forecasts, Tsunami and Storm Surge Early Warnings, Sea Level Rise, Oil Spill Trajectories, Marine Search and Rescue Information, Water Quality Forecasts, Coral Bleaching Alerts, Harmful Algal Blooms, Coastal Vulnerability, etc. are key to enhancing the safety of lives and livelihoods of coastal communities, the efficiency of maritime operations and sustainable management of ocean and coastal ecosystems. The Indian National Centre for Ocean Information Services (NCOIS) provides flagship service advisories on the Potential Fishing Zones (PFZ) each day of the year except during the fishing ban period and adverse sea-state conditions.

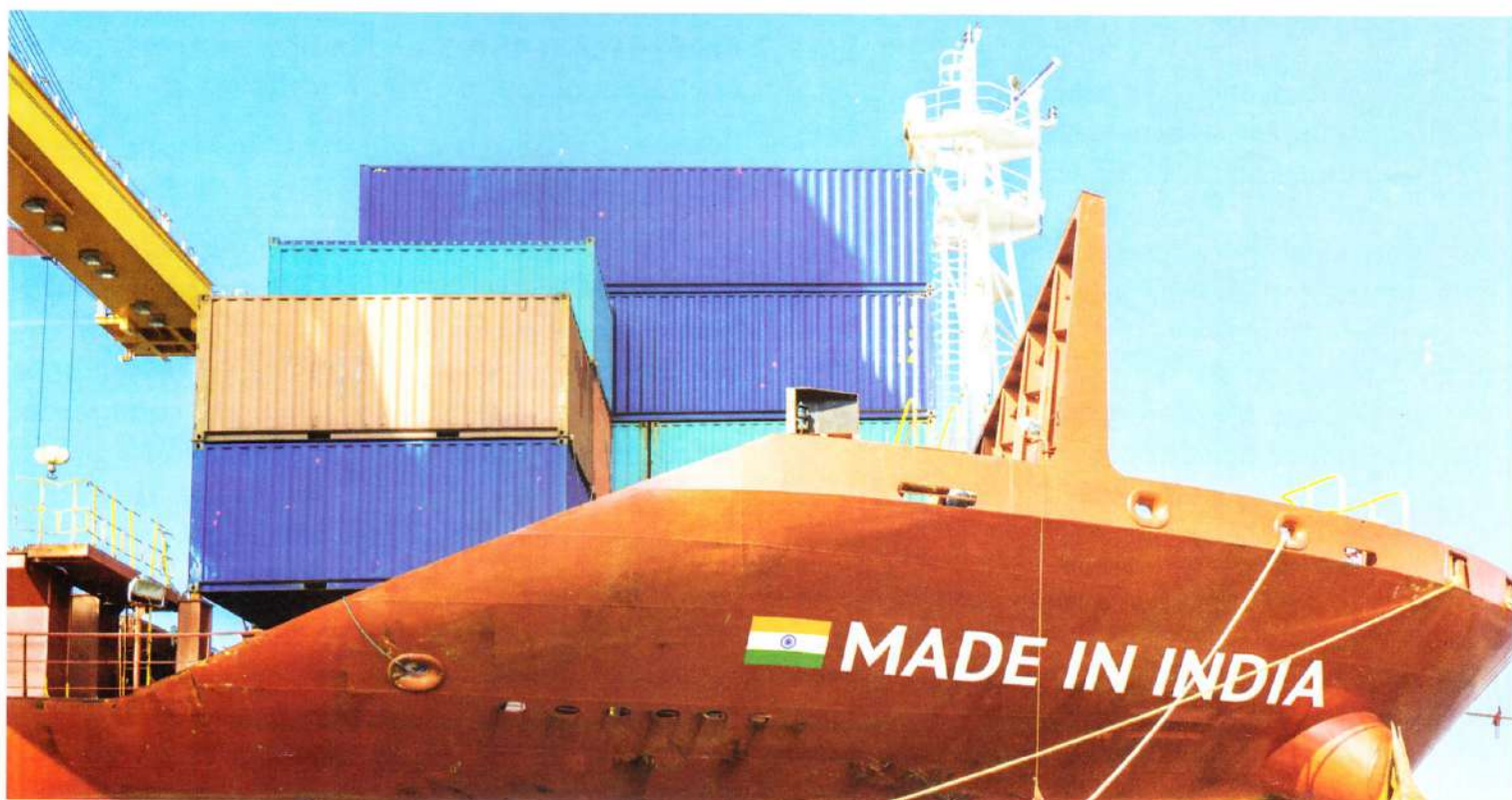
Impact of climate change and disasters on the blue economy: Promoting a sustainable and climate-resilient blue economy has a special responsibility towards the ocean, as all of them are coastal states, collectively responsible for 45 per cent of the world's coastlines and over 21 per cent of Exclusive Economic Zones (EEZs). The ocean holds vast natural capital (Ocean Asset Value), estimated at USD 24 trillion. However, ocean warming, sea-level rise, ocean acidification, and marine pollution are damaging marine ecosystems, productivity, and the lives and livelihoods of those dependent

on the ocean. Nearly 40 per cent of the SDGs depend on ocean sustainability, particularly SDG 14 (life below water) and SDG 13 (climate action). Yet, progress on SDG 14 is slow and inadequate, and in 2019, it received the least funding from official development assistance providers. While coastal areas remain in the spotlight of climate-induced vulnerability, oceans play a crucial role in mitigating global climate change by sequestering about 25% of global anthropogenic emissions of carbon dioxide. Evidence suggests that the net sink has remained the same in recent decades, despite increasing atmospheric CO₂, indicating its weakening potential in climate change mitigation. Coastal ecosystems such as mangroves, seagrass beds, and saltmarshes that contribute to coastal protection and marine biodiversity are adversely affected by climate change.

Coastal hazards such as tsunamis, floods, sea level rise, and earthquakes undermine the resilience and sustainability of the blue economy (IPCC, 2019; Karanja and Saito, 2018). Climate change is expected to increase the frequency and intensity of hydrological, meteorological, and climatological disasters such as floods, tropical cyclones, and droughts (IPCC, 2019). In view of the recent natural coastal disasters faced in southern India, an effective response mechanism to address humanitarian crises and natural disasters should be made.

Behind every warning lies the pivotal role of observation and forecasting. The Early Warnings for All initiative by the World Meteorological Organization and other UN bodies is an effort to ensure everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027. With human-induced climate change leading to more extreme weather conditions, the need for early warning systems is more crucial than ever. Early warning systems are not a luxury but a cost-effective tool that saves lives, reduces economic losses, and provides a nearly tenfold return on investment. Also, a 'Community-Based Flood Early-Warning System' needs to be established with the networking of state and central agencies and the support of local bodies and NGOs. Information and communications technology (ICT)-enabled systems to monitor water levels, mapping of water bodies, desilting, and systematic data collection; geomorphological mapping of the floodplain combined with the analysis of flood management can be an efficient tool for flood hazard assessment and prediction of future flood scenarios.

Marine Biodiversity: Conservation and sustainable use of marine and coastal biodiversity, including the declaration of marine protected areas (MPA), is essential to ensuring that the world's oceans, seas, and marine living resources remain vital for current and future generations.



As per SDG 14.2, 20% of EEZs need to be declared MPAs by 2030, and concerted efforts are a must to achieve this. The more effective management of fisheries that are used for food, protection of the marine environment from pollution, including from agriculture, and destructive actions are critical actions to be taken. India's Exclusive Economic Zone (EEZ) has huge living and non-living resources, including significant recoverable resources such as crude oil and natural gas. The coastal economy sustains over 4 million fisherfolk and coastal communities. Better connectivity in the region will significantly cut transport costs and maritime waste of resources making the trade sustainable and cost-effective. The Indian Ocean's resources have the potential to sustain increased production. The development of the Blue Economy can serve as a growth catalyst for realising the vision to become a \$10 trillion economy by 2032.

Healthy Ocean: Marine pollution has grown to be a major concern globally today, dominated by land-based pollution and plastic waste. The United Nations has also called for the prevention and significant reduction of marine pollution of all kinds by 2025, particularly from land-based activities, which are the main source of plastics and microplastics. The Sustainable Development Goals (SDG 14), Life Below Water, of the UN call for conservation and sustainable use of oceans and marine resources. The growing menace of marine pollution, especially from plastics and microplastics, has to be addressed by a robust Plastic Elimination and National Marine Litter policy involving multiple stakeholders. Further, India's recent single-use plastics ban will help address the marine plastic litter challenge, as globally, land-based sources account for ~80 per cent of marine plastic waste. India has played a key role in the global negotiations on single-use plastics that led to a historic resolution at the 5th UNEA session in 2022 to forge an international legally binding agreement to end plastic pollution.

Research Gap: The blue economy is a new topic that started gaining momentum in the twenty-first century. There are many studies on the blue economy at the international level in marine biology, marine technology, marine chemistry, geology, shipping, oceanography, etc. Also, many studies have been carried out at the national level.

Niche areas

Coastal and Marine Spatial Planning: Coastal and Marine Spatial Planning (CMSP) is a science-based approach that can be used to analyse and allocate coastal and marine uses over space and time to address specific ocean management challenges and advance goals for economic development and conservation. Simply put, in the same manner that land zoning regulates land uses, coastal and marine spatial planning can create ocean zoning, with maps categorising marine space for specific uses. Japan, South Korea, and China. India will now be the sixth country to have it. Marine Spatial Planning (MSP) has been used to allocate human activities spatially, usually through participatory processes, to reconcile differing values and priorities among diverse stakeholders. Ocean Accounting (OA) can provide a structured and integrated 'data foundation' that shapes policy through providing a range of comparable statistics and indicators. These policies, in addition to legislation and other layers of governance, define the objectives of MSP, where OA may provide data to assist in the formation of plans and further evaluate progress towards policy targets. The two frameworks (OA and MSP) possess several synergies that further effective and evidence-based ocean governance. The Ocean Accounts Framework (OAF) is a conceptual framework designed to enhance the consistency, comparability, and coherence of ocean-related maps, data, statistics, and indicators across social, environmental, and economic domains.

Source of Employment in the Blue Economy

Traditional Sectors

Fishing and Aquaculture: Traditional sectors like fishing, aquaculture, and fish processing have been significant sources of employment in the blue economy for many decades. The sector is evolving from subsistence farming to commercial practices, such as aquaculture, requiring a skilled workforce.

Marine Tourism: Marine tourism, including activities like cruise travel, boating, scuba diving, and more, contributes to employment and economic growth in coastal regions. Coastal tourism is a vibrant segment of the blue economy, supporting jobs in hospitality, transportation, and various tourism-related services.

Shipping and Ports: Sea ports are major sources of employment, with jobs in smaller ports increasing over the years. The growth in the logistics sector, driven by industrial demand, emphasises the increasing role of ports in future employment.

Shipbuilding: The shipbuilding industry in India holds significant potential and employs individuals with diverse skills. Indigenisation and self-reliance in the industry could further contribute to employment generation.

Offshore Wind and Marine Biology: Emerging sectors like offshore wind and marine biology provide new employment opportunities. The move towards sustainability in shipbuilding involves using recyclable or biodegradable materials, ensuring energy and resource efficiency.

Skill Development Initiatives: The blue economy has the potential to engage a large workforce and has been doing so for the past many decades, at least in traditional sectors such as fishing, aquaculture, fish processing, marine tourism, shipping, and port activities. Now, engagement in new sectors such as offshore wind, marine biology, biotechnology, and other

activities like shipbuilding and shipbreaking is also gaining extensive traction. Sea ports are a large source of employment. Unlike India's major ports, jobs in smaller ports have increased to tenfold over the years from 2003 to 2017. Shipping and ports require skilled manpower, but meeting the growing and changing demands in this sector would require re-skilling and upskilling in the future. The full potential of the blue economy can be realised by creating suitable employment opportunities for present and future generations. Acknowledging and giving prominence to traditional knowledge is crucial. It ensures the preservation of cultural heritage and sustainable practices that have been integral to traditional fishing communities. Blue economy, spanning traditional and emerging sectors, offers diverse employment opportunities. From traditional fishing practices to innovative sectors like offshore wind and marine biology, the blue economy is evolving. Skill development initiatives, youth involvement, and the preservation of traditional knowledge are integral to harnessing the full potential of the blue economy and ensuring prosperity for all. □

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