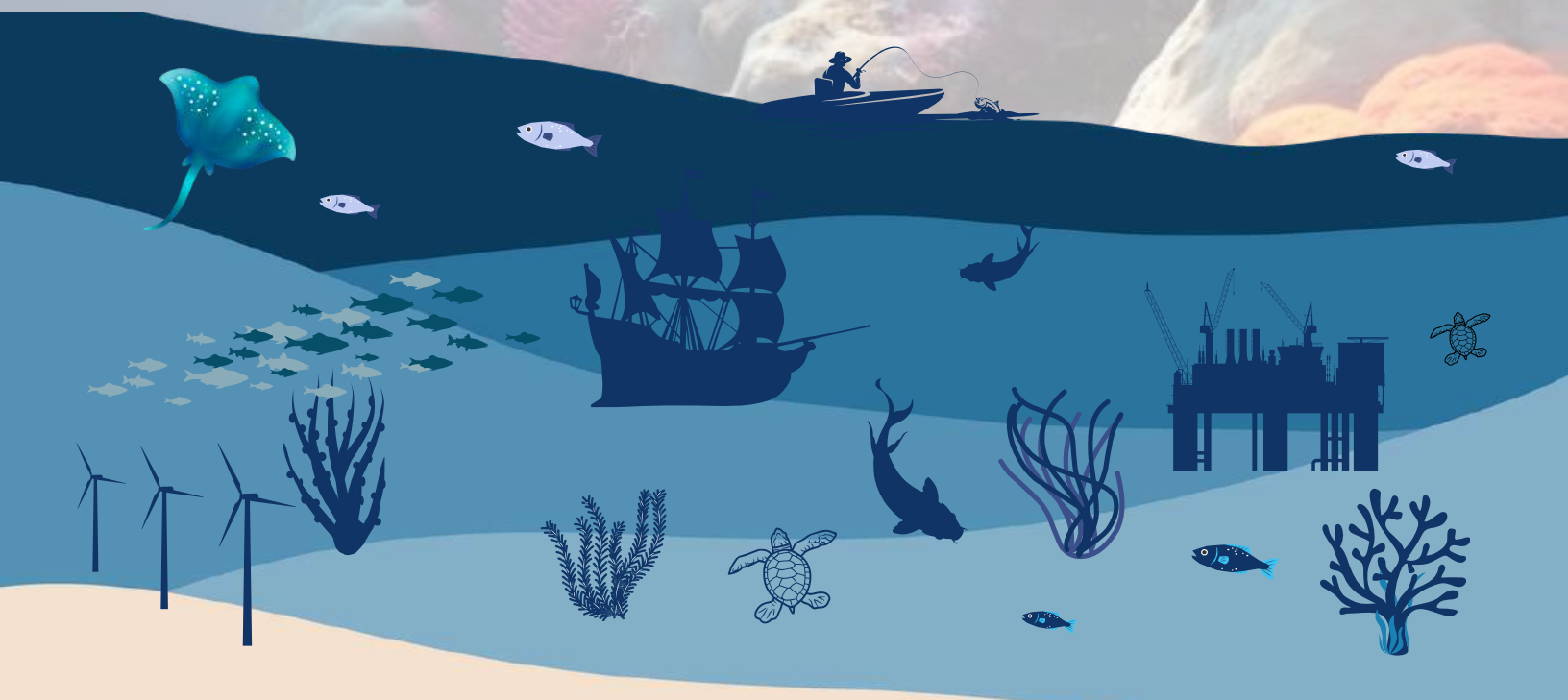


MARINE SPATIAL PLANNING



Summary

The oceans, expansive and teeming with life, have long served as a source of sustenance, energy, and diverse ecosystem benefits. However, as we stand on the cusp of a global population reaching 10 billion by 2050, the pressures on oceanic resources are intensifying. The imperative to meet the multifaceted demands of a burgeoning population, coupled with technological advancements, has propelled the oceans into a critical role in addressing challenges related to food security and energy supply.

The escalating utilization of oceanic resources, driven by ongoing innovations in marine biotechnology, aquaculture, and renewable energy technologies, has ushered in a new era. Yet, this era is not without its challenges. The oceans, once considered inexhaustible, are now facing the consequences of uncontrolled pollution and careless utilization. The United Nations' "The First Global Integrated Marine Assessment" highlights the profound impact of human actions on ocean resources, encompassing issues such as climate change, pollution, and overfishing. These challenges collectively threaten the services provided by the ocean ecosystem.

In response to this critical juncture, the concept of Marine Spatial Planning (MSP) has emerged as a strategic tool for systematically organizing human activities in ocean spaces. The imperative to realize the objectives outlined in Sustainable Development Goal 14, focused on preserving ocean ecosystems and resources, underscores the need for a collaborative and comprehensive strategy involving all relevant stakeholders.

Efforts at a global scale have materialized in the form of frameworks such as the United Nations Convention on the Law of the Sea (UNCLOS) and the Convention on Biological Diversity, guiding the development of MSP. The European Union, recognizing the urgency of MSP, has introduced the Marine Spatial Directive, providing a model for other nations. Presently, around 100 countries and territories have embarked on MSP initiatives, each tailoring its approach to align with specific needs and development goals.

To create robust MSP frameworks, nations must enhance their technological and Research and Development (R&D) capacities. Inclusivity is key, involving public and private sector stakeholders from strategic security, blue economy, sustainability, climate change management, and digital transformation domains. The primary objective of MSP is twofold: to bolster long-term socio-economic advantages and to safeguard the integrity of the marine ecosystem.

In the context of developing nations, MSP serves as a crucial tool in managing the rapid economic growth and population pressures on ocean resources. Ecosystem-Based Management (EBM) is gaining traction, advocating for a holistic approach to MSP that considers ecological, economic, and social dimensions. This approach is essential for preventing conflicts and unsustainable resource exploitation as diverse activities occupy ocean spaces.

MSP encompasses a wide range of ocean-related aspects, from traditional industries such as fishing and shipping to emerging sectors like biotechnology, seabed mining, and renewable energy. Oceans provide essential ecosystem-based services, including carbon sequestration, oxygen production, climate regulation, and biodiversity support. Balancing traditional and emerging ocean-based industries with environmental conservation is crucial for a sustainable and responsible future.

The Indian Ocean Region (IOR), a nexus of ecological, economic, and geopolitical dynamics, calls for Regional MSP. India, with its extensive coastline, is actively engaged in developing MSP frameworks, recognizing the importance of collaborative decision-making and conflict mitigation. The integration of MSP with the Blue Economy, centered on sustainable ocean-based economic activities, is vital for fostering economic development while preserving marine ecosystems.

Despite the promising outlook of MSP, challenges persist. The need for technological enhancement, stakeholder collaboration, adaptability, and periodic revisions to MSP frameworks must be addressed. The dynamic nature of ocean activities requires a flexible and evolving approach.

Crucially, MSP plays a pivotal role in Underwater Domain Awareness (UDA), enhancing national security and maritime safety. By providing a structured framework for monitoring underwater activities, MSP contributes to identifying potential security risks and deploying resources effectively. UDA and MSP represent complementary pillars in the strategic governance of oceanic activities. UDA involves a spectrum of activities such as the surveillance of shipping lanes, monitoring of maritime boundaries, and addressing potential threats to underwater infrastructure. MSP, on the other hand, provides a structured framework for organizing and managing diverse human activities in coastal and oceanic areas. Together, UDA and MSP create a synergistic approach to ocean governance. MSP contributes to UDA by mapping spatial arrangements, identifying zones for specific activities, and fostering intersectoral coordination. This integration ensures a holistic approach that not only enhances security but also promotes the sustainable use of marine resources, aligning economic development with environmental conservation. The collaboration between UDA and MSP is crucial for addressing the complexities and challenges associated with underwater activities, fostering a balance between national security imperatives and the responsible utilization of the marine environment.

Recommendations include prioritizing investments in technological capabilities, fostering stakeholder collaboration, ensuring adaptability and periodic revisions to MSP frameworks, and closely integrating MSP with Blue Economy initiatives. Implementing these recommendations will enable nations to navigate the complexities of oceanic activities, promote sustainable economic development, and safeguard marine ecosystems. The responsibility for implementing MSP is shared, transcending borders and generations, underscoring its critical role in shaping the future of our oceans.

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1. Introduction

The oceans stand as a diverse and highly productive ecosystem, offering sustenance, raw materials, energy, and a wide array of ecosystem benefits. The utilization of oceanic resources is progressively increasing and expanding, driven by technological advancements and the imperative to meet the multifaceted demands of a growing population. The oceans have emerged as a viable solution to tackle challenges related to food security and energy supply, thanks to ongoing innovations in marine biotechnology, aquaculture, renewable energy technologies, and related fields.

By the year 2050, the global population is expected to reach 10 billion, bringing with it increased demands and the consequences associated with meeting these demands. The marine ecosystem is not immune to this escalating use and uncontrolled pollution. The precious biodiversity of our oceans faces threats due to careless utilization and a lack of awareness. As human activities in the marine environment intensify, inevitable conflicts amongst various ocean-based sectors and the marine biodiversity that coexist in the same time and space are likely to arise. According to the United Nations' "The First Global Integrated Marine Assessment," the impact of human actions on ocean resources has ceased to be inconsequential, as issues like climate change, pollution, overfishing, and others have collectively begun to affect the services provided by the ocean ecosystem.

To realize the objectives outlined in Sustainable Development Goal 14, which focuses on the preservation of ocean ecosystems and resources, it is imperative to formulate a comprehensive strategy for governing human interactions with the oceans. Creating such a strategy should be a collaborative and all-encompassing effort, involving all relevant stakeholders. The idea of Marine Spatial Planning has emerged in response to the necessity of systematically organizing human activities in ocean spaces over time. This undertaking is data-driven and necessitates a high degree of cooperation among stakeholders.

Efforts have been undertaken worldwide to formulate a strategy for the effective management of ocean-related activities. Frameworks such as the United Nations Convention on the Law of the Sea (UNCLOS) and the Convention on Biological Diversity have been established to guide the development of Marine Spatial Planning (MSP). UNESCO, in conjunction with the Intergovernmental Oceanographic Commission (IOC), has also issued MSP guidelines for countries lacking MSP frameworks. In response to the growing need for MSP, the European Union has introduced the Marine Spatial Directive. Presently, approximately 100 countries and territories have implemented MSP initiatives, with these initiatives being in various stages of development. This ranges from the establishment of new authorities and funding mechanisms to the ongoing process of plan revisions and adaptations. It is crucial to emphasize that each country must tailor its approach to MSP to align with its specific needs and development goals.

In order to create a robust Marine Spatial Plan (MSP), nations need to enhance their technological and Research and Development (R&D) capacities. A sustainable MSP should involve both public and private sector stakeholders particularly from strategic security, blue economy, sustainability & climate change management and digital transformation domains, who have an impact on activities within their national jurisdiction. The primary objective of MSP should be to bolster long-term socio-economic advantages while fundamentally safeguarding the integrity of the marine ecosystem.

While Marine Spatial Planning (MSP) represents a relatively recent concept, rudimentary forms of managing marine activities have existed for a considerable period. Many countries historically managed their ocean affairs through sectoral planning and strategies, often within their national boundaries, and largely detached from broader national and global plans. However, with growing population pressures and increased pollution on land resources, decision-makers have redirected their attention toward harnessing ocean resources for socio-economic development.

Recognizing the limitations of the ad hoc and sectoral approach to marine management, scholars and practitioners are increasingly advocating for an Ecosystem-Based Management (EBM) approach in the form of Marine Spatial Planning (MSP). In the context of developing nations, the rapid economic growth and population pressures on ocean resources require special attention and proactive management to prevent conflicts and unsustainable resource exploitation as a multitude of activities begin to occupy ocean spaces.

Given that oceans are shared resources, global challenges like climate change and resource competition have multilayered impacts. Consequently, the management of oceans necessitates coordination across various scales. MSP emerges as a pivotal tool to facilitate ecosystem-based management of oceans and seas. The development of policy and legal frameworks is imperative to enable the effective implementation of Marine Spatial Plans. These frameworks should encompass the socio-economic and sustainability dimensions of ocean activities and clarify the rights and responsibilities of diverse stakeholders. Given the dynamic nature of ocean activities and technological advancements, MSP must undergo periodic revisions to remain effective.

2. Ocean Wealth

Marine Spatial Planning (MSP) takes into account a wide range of ocean-related aspects, including marine conservation, sustainable use, fishing, aquaculture, shipping, oil and gas exploration and production, mining, seabed cables and pipelines, military operations, marine renewable energy, tourism, and cultural assets, such as underwater archaeology and seascape. The table provided below illustrates the various established and emerging maritime activities in this context.

Types of established and emerging maritime uses			
Uses	Mobile	Fixed	Others
Established	- Coastal and maritime tourism and recreation - Fisheries - Shipping	- Coastal aquaculture - Marine Protected Areas (MPAs) - Oil and gas - Pipelines and cables - Ports - Sand and gravel mining	- Coastal communities - Military defence and security - Maritime and underwater cultural heritage - Scientific research
Emerging	Dynamic marine protected areas (DMPAs)	- Carbon sequestration through carbon capture and storage - Deep sea mining - Desalination plants - Offshore aquaculture - Offshore renewable energy (wind, tidal, solar and wave energy) - Other effective area-based conservation measures (OECMs)	Marine bioprospecting

Table (1): Types of Established and Emerging Maritime Uses,

Source: MSPglobal International Guide on Marine/Maritime Spatial Planning, 2021

Oceans provide a myriad of ecosystem-based services that are indispensable to the health of our planet and the well-being of its inhabitants. One fundamental service is carbon sequestration, where oceans act as a vast reservoir, absorbing and storing substantial amounts of carbon dioxide from the atmosphere. This not only mitigates climate change by regulating greenhouse gas levels but also plays a critical role in balancing the Earth's carbon cycle. Additionally, oceans contribute significantly to the production of oxygen through photosynthesis carried out by marine plants, particularly phytoplankton. This oxygen production is essential for sustaining life on Earth. The ocean's influence on climate is profound, as it regulates temperature and weather patterns, impacting global climate systems. Hydrologically, oceans are integral to the water cycle, influencing precipitation and maintaining balance in terrestrial ecosystems. Oceans harbor immense biodiversity, providing habitat for countless species and supporting intricate food webs. The conservation of these ecosystem-based services is paramount for the overall health and resilience of our planet.

The emergence of new ocean-based industries, notably in biotechnology, seabed mining, and renewable energy, marks a transformative phase in harnessing the vast potential of the marine environment. In biotechnology, the ocean serves as a rich source of biodiversity, offering unique organisms with pharmaceutical and industrial applications. Researchers explore marine organisms for their bioactive compounds, holding promise for the development of new medicines and biotechnological innovations.

Seabed mining, though a relatively nascent industry, is gaining traction as advances in technology enable the extraction of valuable minerals from the ocean floor. While presenting economic opportunities, careful environmental stewardship is essential to mitigate potential ecological impacts. Renewable energy from the ocean, including wave and tidal energy, has emerged as a sustainable alternative to traditional sources. Innovations in harnessing ocean currents and thermal gradients hold the potential to contribute significantly to the global renewable energy landscape. These new ocean-based industries underscore the importance of balancing economic development with environmental conservation for a sustainable and responsible future.

Traditional ocean-based industries have long been pillars of human civilization, serving essential roles in sustaining economies and meeting fundamental needs. The fishing industry, a cornerstone of traditional ocean activities, provides a vital source of food for countless communities worldwide. Oceans have also been integral to energy production, particularly through the extraction of hydrocarbons such as oil and natural gas. Maritime transport, facilitated by ships and seafaring vessels, remains a critical mode of global trade, connecting nations and facilitating the exchange of goods. Additionally, oceans offer vast opportunities for recreational activities, from coastal tourism to water sports, attracting millions seeking leisure and adventure. These traditional ocean-based industries have not only shaped human history but continue to play integral roles in contemporary society, illustrating the enduring significance of the seas in meeting a diverse array of human needs.

Additionally, ocean-based renewable energy must be harnessed efficiently to support the transition toward a more sustainable marine industry. Ocean-based energy holds the potential to become a leading energy source. MSP should also incorporate measures to facilitate sustainable ocean-based tourism, which should be environmentally conscious and resilient to climate impacts. Tourism should not disrupt or negatively impact ecosystem restoration and biodiversity preservation. Tourism has the potential to create local employment opportunities and enhance community well-being.

Marine Spatial Planning (MSP) is a crucial framework designed to manage and allocate marine resources while minimizing conflicts among diverse stakeholders and activities in coastal and oceanic areas. As various sectors, such as fisheries, shipping, tourism, and conservation, vie for limited maritime space, conflicts are inevitable. MSP aims to provide a comprehensive approach, facilitating intersectoral coordination and addressing potential conflicts. By mapping out spatial arrangements and identifying zones for specific activities, MSP helps balance economic development, environmental conservation, and social interests. The process involves engagement with stakeholders, including government agencies, industries, and local communities, to foster collaborative decision-making and sustainable use of marine resources. While challenges may arise, MSP serves as a vital tool in promoting harmony among competing interests and ensuring the effective and equitable utilization of the maritime environment.

There is an immediate requirement for effective management of diverse ocean activities to reduce competition and conflicts. Area-specific planning, such as Marine Spatial Plans, will play a vital role in harmonizing the array of activities within a nation's jurisdiction or in transboundary areas.

Furthermore, MSP should coordinate responsible investments in shipping, aiming to move toward zero-emission and low-impact marine vessels. There are several emerging ocean industries where investments can significantly bolster socioeconomic development. Spatial management is essential to ensure that these industries operate in an environmentally responsible manner and promote inclusive economic growth. In particular, seabed mining should adhere to rigorous scientific principles and avoid causing habitat destruction or undermining ocean resilience.

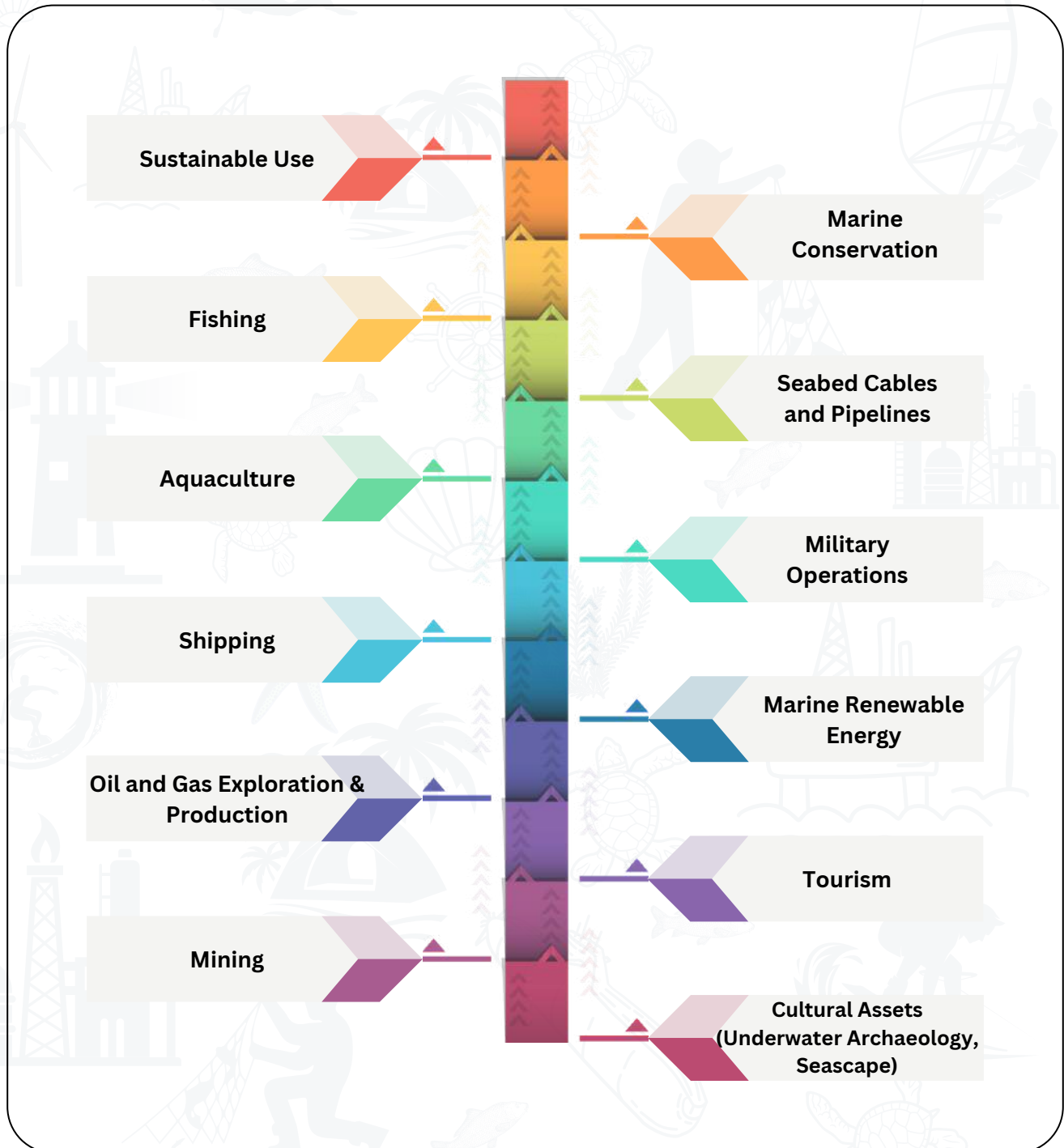


Figure (1): Comprehensive Scope of Marine Spatial Planning (MSP)

3. Global Developments in Marine Spatial Planning (MSP)

The notion of Marine Spatial Planning with multiple objectives originated in Europe around 2001 when efforts were made to create a spatial plan for the marine environment. Prior to that, MSP had primarily been approached from the perspective of mitigating marine degradation. In 2006, the first International Workshop on modern MSP was organized by UNESCO's Intergovernmental Oceanographic Commission (IOC), which redefined MSP as a science-based, integrated, adaptive, strategic, and participatory process. IOC also developed the "Marine Spatial Planning: A Step-by-Step Approach toward Ecosystem-based Management" in 2009 to assist nations in crafting their own Marine Spatial Plans.

The second International Conference on MSP took place in 2017, outlining a roadmap to accelerate the adoption of MSP. Subsequently, the IOC, in collaboration with the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE), established the MSP roadmap and MSP Global initiatives with the aim of tripling the maritime areas under national jurisdiction benefiting from MSP by 2030. Additionally, in 2021, the "International Guide on Marine/Maritime Spatial Planning" was published to offer support to national, regional, and international partners. The IOC has also played a crucial role in providing technical support to UNDP/UNEP (United Nations Development Program), which implemented the IW: LEARN Phase 5 (2022-2026) funded by GEF (Global Environment Facility) as a technical executing agency, with a focus on capacity-building activities.

The work of the IOC has further enriched the potential of the blue economy by integrating MSP into the science-to-policy processes of GEF-funded Large Marine Ecosystem (LME) projects. The contribution of the blue economy to GDP is represented in the provided figure (2). The IOC has also applied MSP in the Man and Biosphere Programme and the World Heritage Marine Programme to develop marine conservation plans.

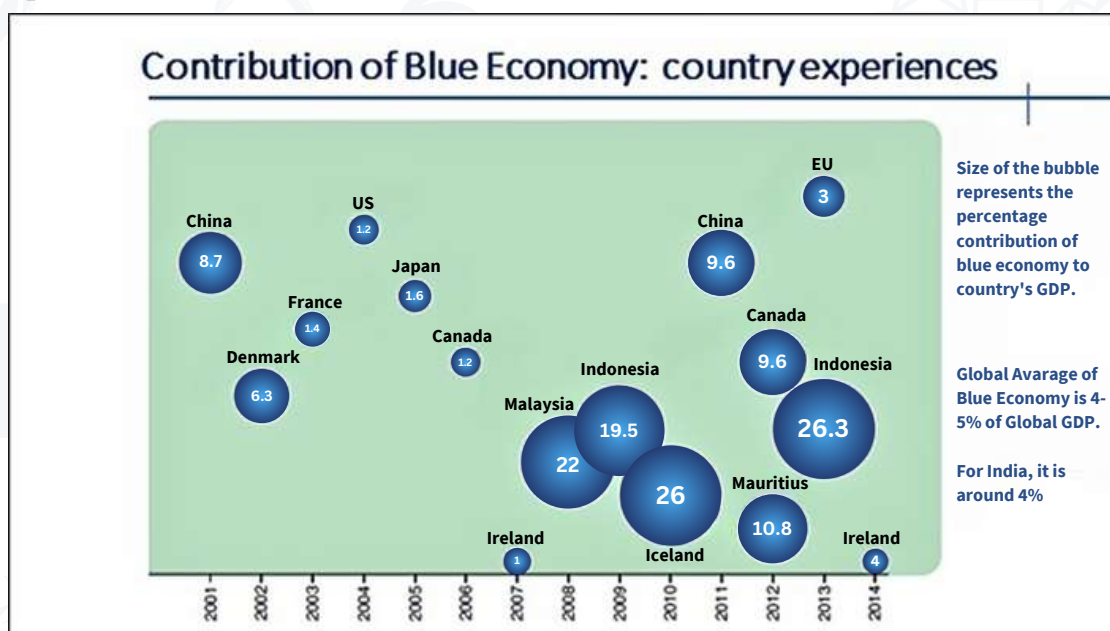


Figure (2): Contribution of Blue Economy,
Source: India, Science, Technology and Innovations



Figure (3): Global Developments in MSP,
Source: Maritime Research Center

In 2021, a new alliance called 'Ocean Action 2030' was established by the High-Level Panel for a Sustainable Ocean Economy, consisting of 17 member countries. The primary objective of this coalition is to formulate and implement Sustainable Ocean Plans tailored to their specific requirements, with the aim of achieving sustainable management of 100% of the ocean areas within their national jurisdictions. As defined by the panel, a Sustainable Ocean Plan serves as a comprehensive framework for governing ocean-related activities, and within this framework, Marine Spatial Planning (MSP), which is an area-specific planning approach, will be incorporated. The Ocean Plan will serve as an essential roadmap for all stakeholders involved in the sustainable management of maritime areas within their national jurisdiction.

In 2013, the G20 summit, a pivotal platform for shaping global economic policies, evolved into a prominent advocate for sustainability initiatives, earning the moniker of the "Mother of Sustainability" meetings. This marked a significant turning point, as the summit placed a robust emphasis on sustainable development and environmental considerations, acknowledging the intricate link between economic growth and ecological well-being among leaders from major economies worldwide. Discussions during the 2013 summit delved into sustainable development practices, renewable energy strategies, and the imperative to address climate change. The legacy of the G20 in 2013 stands as a landmark moment in championing a more sustainable and environmentally responsible approach to global economic governance. Fast forward to the G-20 meeting in 2023, where participating nations embraced the Chennai High-Level Principles for a Sustainable and Resilient Blue/Ocean-Based Economy, reaffirming their commitment to sustainability. These principles underscored the paramount importance of prioritizing ocean well-being, promoting social and intergenerational fairness, and ensuring the sustainable use of the marine environment. As the 2030 deadline for the Sustainable Development Goals (SDGs) approaches, adopted by all UN member states in 2015, efforts to achieve these goals persist in various international and national forums despite the challenges. While the current timeline may seem daunting, the determination to realize these objectives remain steadfast.

4. Need For Regional MSP in The Indian Ocean Region (IOR)

The Indian Ocean Region extends from the eastern shores of Africa to the western coast of Australia, encompassing the third-largest ocean on the planet. Within this vast expanse are numerous trade routes and major sea lanes that facilitate the transportation of nearly half of the world's container ships and a third of the world's oil shipments, highlighting the Indian Ocean's pivotal role in international trade and transport. Among the nations situated in the Indian Ocean Region, Australia, Indonesia, and India boast the longest coastlines and Exclusive Economic Zones (EEZ), as illustrated in Figure (4). Approximately 15% of the Indian Ocean is characterized by a continental shelf. The countries bordering the Indian Ocean collectively have a population of nearly 2.7 billion.

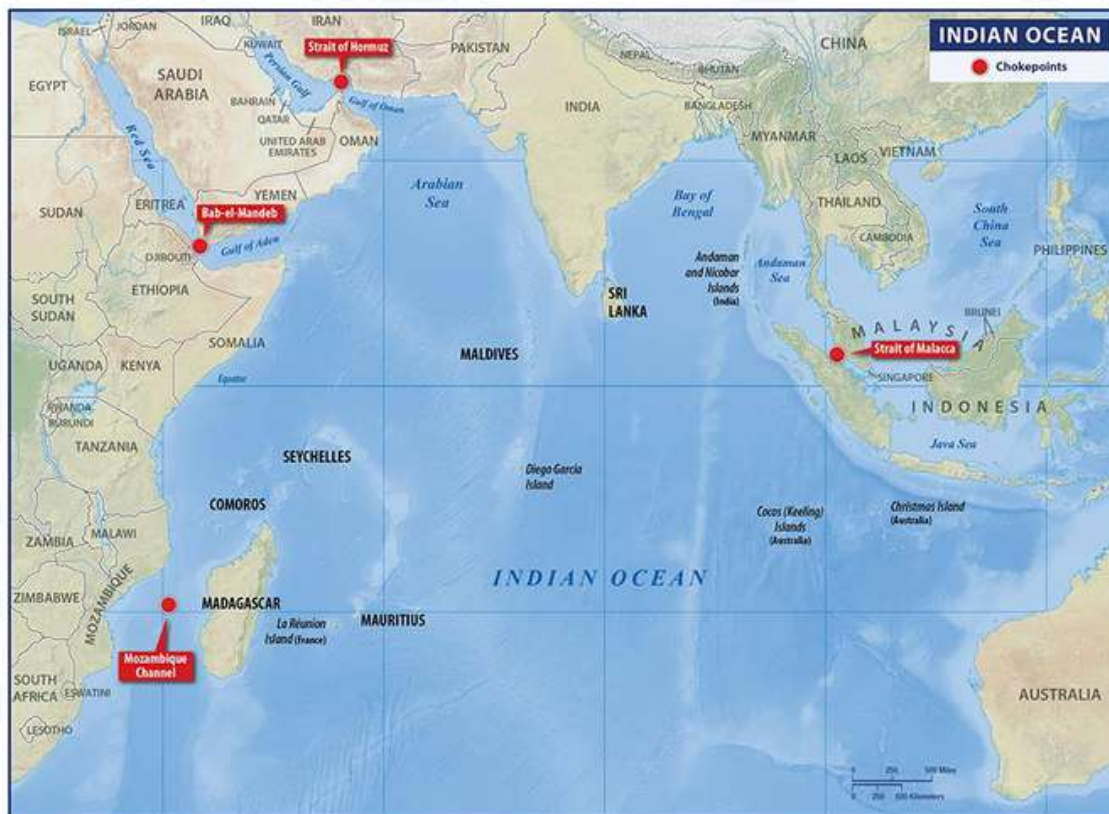


Figure (4): Indian Ocean Chokepoints,
Source: Carnegie Endowment for International Peace

Following World War II, as many countries in the region gained independence from colonial rule, their primary focus shifted towards addressing political and economic matters within their borders, resulting in a reduced emphasis on ocean governance. However, the growing interest in the ocean's resources has prompted countries in the Indian Ocean Region (IOR) to engage in dialogues aimed at enhancing regional economic development based on ocean resources and collaborating on issues related to strategic security.

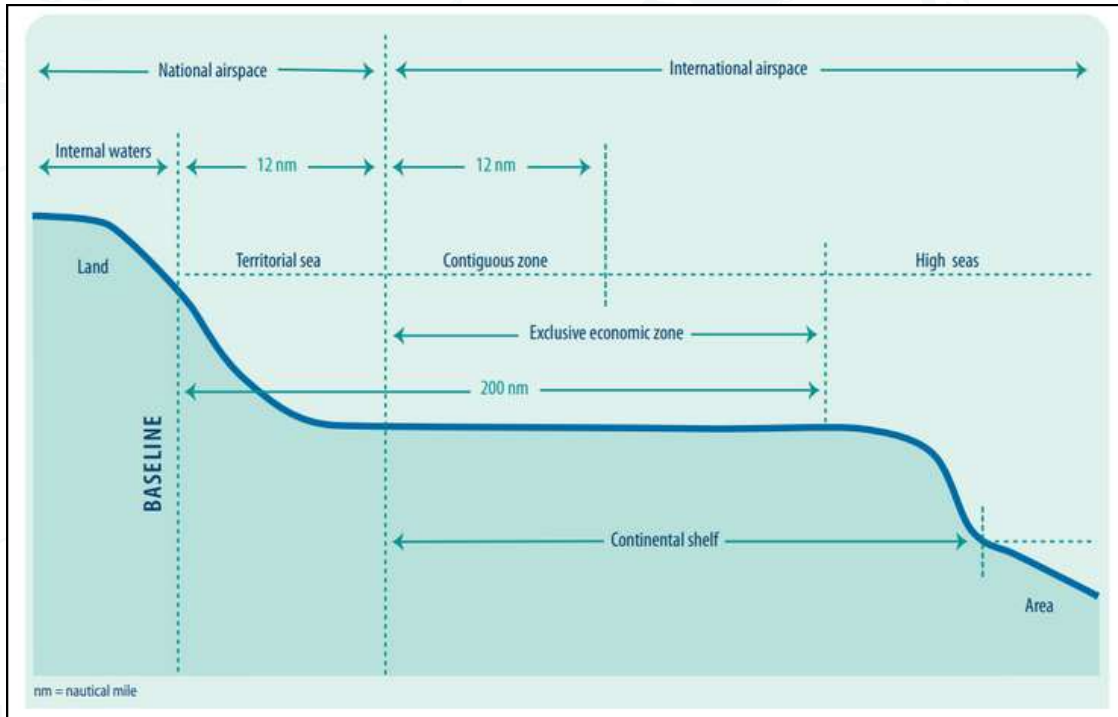


Figure (5): International Institute for Law of the Sea Studies,
Source: MSPglobal International Guide on Marine/Maritime Spatial Planning, 2021

The IOR encompasses a wide array of politically, socially, and culturally diverse nations, each with variations in terms of land area, geographical features, population, climate, and economic development. The most pressing challenge amongst other challenges related to the ocean in this region is climate change, which poses particular vulnerability to the Indian Ocean, to effectively address these challenges, it is crucial to monitor ocean dynamics through the use of floats, buoys, and remote sensing technologies and to streamline these monitoring efforts. This underscores the importance of coordinated efforts among IOR countries for the stability of the global economy.

The IOR can be divided into sub-regions, including Australasia, Southeast Asia, South Asia, West Asia, and Eastern & Southern Africa, each with its own regional forums such as ASEAN, SAARC, GCC, SADC, Indian Ocean Commission, BIMSTEC, and more. Both from security and economic perspectives, the IOR requires a regional approach to Marine Spatial Planning (MSP). Platforms like the Indian Ocean Rim Association (IORA) could facilitate the establishment of such a regional cooperation framework.

Currently, there are 23 member states in IORA. Such regional forums can promote coordination and economic development in the IOR through a comprehensive MSP that supports cross-border and trans-boundary cooperation among stakeholders. As ocean-based activities intensify, the actions of one coastal state can have significant environmental, economic, and social impacts on neighboring states. Hence, the development of a comprehensive framework is necessary to prevent conflicts. Involving stakeholders actively in the MSP formulation process, taking into account the limitations of existing ocean-specific mechanisms, can help prevent conflicts and ensure the success of governance mechanisms.

At present, IORA focuses on eight key priority areas, which include Maritime Safety and Security, Trade and Investment Facilitation, Fisheries Management, Disaster Risk Management, Tourism and Cultural Exchanges, Women's Economic Empowerment, Blue Economy, and Academic, Science and Technology Cooperation. Inclusion of Marine Spatial Planning as a priority area of IORA will give an impetus to the planning and execution of MSP among the IORA states.

Nation-states can also establish bilateral or multilateral Marine Spatial Plans or leverage multilateral bodies, whether supranational or intergovernmental, to facilitate consultations among stakeholder states. Such plans may include provisions to address border disputes, promote technological collaboration, ensure coherence in plan implementation, and foster synergies across borders. Such a plan is indispensable for managing diverse activities within an interconnected space, even in the face of geographic, geopolitical, and geostrategic differences.



Figure (6): IORA Member States,
Source: IORA

During the IOC's MSP Roadmap seminar, it was suggested that adopting a regional approach to Marine Spatial Planning (MSP) can yield substantial benefits for the region. This approach expands the perspective on the challenges related to marine governance and provides an opportunity for collaborative learning, knowledge exchange, enhanced cooperation, and capacity building. Over the past decade, several countries in the western Indian ocean region have undertaken the preparation and implementation of MSP. Each of these countries has tailored their plans to their specific contexts. For example, Kenya has developed an ecosystem-based management plan aimed at promoting the sustainable management of its marine environment. Following successful implementation in select pilot areas, Kenya is now working on integrating the plan more comprehensively. Mauritius, on the other hand, has focused its MSP on economic diversification, while Seychelles has utilized MSP to design a participatory mechanism for the sustainable utilization of its Exclusive Economic Zone (EEZ).

5. MSP in India

India's Exclusive Economic Zone (EEZ) spans over 2 million square kilometers and is rich in ocean resources, including crude oil and natural gas, which can be harnessed for socioeconomic development. India boasts a total of 12 major ports and an extensive network of around 200 non-major ports along its coastline. The major ports are administered by the central government, while the non-major ports fall under the jurisdiction of state governments. During the period from April to March in 2022-23, these ports collectively handled approximately 1,433 million tons of cargo. The Indian coastal economy also supports a population of over 260 million.

Over time, India has acknowledged the necessity for a tailored approach in managing distinct sectors within its ocean-based industries. This sectoral management encompasses targeted initiatives and policies for fisheries, shipping, offshore energy, tourism, and other marine-related activities. The establishment of sector-specific regulatory frameworks and institutions, complemented by technological advancements, has been instrumental in optimizing the sustainable utilization of marine resources. As the nation continues to navigate the complexities of ocean-based sectors, this historical trajectory lays the groundwork for informed and strategic decision-making, notably through the implementation of Marine Spatial Planning.

India has proactively implemented Integrated Coastal Zone Management (ICZM) plans to address the complex challenges of its vast and diverse coastal areas. These plans, formulated under the Coastal Regulation Zone (CRZ) framework, aim to strike a balance between environmental conservation and sustainable development. The ICZM approach involves comprehensive mapping, risk assessment, and stakeholder engagement to ensure holistic management of the coastal zones. India's ICZM plans emphasize the conservation of biodiversity, protection of critical habitats, and sustainable land-use practices. Key initiatives include the identification of ecologically sensitive areas, the promotion of climate-resilient strategies, and the integration of local communities into decision-making processes. These plans play a crucial role in safeguarding coastal ecosystems, mitigating the impact of natural disasters, and fostering responsible coastal development. Through the integration of scientific insights, community involvement, and regulatory frameworks, India's ICZM plans serve as a robust model for balancing ecological integrity and socio-economic needs along its extensive coastline.

The history of port planning in India reflects a dynamic evolution shaped by the country's maritime trade and economic needs. Ancient Indian civilizations had well-established ports along the coastline, facilitating trade with neighboring regions. During the colonial era, the British further developed and expanded Indian ports to serve their trade interests. Post-independence, the emphasis shifted towards modernizing and upgrading existing ports and building new ones to accommodate growing trade volumes. The formation of the Major Port Trusts Act in 1963 marked a significant milestone in port governance, establishing autonomous bodies for port administration. In recent decades, strategic initiatives like the National Maritime Development Program and the Sagarmala Programme have underscored the importance of comprehensive port planning, focusing on infrastructure development, connectivity, and sustainability. The historical trajectory of port planning in India showcases a continuous commitment to optimizing maritime infrastructure for economic growth, global trade, and efficient logistics.

India has taken proactive steps to effectively manage its coastal and marine resources, with Coastal Economic Zones (CEZs) emerging as a strategic tool to harness the economic potential of its extensive coastline. Rooted in broader economic policies, the historical evolution of CEZs traces back to the establishment of Special Economic Zones (SEZs) in the early 2000s. This marked a pivotal move towards fostering economic growth, attracting foreign investments, and boosting exports. Over time, the concept of Coastal Economic Zones gained prominence, emphasizing the distinctive advantages of coastal landscapes, such as enhanced connectivity to ports and international trade routes.

The government's commitment to the Sagarmala Programme, initiated in 2015, underscores the strategic importance of CEZs in bolstering maritime infrastructure, connectivity, and overall economic development along the coastline. This comprehensive approach is exemplified by numerous projects focusing on port modernization, improved connectivity, industrialization driven by ports, and the development of coastal communities across 14 coastal economic zones.

India has made significant strides in marine conservation through the establishment of Marine Protection Zones (MPZs) aimed at preserving and safeguarding its rich coastal and marine ecosystems. These zones, strategically designated along the extensive coastline, play a pivotal role in biodiversity conservation, habitat preservation, and sustainable fisheries management. India's commitment to marine protection is evident in initiatives like the Gulf of Mannar Marine National Park, the Gulf of Kachchh Marine National Park, and the Great Nicobar Biosphere Reserve, among others. These MPZs not only serve as sanctuaries for diverse marine species but also contribute to the overall health and resilience of coastal ecosystems. The establishment of Marine Protection Zones underscores India's dedication to balancing economic development with environmental sustainability, ensuring the long-term viability of its marine resources for future generations.

In 2019, the Government of India introduced the Coastal Regulation Zone Notification to conserve and safeguard coastal zones and marine areas. The Ministry of Earth Sciences (MoES) and the National Centre for Coastal Research (NCCR) in Chennai have developed Coastal Zone Management (CZM) plans, designating specific coastal stretches as Coastal Regulation Zones (CRZ), as illustrated in the figure (7). MoES has played a pivotal role as a nodal agency in various programs and projects that have had significant socioeconomic impacts on the livelihoods of coastal communities.

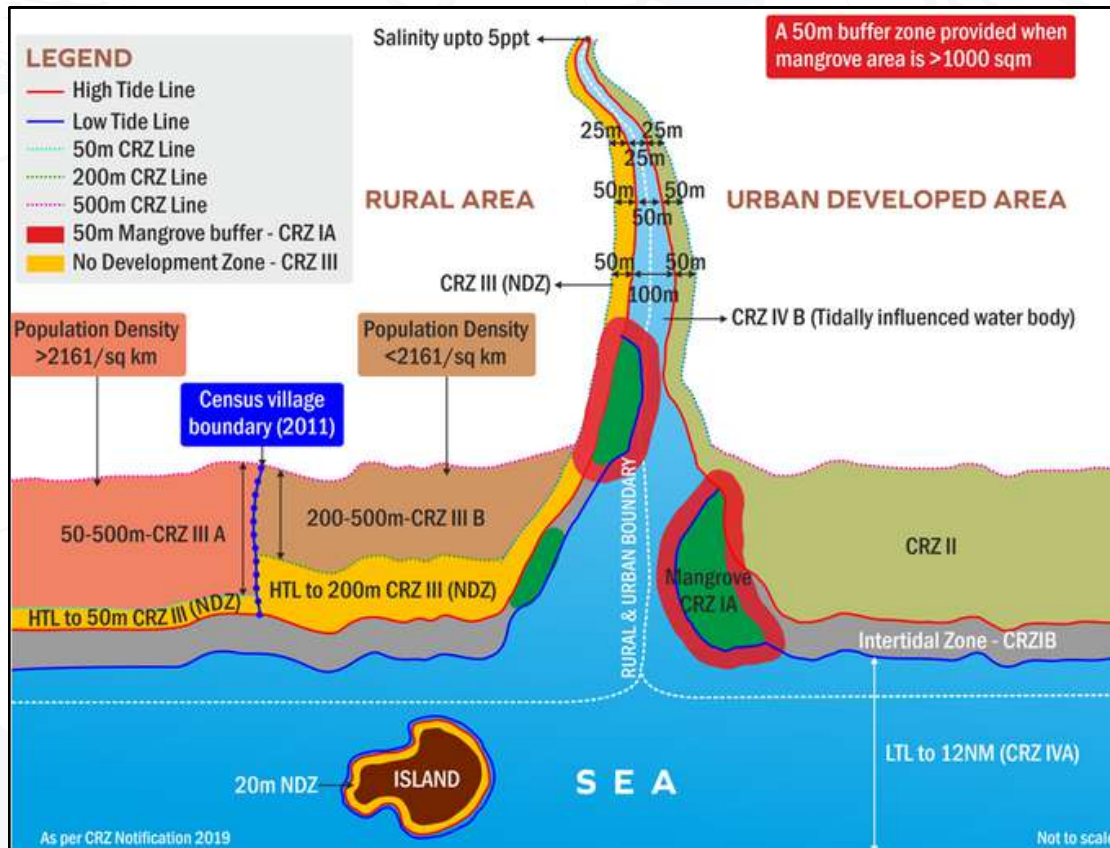


Figure (7): Conceptual Diagram of Coastal Zone Management Plan,
Source: [National Center for Sustainable Coastal Management](#)

India's maritime legacy is characterized by proactive initiatives, such as the utilization of buoys spanning up to 30 years for diverse maritime applications. Buoys have been instrumental in monitoring oceanographic parameters, bolstering weather forecasting, and elevating maritime safety. The Ministry of Ocean Development, founded in 1981 and later merged into the Ministry of Earth Sciences, has been a driving force in shaping policies for ocean exploration, research, and sustainable development. Beyond domestic waters, India's maritime influence extends to the pristine Antarctic region, exemplified by the initiation of the Indian Antarctic Program in 1981. Research stations like Maitri and Bharati in Antarctica have significantly contributed to global scientific knowledge. These endeavors underscore India's dedication to comprehensively understanding and responsibly utilizing the vast maritime expanse. In 2021, India launched the Deep Ocean Mission, allocating a budget exceeding Rs 4,000 crore over five years, further showcasing its commitment to gaining a deeper understanding of oceans and their resources. This mission includes extensive deep ocean survey exploration, programs for the protection of deep-sea biodiversity, and collaborative efforts to address marine litter and plastic pollution through initiatives like the "Clean Seas Programme" with the United Nations.

In the context of the Indian rivers such as Ganges and Brahmaputra in India, the Blue Economy and Marine Spatial Planning (MSP) represent interconnected approaches to harnessing economic and environmental potential. The Blue Economy concept emphasizes sustainable development in water-related sectors, extending beyond coastal areas to include inland water bodies like rivers.

For the Ganges and Brahmaputra, the Blue Economy entails responsible utilization of river resources for fisheries, transportation, agriculture, and tourism. Integrating Marine Spatial Planning into the equation enhances the strategic management of these water systems, ensuring optimized use of space while considering ecological and socio-economic factors. MSP facilitates coordinated decision-making, helping balance competing interests and supporting sustainable practices along the riverbanks. By aligning the Blue Economy principles with effective Marine Spatial Planning, the Ganges and Brahmaputra rivers can contribute significantly to economic growth while preserving the rich biodiversity and cultural heritage associated with these vital waterways.

India's vision for "New India by 2030" includes the blue economy as one of the ten fundamental pillars of growth. To steer the blue economy, Marine Spatial Planning (MSP) is considered a vital tool. MSP has been adopted in over 100 countries, with varying stages of implementation, ranging from initial planning to plan revisions. Twenty countries, representing 22% of the world's Exclusive Economic Zones (EEZs), have already adopted and are implementing plans for their maritime territories. Additionally, twenty-six countries have endorsed plans for their jurisdictional waters, covering 25% of the world's EEZs. Furthermore, eighty-two nations have expressed their commitment to initiate MSP processes in their underwater domains, encompassing 47% of the world's EEZs, with planning still in its nascent stages.

According to Ministry of Earth Sciences (2023), addressing scientific data gaps is crucial for successful Coastal and Marine Spatial Planning (CMSP) and Blue Economy (BE) development. This involves filling gaps in analytically derived data, historical records, and essential spatial information, particularly in socio-economic data for various uses and baseline data on biophysical ecosystem features, ecosystem services, and socio-cultural information. Stakeholder engagement is another pivotal aspect, with active involvement necessary at all decision-making phases.

Developing the institutional architecture for CMSP governance to identify suitable sectors and corresponding social interactions is a challenging but essential task. Generating synergies between different sectors requires an effective institutional framework due to the multi-layer usages, uncertainties, and complex dynamics of the coast. The integration of horizontal, two-dimensional, vertical, and temporal data is vital for mapping potential conflicts and synergies. Adapting to climate change is imperative for the resilience of CMSP and BE, necessitating the effective integration of climate change strategies. Identifying shortcomings in political and institutional frameworks is essential for collaboration, addressing conflicting interests, preventing duplication of efforts, and optimizing resource utilization. Building potential synergies and trade-offs, synthesizing best practices, and transferring knowledge are critical for developing new practical solutions in CMSP and BE.

Countries worldwide have started to prepare for improved ocean resource management by increasing investments and introducing advanced technology and data management techniques. It is anticipated that the implementation of MSP will foster economic growth, optimize sea utilization, reduce information-related costs, streamline regulation, enhance planning, and improve decision-making processes. MSP is also expected to minimize coordination and transaction costs, including those related to research, legal matters, administration, and conflict resolution, while boosting investments. Additionally, MSP has the potential to mitigate conflicts among various maritime economic sectors by delineating ocean spaces for different uses and activities.

India has embarked on the early stages of comprehensive Marine Spatial Planning (MSP) through a collaborative effort with Norway, concentrating on the regions of Lakshadweep and Puducherry. This initiative underscores a strategic approach to effectively manage and organize activities in the marine environment, considering ecological, economic, and social factors. As part of this commitment, India has allocated a substantial investment of approximately 8-10 crores per annum for a period of five years, reflecting the nation's dedication to the sustainable development of its coastal and marine resources. Notably, the involvement of esteemed international entities, such as the World Bank and the United Nations Environment Programme (UNEP), signifies a broader recognition and support for India's MSP initiative. Their expressed interest suggests potential collaboration, financial backing, and expertise, which can significantly contribute to the success and effectiveness of India's Marine Spatial Planning efforts. This joint venture exemplifies a proactive and inclusive approach towards ensuring the responsible and balanced utilization of marine spaces for the benefit of both the environment and society.



Figure (8): Key Benefits of MSP Implementation

6. MSP and Blue Economy

In September 2020, India unveiled the draft of a policy framework for the blue economy, aimed at efficiently harnessing ocean resources and building ocean-related capabilities, capacities, and skills to generate employment, increase gross value addition, and ensure environmental conservation. Several countries have already implemented blue economy projects with quantifiable objectives and allocated budgetary resources. Nations like Australia and Canada have also enacted legislation and established hierarchical structures at both the federal and state levels to support their blue economy initiatives.

At this juncture, India must develop a comprehensive Marine Spatial Planning (MSP) tool that offers clear guidelines for realizing a sustainable Blue Economy. MSP facilitates the more efficient utilization of underwater space and the sustainable exploitation of marine resources, thereby reducing potential competition and conflicts. Moreover, it enables more thorough assessments of the impacts associated with proposed new activities, as opposed to the current approach of evaluating projects on a case-by-case or sector-by-sector basis. Marine spatial plans establish a transparent and predictable framework for investments in the blue economy. With a robust MSP foundation, all the objectives of the blue economy, including socioeconomic development, livelihood enhancement, and environmental sustainability, can be achieved.

Initially, MSP can take the form of a sector-driven plan with a primary focus on one or two key goals, such as renewable energy and nature protection. Alternatively, it can stem from a multisectoral policy, such as a sustainable blue economic policy, where the integration of MSP into ocean plans creates a systematic and coordinated framework that facilitates the attainment of multiple objectives, including nature preservation and conservation, food security, clean energy production, mobility, security, and more. MSP thus provides a systematic approach for realizing the goals of the blue economy.

MSP is a strategic and integrated planning approach that helps nations effectively manage their coastal and marine areas, making it an essential tool for achieving the objectives of the Blue Economy. Here's how MSP and the Blue Economy are interconnected:

1. Sustainable Resource Management: MSP helps optimize the use of maritime space and resources by facilitating the coordinated development of various sectors, such as fisheries, aquaculture, shipping, tourism, renewable energy, and conservation. This ensures that resource utilization is sustainable and minimizes conflicts between competing activities.

2. Economic Growth: The Blue Economy aims to promote economic growth by creating jobs, generating revenue, and fostering innovation in ocean-related industries. MSP provides a framework for identifying areas suitable for different economic activities and investments, thus contributing to the growth of the blue economy.

3. Environmental Conservation: Sustainability is a core principle of the Blue Economy, and MSP aligns with this goal by incorporating environmental considerations into planning processes. It helps identify and protect ecologically sensitive areas, biodiversity hotspots, and critical habitats, ensuring the long-term health of marine ecosystems.

4. Predictable Investment Environment: MSP offers a transparent and predictable system for investors and stakeholders in the blue economy. By delineating zones for specific activities and providing a roadmap for development, MSP reduces uncertainty and risks associated with investment in ocean-based sectors.

5. Multisectoral Approach: MSP encourages a multisectoral approach to planning, bringing together diverse stakeholders, including government agencies, industries, environmental organizations, and local communities. This collaborative approach ensures that the blue economy benefits a broad range of interests.

6. Socioeconomic Development: The Blue Economy aims to enhance livelihoods, particularly for coastal communities. MSP considers the social aspects of development, including equitable access to resources, employment opportunities, and community well-being, aligning with the socioeconomic objectives of the blue economy.

7. Climate Resilience: As climate change affects coastal and marine environments, MSP can help identify areas vulnerable to climate impacts and incorporate adaptation measures into blue economy strategies, enhancing the resilience of coastal communities and industries.

MSP and the Blue Economy are intertwined, with MSP serving as a strategic planning tool to achieve the sustainable, economic, environmental, and social objectives of the blue economy. By fostering coordination, minimizing conflicts, and promoting responsible resource management, MSP contributes to unlocking the full potential of the ocean's economic and ecological resources while safeguarding its long-term health.

7. MSP and Ecosystem Based Management

Marine Spatial Planning (MSP) represents an ecosystem-centered strategy that takes into consideration the entire ecosystem, encompassing human activities as well. The fundamental goal of ecosystem-based management is to ensure the health, productivity, and resilience of an ecosystem, thereby enabling it to continue providing the goods and services that are both desired and essential for human well-being. To harness marine resources for anthropogenic use sustainably, environmental sustainability stands as a critical prerequisite.

The current status of Marine Protected Areas (MPAs) reveals a stark reality, with just a tiny fraction, a mere 0.8 percent, of the world's oceans designated as protected zones. This highlights a critical gap in global efforts to conserve marine ecosystems and biodiversity. The International Union for Conservation of Nature (IUCN) has set an ambitious and imperative goal, advocating for a binding agreement to increase MPA coverage to 30 percent by 2030. This proposed expansion is a response to the escalating threats facing oceans, such as overfishing, habitat degradation, and climate change. The commitment to protect nearly a third of the world's oceans underscores a collective recognition of the urgent need for enhanced conservation measures. Achieving the 30% target requires concerted international cooperation, the establishment of robust policies, and effective enforcement mechanisms. By significantly expanding the network of MPAs, the global community aims to create sanctuaries that promote ecological resilience and contribute to the overall health and sustainability of marine ecosystems.

Maritime activities and sources of pollution are growing more diverse and intensifying. The intricate and multi-layered interactions among various oceanic activities are exerting profound impacts on the delicate marine ecosystem. Biological diversity and the invaluable ecosystem services it provides face considerable threats from a spectrum of marine activities, including the generation of renewable energy (such as wind, wave, and tidal energy), the installation of cables and pipelines, oil and gas exploitation, sand and gravel extraction, benthic trawling, anchoring, and the development of other marine infrastructure. The environmental consequences encompass NO_x production, the release of wastewater from ships, which accelerates eutrophication, marine litter accumulation, the introduction of invasive species, overexploitation of marine resources, historical use of antifouling agents, oil and chemical spills, underwater noise pollution, collisions with marine megafauna, seabed mining, tourism, and transport. MSP serves as an indispensable tool for safeguarding the integrity of the sea floor and the marine food webs from the adverse impacts of these activities. It also involves active monitoring and control of contaminants in seafood to protect human health.

Marine Spatial Planning (MSP) is a critical tool that primarily addresses activities and outcomes within the marine environment. However, it is essential to recognize that the health of the marine ecosystem is intricately linked to various land-based activities. Industrial operations, agricultural practices, and the discharge of urban wastewater are among the significant contributors to the deterioration of marine ecosystems. To comprehensively address these challenges, an ecosystem-based approach is imperative. This approach goes beyond the marine domain and considers the interconnected roles of ocean-based, territorial, and natural components within the broader ecosystem.

By adopting an ecosystem-based perspective, MSP can integrate land and sea interactions, ensuring a holistic and sustainable management strategy that takes into account the complex dynamics between terrestrial and marine environments. This broader approach is essential for effectively preserving marine ecosystems and promoting the overall well-being of both terrestrial and marine components of our environment.

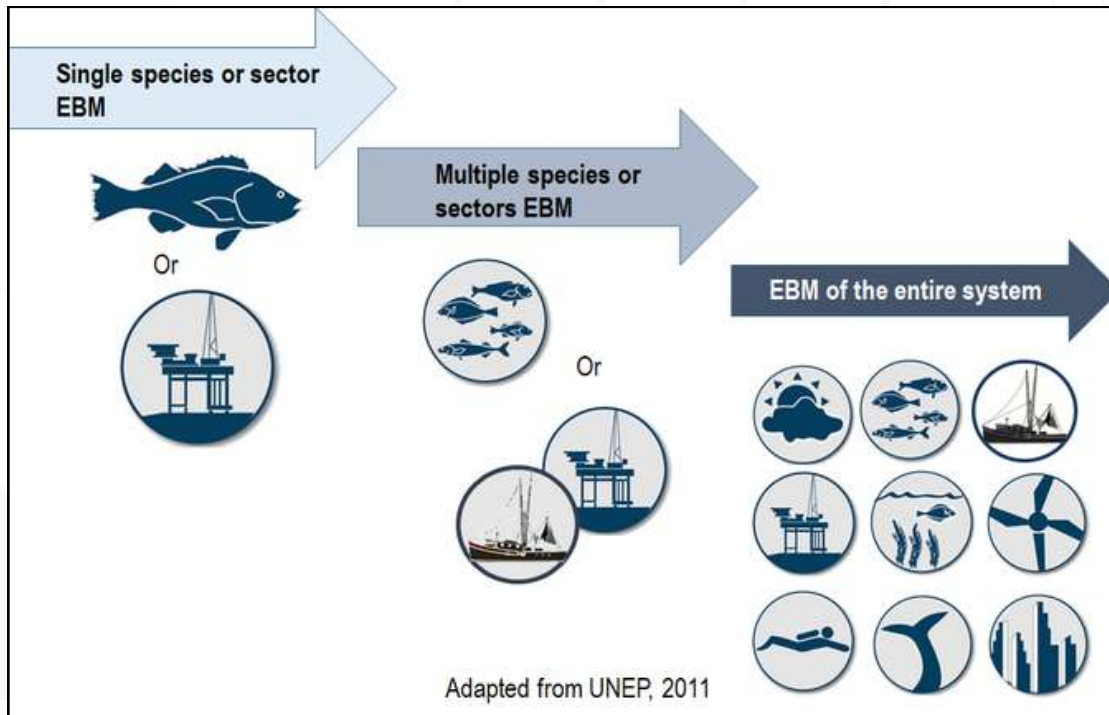


Figure (9): Continuum of Ecosystem-Based Management,
Source: UNEP 2011

The ecosystem-based approach offers a holistic approach to managing land, water, and living resources, with the goal of promoting conservation and sustainable utilization in an equitable manner. Achieving synergy between territorial and marine activities is also crucial to ensuring the sustainability of the marine environment. MSP plays a pivotal role in identifying and allocating areas for the conservation of representative, rare, vulnerable, and valued species and habitats. An MSP approach can effectively pinpoint priority areas for preservation and restoration, such as Marine Protected Areas (MPAs), Biosphere Reserves, Ecologically or Biologically Significant Marine Areas (EBSAs), among others. Moreover, MSP aids in mapping the goods and services provided by ocean ecosystems and their vulnerabilities, facilitating well-informed decision-making processes.

Pathways to support the inclusion of climate change in MSP	
Approaches	Actions
Integrating climate change impacts in MSP policies	Recognising climate change as a threat or challenge
	Including specific objectives related to climate change responses
	Developing climate-related modelling and mapping tools in assessments about future conditions of ecosystems and biodiversity, as well as maritime activities
	Developing climate-related vulnerability and risk analyses
	Including climate change in spatial-use scenarios and visioning processes
Promoting adaptation to climate-related change	Adopting dynamic ocean management, i.e. defining flexible designated areas with boundaries that change in space and time in response to climate-related change
	Developing anticipatory zoning, e.g. defining a priori designated or exclusion areas in anticipation of potential climate change impacts
	Adopting an adaptive planning approach that includes revision opportunities to incorporate new climate-related knowledge

Sources: Adapted from Frazão Santos et al., 2020; Cashion et al., 2020.

Table (2): Pathways to Support Inclusion of Climate Change in MSP,
Source: MSPglobal International Guide on Marine/Maritime Spatial Planning, 2021

8. Major Challenges

There are several attributes of a comprehensive MSP that must be integrated to create a plan that is sustainable. Marine Spatial Plan has to be inclusive, integrative and iterative: Its content is area based, ecosystem-based and knowledge-based.

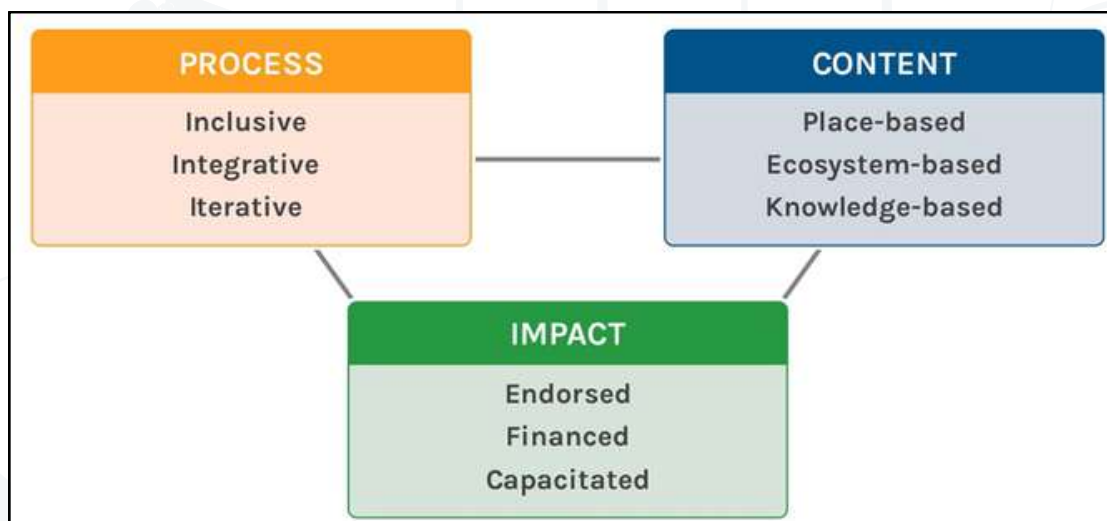


Figure (10): Attributes of MSP,
Source - Ocean Panel, 2022

Creating a comprehensive Marine Spatial Plan that effectively integrates the interests of local, state, and national stakeholders necessitates the establishment of a supportive legal framework that explicitly outlines the rights and responsibilities of all parties involved in the management and protection of the marine environment. To initiate MSP projects, obtaining statutory clearances is essential, and this can be achieved either by aligning with existing legislation or by enacting new acts or laws. Globally recognized frameworks, such as The United Nations Convention on the Law of the Sea, the Convention on Biological Diversity, and other regional frameworks can serve as valuable references for developing a national framework that addresses the legal aspects of MSP. India has implemented several legal measures to address and regulate activities impacting the marine environment. The Merchant Shipping Act of 1958 and its subsequent amendments play a crucial role in governing various aspects related to shipping and marine pollution. The rules known as the "Merchant Shipping (Prevention of Pollution by Sewage from Ships) Rules, 1981" are specifically designed to address and prevent marine pollution arising from the discharge of sewage from ships. Additionally, the Coastal Regulation Zone (CRZ) Notification, under the Environment (Protection) Act of 1986, regulates activities along the coastal areas to safeguard the marine environment and coastal ecosystems. These laws aim to control and prevent pollution, manage maritime activities, and ensure the sustainable use of marine resources. India's legal framework for the marine environment reflects a commitment to balancing economic development with environmental conservation, promoting responsible maritime practices for the benefit of both ecosystems and coastal communities. This framework should outline the criteria for engaging the appropriate stakeholders, enforcement mechanisms, and incentives to ensure plan compliance. Legal frameworks are indispensable for promoting integration across different levels of government, policy alignment, and sectoral coordination, as well as for addressing security concerns.

In India, issues related to maritime affairs have occasionally resulted in jurisdictional disputes between states and the central government. One notable example is the disagreement over the jurisdiction of state governments in regulating and overseeing minor ports. States have asserted their authority to govern activities within their respective territories, including the establishment and management of minor ports. However, the central government, under its constitutional powers, contends that certain aspects of maritime affairs, especially those concerning national security and international trade, fall within its purview. These disputes highlight the complexity of delineating authority in maritime matters and the need for effective coordination and resolution mechanisms between the central government and states to ensure coherent governance of the country's maritime domain. Consequently, without a well-established legal structure, the coordination and integration of national marine assets, resources, and activities may not be optimal. MSP relies heavily on legislative support, necessitating the development of enabling policies and governance mechanisms. The legal system should also accommodate environmental impact assessments (EIA). There is a shortage of evaluative processes designed to assess the tangible outcomes of MSP projects, such as measurable improvements in environmental quality and the enhanced regulation of marine operations and infrastructure. While some results, like the declaration of protected marine areas, are evident, there is a noticeable absence of systematic and official evaluations that could provide insights into the overall impact of MSP projects.

The monitoring and evaluation (M&E) of MSP represent the most critical aspects of the plan, demanding various skills and resources. M&E efforts should encompass specific considerations such as land-sea interactions, equity and participation, the unique conditions of individual nations and sea basins, traditional knowledge, among others. Developing an evaluation framework for MSP is essential to assess outcomes, conflicts, and trade-offs while establishing an iterative feedback process. MSP operates as an adaptive management framework, signifying a systematic, iterative approach where management evolves based on new information obtained through monitoring and evaluation.

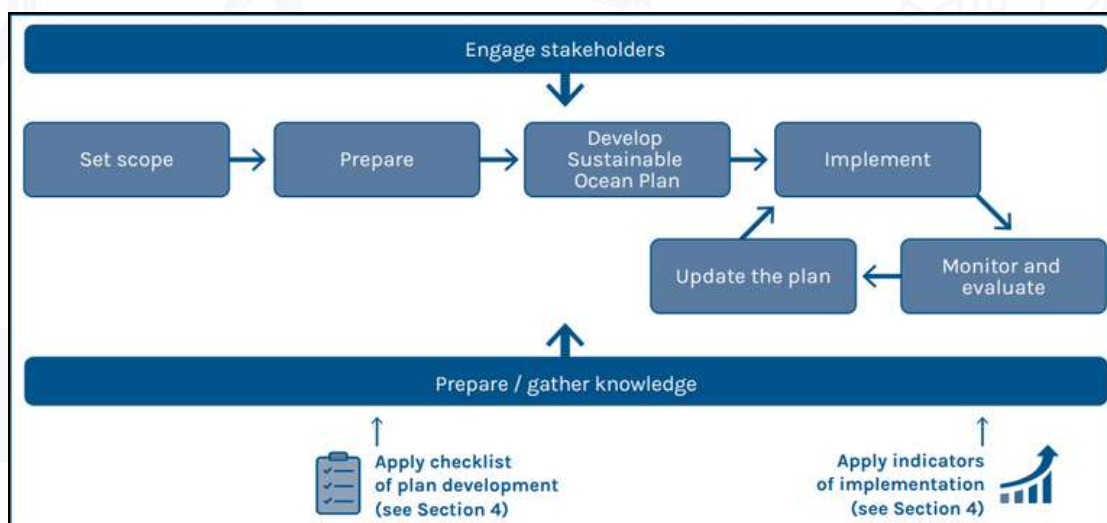


Figure (11): Iterative Process for MSP,
Source: Ocean Panel, 2022

To ensure the effectiveness of MSP, it is imperative to establish sustainable financing strategies. Some countries, such as China and Australia, have implemented taxes on sea users as a means of generating revenue. In the context of transboundary MSP, there is potential to create regional funds to mitigate conflicts over space and resource usage while also funding planning initiatives. Memorandums of Understanding (MOUs) can also be drafted between coastal nations to distribute the financial burden. An illustrative example is the Seychelles government's use of ocean-based debt conversion and the issuance of a sovereign blue bond to fund all ocean-based activities in a sustainable manner.

Within Marine Spatial Planning, it is critical for government agencies to collaborate with private sector entities to address the needs and challenges of diverse stakeholders, strategically allocating suitable areas for their activities. MSP should actively promote ocean equity by ensuring that all individuals have equal opportunities to reap the benefits of ocean resources. Particular attention should be directed toward safeguarding the most vulnerable populations from socio-economic and cultural harm.

Currently, MSP tends to restrict the types of knowledge considered in decision-making processes. Traditional and cultural knowledge that empowers small-scale sectors has largely been excluded from the planning process. Consequently, the MSP process must identify pathways to incorporate coastal stakeholders into decision-making and rectify existing power imbalances. Moreover, coastal and marine operations often exhibit connections to terrestrial activities and components that must be taken into account. A comprehensive understanding of the linkages between land and marine planning systems is pivotal for the success of MSP.

MSP should also adopt a climate-smart approach. In addition to achieving sectoral objectives, MSP should prioritize the restoration of the health of marine and coastal ecosystems. Preserving the resilience and productivity of ocean biodiversity requires the implementation of nature-based and ecosystem-based solutions in the development of coastal infrastructure and processes. The ocean's capacity to act as a carbon sink is under increasing threat due to rising pollution levels. Consequently, blue economy plans and Marine Spatial Plans should focus on reducing pollution and minimizing the formation of ocean dead zones.

Sustainability is a cornerstone of effective ocean governance, and MSP must encompass provisions to ensure the sustainability of ocean-based sectors such as food, energy, tourism, transportation, and emerging ocean industries.

Various challenges related to institutional capacity, technology integration, and data generation, storage, and analysis must also be addressed. Inadequate data management can adversely impact the MSP decision-making process. To overcome limitations in the range of knowledge considered in MSP management, dedicated agencies should consolidate data. Furthermore, securing the data required to assess social and non-market issues necessitates a flexible approach to knowledge production and integration.

9. MSP and Underwater Domain Awareness (UDA)

Underwater Domain Awareness (UDA) and Marine Spatial Planning (MSP) are intricately linked components of effective ocean governance. UDA provides the necessary foundation for understanding and monitoring underwater activities, including the movement of vessels, environmental conditions, and potential security threats. MSP, on the other hand, involves the systematic planning and organization of various marine activities to ensure sustainable and coordinated use of ocean resources. The integration of UDA into MSP is paramount, as the information gathered through UDA feeds into the spatial planning process. UDA data, such as marine traffic patterns, ecological data, and potential risks, informs decision-makers during the formulation and implementation of MSP. By combining these two approaches, policymakers and planners can enhance their ability to make informed, strategic decisions that promote both the security and sustainable development of the marine environment.

Unlike Marine Spatial Planning (MSP), which primarily focuses on planning and organizing marine activities, UDA operates as a scientific platform that delves into the root causes of maritime phenomena. It recognizes that addressing the symptoms without understanding the underlying causes is insufficient for effective governance. UDA employs advanced technologies and methodologies to gather and analyze data related to underwater activities, environmental conditions, and potential threats. It acts as a connective tool, linking the causes and effects in the marine domain. The use of acoustic signatures is a notable example, as it provides a unique and effective tool for identifying and understanding underwater phenomena. By connecting all the dots in the underwater environment, UDA facilitates a holistic understanding of the complex interactions, enabling more informed decision-making and strategic planning in the realm of marine governance.

1. Digital Transformation for Data Collection and Management - Effective Marine Spatial Planning (MSP) relies on robust data, necessitating a digital infrastructure for analysis and decision-making. Numerous countries engaged in the MSP process encounter challenges related to data mismanagement. The development of a comprehensive Marine Spatial Plan depends on the availability of reliable data, yet existing data may be inaccessible or presented in formats unsupportive for planners. Global and regional platforms, such as GEBCO, OBIS, COPERNICUS Marine Service, EMODNET, research initiatives, and cross-border cooperation projects, have been established to generate, store, and share data for Marine Spatial Planning. The Ocean Decade initiative introduces a "Digital Ocean Ecosystem" to foster collaboration between data generators and users. However, these platforms may not perfectly align with the specific needs of the Indian Ocean context. This paper advocates for the establishment of data generation and analysis entities within India and the Indian Ocean Region (IOR) that possess a deep understanding of the region's context. Indigenous platforms in India would offer the flexibility and adaptive management crucial for successful Marine Spatial Plans. Additionally, various organizations are diligently developing monitoring and evaluation (M&E) tools tailored to diverse ocean-based sectors, including fisheries, seaweed farming, shrimp farming, and more.

2. Knowledge Generation and Dissemination Platforms - Knowledge Generation and Dissemination Platforms are pivotal components of educational initiatives geared towards elevating ocean literacy and fostering skill development. These platforms, through a variety of programs and courses, aim to cultivate an appreciation for the ocean's intrinsic value and empower stakeholders with the requisite skills and knowledge to actively engage in the sustainable ocean economy. By offering diverse educational opportunities, these platforms play a crucial role in building a community of individuals well-versed in the complexities of marine environments, including the intricacies of Underwater Domain Awareness (UDA) and Marine Spatial Planning (MSP). It is essential for stakeholders, including decision-makers, to comprehend the economic and social impacts of MSP thoroughly. This knowledge equips them to formulate plans and strategies that align with these impacts, fostering informed decision-making and contributing to the long-term sustainability of oceanic ecosystems and economies.

3. Technological Advancements - Marine Spatial Planning (MSP), requires the incorporation of sophisticated Decision Support Tools (DSTs). These DSTs encompass a diverse array of computer-based tools, including simulation models and methodologies, designed to streamline decision analysis and participatory processes in the context of MSP. Recognizing the unique characteristics of Indian littoral waters, it becomes imperative for India to continually enhance its indigenous capacity and capability in planning and implementing MSP. This involves a deep understanding of the underwater domain, and the utilization of cutting-edge technologies becomes paramount to effectively navigate the complexities of the marine environment in the region.

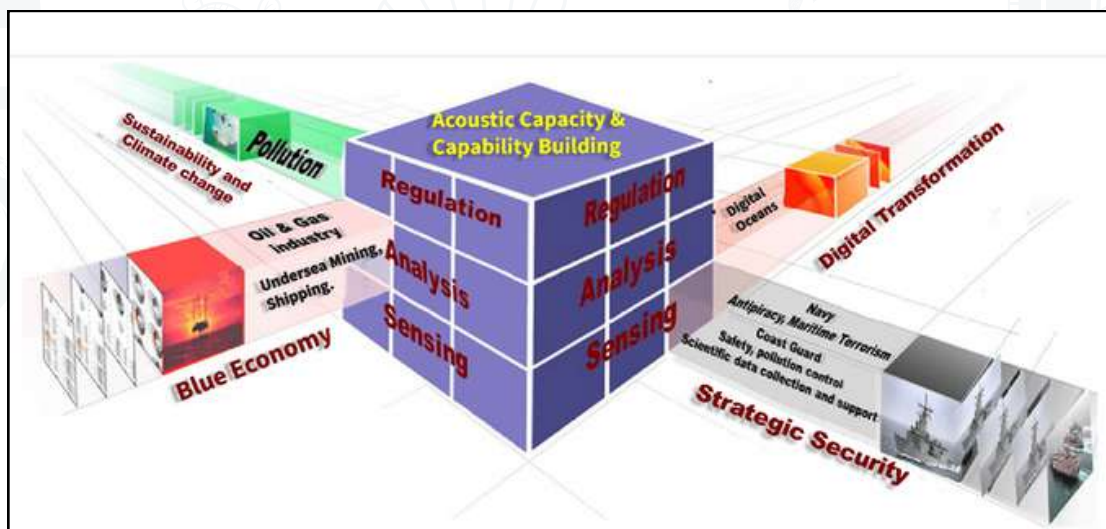


Figure (12): UDA Framework,
Source: [Maritime Research Center](#)

4. Building Capacity and Capability - Building Capacity and Capability for Marine Spatial Planning (MSP) requires a phased approach, incorporating regular reviews to ensure a harmonious balance between ecological objectives and the strengthening of institutional capacity. Crucially, long-term investments in human and institutional development, coupled with participatory planning processes, are essential for effective MSP implementation. The enhancement of MSP capacity involves the exchange of experiences and knowledge, fostering participatory planning to cultivate a shared understanding. Insufficient institutional capacity can hinder scaling-up management efforts and create mistrust among stakeholders. Complementary strategies include disseminating knowledge and sharing experiences related to MSP. The knowledge center possesses the institutional skills to provide training and distribute MSP and ocean-related knowledge to all stakeholders. This center has played a pivotal role in raising awareness about the benefits of MSP and ocean governance planning. Prioritizing infrastructure and training are vital to nurture young talents and engage them in emerging ocean-based fields. Skill development facilitates science-based exploration with cutting-edge knowledge, ultimately minimizing environmental impacts. The establishment of dedicated research platforms in India will facilitate a wide range of studies encompassing all elements of ocean exploration and management.

5. Monitoring and Impact Assessments of Socioeconomic and Environmental Outcomes - To address undesirable outcomes in MSP, the establishment of a robust monitoring system is imperative. MSP provides a platform for integrating scientific knowledge, environmental protection needs, sustainable development objectives, and poverty alleviation goals. Regular assessments of the socioeconomic and environmental impacts on coastal communities and other stakeholders affected by MSP are crucial. These assessments necessitate a continuous monitoring system and active stakeholder engagement. Workshops and seminars must be organized to involve stakeholders from different levels, and tools have been developed to bridge information gaps. To ensure MSP's adaptability and flexibility, stakeholders' evolving expectations must be compared against actual project outcomes. The framing of MSP can have varied effects on different social groups, influencing their perception of the planning process. Inclusive development, considering socioeconomic, sociopolitical, and environmental aspects related to the distribution and utilization of marine resources, is essential for MSP to achieve its intended goals. For instance, the government of Abu Dhabi employed data-driven spatial scenarios to quantitatively and qualitatively assess MSP's consequences on economic development, marine conservation, public access, recreation, and tourism. These scenarios were tested with stakeholders to determine a preferred spatial vision for maritime management. In addition to meeting the needs of local stakeholders, industry, and government, MSP requires a feedback mechanism to monitor changes in the ocean's ecosystem, comprehensively evaluating the impact of climate change and human activities, aligning with global goals such as Sustainable Development Goal 14 (SDG 14).

	ATTRIBUTE	CHECKLIST	EXPLANATION
Process	Inclusive	☐ Is the plan's development process inclusive?	The plan should be developed and implemented through a participatory, transparent, equitable and accountable process that ensures all relevant interests are heard and addressed at an early stage. The process should include all relevant stakeholders.
	Integrative	☐ Does the plan integrate government agencies, sectors and processes?	The plan should establish cross-sectoral and cross-administrative coordination mechanisms that bring together relevant authorities with sectoral responsibilities on ocean management—breaking down proverbial management and data silos among ministries (e.g. fisheries, environment, commerce, transport, finance, statistics) and scales (e.g. national, state, local, tribal). It should combine sustainable use by ocean sectors (e.g. ports, fisheries, energy, tourism, shipping) with effective protection of marine ecosystems in a holistic manner. In addition, it should link various ocean-related plans, processes and data that a country may already have (or is developing) into a coherent whole.
	Iterative	☐ Is the plan's process iterative?	The plan should be a 'living' document—working today yet anticipating the changes of tomorrow. It should establish a defined timeframe and process for periodic, transparent monitoring and evaluation to check progress against agreed-upon goals and indicators of implementation. It should be refined in light of results, new knowledge, new stakeholder input and changing conditions.
Content	Place-based	☐ Does the plan address the entire marine/ocean area under national jurisdiction?	The plan should encompass all marine and coastal areas under national jurisdiction (captured in one single plan or a suite of plans); include the surface, water column and seabed; and consider the linkages among the national marine jurisdiction and adjacent land and river basins (including watersheds). If relevant, linkages among national and neighbouring waters, and with areas beyond national jurisdiction, also may be considered.
	Ecosystem - based	☐ Is the plan grounded in an ecosystem-based approach?	The plan should be grounded in an ecosystem approach or ecosystem-based management, namely, the management of natural resources focusing on the health, productivity and resilience of a specific ecosystem, group of ecosystems or selected natural assets as the nucleus of management—recognising the full array of interactions within an ecosystem, including with people. It acknowledges that to maintain healthy, resilient and functioning ecosystems, ocean areas need to be protected from unsustainable use. It also integrates the needs of human communities that rely on marine ecosystems for food security and livelihoods and it underpins nature-based climate solutions.
	Knowledge - based	☐ Is the plan underpinned by knowledge and evidence?	The plan should be underpinned by the best available science and knowledge, including Indigenous and local knowledge, creating a shared and publicly available (except for security-sensitive items) knowledge foundation. Knowledge should cover current and planned economic activities, social conditions and dynamics, the current and anticipated future state of the marine environment in the plan's area—including cumulative impacts on the marine environment of human activities, land-based activities and projected climate change.
Impact	Endorsed	☐ Is there national political support for a Sustainable Ocean Plan?	The plan and planning process should be officially endorsed or politically supported by the national government at the highest levels (e.g. president, prime minister, cabinet, parliament). Where relevant, it should be endorsed by relevant subnational levels, including leadership from Indigenous Peoples.
	Financed	☐ Is there sufficient financing for sustainable ocean planning?	The plan should have sufficient long-term financial resources for its development, implementation, monitoring, evaluation and improvement. This funding should come from domestic resources (where feasible) and can be supplemented by funding from development banks, official development assistance, philanthropies and other sources.
	Capacitated	☐ Is there sufficient human capacity for the plan?	The plan should include measures to ensure sufficient institutional capacity (e.g. skills and knowledge in relevant agencies) for development, implementation, monitoring and periodic evaluation and improvement.

Table (3): Checklist for Sustainable Ocean Planning,
Source: Ocean Panel, 2022

10. Recommendations and Conclusion

Marine Spatial Planning (MSP) serves as a reliable foundation for ensuring the long-term well-being and adaptability of the ocean, attracting investments, and creating employment opportunities that benefit both coastal communities and national economies. Integrating a comprehensive MSP framework into India's blue economic policy could enhance the implementation and monitoring of various ocean-centric initiatives, such as the Sagarmala programme. Several key components of MSP require attention to establish a solid foundation for effective ocean governance.

Capacity development is crucial for mapping the ocean, defining, and prioritizing economic activities. Through the documentation and assessment of the compatibility of marine activities, ocean management can be significantly improved, resulting in a reduction of spatial conflicts and competition. These geospatial maps will serve as the foundational basis for the subsequent formulation of development and conservation plans. This approach ensures a holistic and sustainable utilization of marine resources, aligning with broader environmental and socioeconomic goals.

Recommendations from the multi-use action plans

Recommendations for	Type 1 Multi-purpose/ multi-functional	Type 2 Symbiotic use	Type 3 Co-existence/ Co-location	Type 4 Subsequent use/ repurposing
Policy (macro-regions/nations/ regions)	Provide financial incentives and sureties for development of new technologies and combinations	Mainstream and include multi-use concept on all relevant policy levels	Clarify rights and responsibilities of different users to ocean space	Adopt clear legal frameworks and clarify liability rules (between current and future platform users), allowing for better management of expectations and predictability
Regulation (nations/regions)	Develop and deploy joint licensing procedures for multi-use development throughout entire life cycles	Identify and apply site selection criteria to establish viable multi-use sites in managed waters	Ensure that effective cooperation and mediation mechanism are in place between representatives of all sectors (i.e. working groups)	Develop general suitability criteria as to which sites and types of installations are suitable, for which type of reuse
Research (academia/industry)	Identify and address gaps in current knowledge about safety, benefits and drawbacks and create decision support systems	Identify operational overlaps allowing for the sharing of cost for supporting services and infrastructure	Gather and communicate data about compatibility of uses	Carry on time series research about long-term local impacts of maritime infrastructure and installations to ecosystems
Industry (corporations/ associations)	Develop pilot sites to showcase and advance new technology in the field	Formulate exemplary benefit and cost sharing agreements between involved actors	Facilitate industry wide capacity building regarding opportunities and operations	Suggest suitable investment mechanisms to facilitate re-use of installations after initial lifespan

Source: Schupp et al., 2019.

Table (4): Recommendations from the Multi-use Action Plans,
Source: MSPglobal International Guide on Marine/Maritime Spatial Planning, 2021

Ensuring equitable access to benefits within Marine Spatial Planning (MSP) relies on a nuanced understanding of the social, anthropological, and cultural characteristics of coastal communities, particularly those facing greater disadvantages. Implementing co-management strategies for shared resources emerges as an effective approach to achieving sustainable production and utilization. Involving all stakeholders in the planning process establishes a framework of trust and mutual advantage. The level of participation by local communities, including women, girls, and youth, in decision-making processes related to biodiversity is a pivotal determinant of MSP's success. Assessing the ease of implementing legal, regulatory, policy, and institutional frameworks safeguarding access rights for small-scale fisheries becomes crucial for ensuring sustainability.

The advent of new ocean-based industries introduces additional stakeholders and brings forth new expectations. MSP's adaptability to manage these changes hinges on the effectiveness of existing strategies and the legal support system in place. These strategies should provide clear guidelines for sustainable economic planning and execution, benefiting industries, investors, governments, and local communities.

While the ocean's wealth is vast, it has limitations. Therefore, evaluating the ocean's capacity and monitoring compliance with the plan are integral aspects of MSP. Introducing suitable incentives can encourage compliance. To ensure the long-term sustainability of blue economy infrastructure, ocean resources must be used judiciously. Parameters such as coastal eutrophication, plastic pollution levels, average marine acidity (pH), and the extent of protected areas should be periodically examined to gauge ocean health.

Engaging private sector partners and aligning support through organizations like FICCI will generate demand and attract investments. Public-Private Partnerships (PPP) can facilitate technical assistance, enhancing transparency and efficiency. Private partners can also contribute to outreach, advocacy, independent auditing, and systematic economic evaluations of MSP. This collaborative approach ensures a balanced and sustainable integration of economic activities with environmental conservation.

Securing research funding is integral to the development of a comprehensive Marine Spatial Plan (MSP), involving the strategic planning of both public and private expenditures for research in marine technology, socio-economic baseline analysis, and related fields. Essential to this process is raising awareness of MSP among students and community members engaged in ocean-related activities. Moreover, the strategic planning of development assistance for conservation measures should be informed by insights derived from various data collected and analyzed. It is crucial to inform relevant ministries and authorities about knowledge gaps, stakeholder expectations, available management tools, and human, institutional, and technical capacities. Informed decision-makers can then formulate practical and sustainable spatial plans based on this information.

MSP is a flexible process that allows for revisiting initial objectives and responding to recommendations at any stage, and continuous research is vital to explore the realities of MSP and compare motivations, strategies, methodologies, politics, and consequences of various MSP systems. Establishing a more robust dialogue between research and policy is paramount for achieving these objectives and ensuring the ongoing success of MSP.

11. Enclosures: Underwater Domain Awareness (UDA) Framework

The concept of Underwater Domain Awareness (UDA) in a more specific sense will translate to our eagerness to know what is happening in the underwater realm of our underwater areas. The emphasis on underwater awareness from a security standpoint involves protecting our Sea Lines of Communication (SLOC), coastal waters, and diverse underwater assets. This is in response to the proliferation of submarines and mine capabilities, which are designed to restrict access to the seas and littoral waters. However, just the military requirement may not be the only motivation to generate underwater domain awareness. The earth's underwater geophysical activities have a lot of relevance to the well-being of humankind and monitoring such activities could provide vital clues to minimize the impact of devastating natural calamities. Commercial activities in the underwater realm need precise inputs on the availability of resources to be able to explore and exploit them for economic gains effectively and efficiently. The regulators on the other hand need to know the pattern of exploitation to manage a sustainable plan. The extensive commercial and military activities have a significant impact on the environment. Any conservation initiative needs to precisely estimate the habitat degradation and species vulnerability caused by these activities and assess the ecosystem status. The scientific and research community needs to engage and continuously update our knowledge and access to the multiple aspects of the underwater domain. Figure (13) provides a comprehensive overview of the Underwater Domain Awareness (UDA). The underlying requirement for all the stakeholders is to know the developments in the underwater domain, make sense of these developments and then respond effectively and efficiently to them before they take the shape of an event.

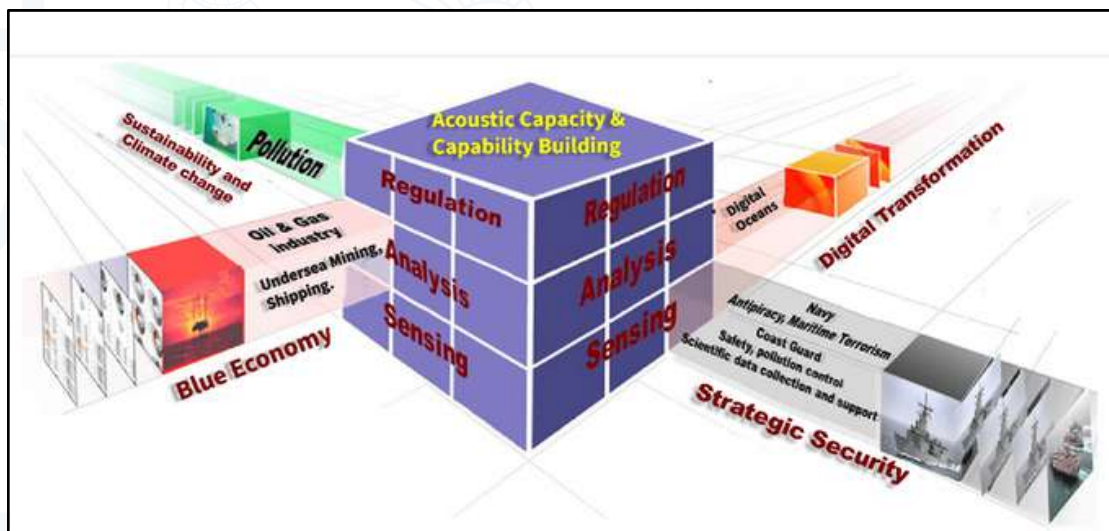


Figure (13): Comprehensive Perspective of Underwater Domain Awareness,
Source: [Maritime Research Center](#)

Understanding Underwater Domain Awareness (UDA) on a comprehensive scale involves recognizing its horizontal and vertical constructs. The horizontal construct pertains to resource availability, encompassing technology, infrastructure, capability, and capacity that are specific to stakeholders or otherwise. The stakeholders represented by the four faces of the cube will have their specific requirements, however, the core will retain the acoustic capacity and capability. The vertical construct involves establishing a comprehensive Underwater Domain Awareness (UDA) hierarchy. The first level, or the ground level, entails sensing the underwater domain for threats, resources, and activities. The second level involves interpreting the generated data to formulate security strategies, conservation plans, and resource utilization plans. The next level would be to formulate and monitor regulatory frameworks at the local, national, and global levels.

The figure above outlines a comprehensive way forward for stakeholders to engage and interact. Each individual cube represents specific aspects that require attention. The User-Academia-Industry partnership can be seamlessly established based on user requirements, academic inputs, and industry interface, as represented by the specific cube. This approach facilitates a more focused and well-defined interactive framework. With the right momentum, the Underwater Domain Awareness (UDA) framework can effectively address various challenges faced by the nation. Meaningful engagement of Young India for Nation Building is arguably the most critical aspect that deserves attention. Interactions among multi-disciplinary and multi-functional entities can contribute synergistically towards a larger goal.

The UDA Framework as proposed above has been formulated jointly by the Maritime Research Centre (MRC), Pune, and M/S Nir Dhwani Technology Pvt Ltd (NDT). The focus is on all three aspects namely Policy, Technology & Innovation, and Human Resource Development. More details are available on the MRC website <https://mrc.foundationforuda.in/>.

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Think
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The Maritime Research Center (MRC) is a think tank dedicated to Underwater Domain Awareness* (UDA).

Focused on acoustic capacity and capability building for the tropical and littoral waters in the Indian Ocean Region, MRC collaborates with stakeholders from Blue Economy, National Security, Marine Environment to Science and Technology.

MRC's Centers of Underwater Excellence molds tangible products, policies and human skills. Towards this, MRC is guided by its holistic UDA framework which has been embraced by stakeholders nationally and globally.

Join us to contribute in making our blue planet more safe, secure, sustainable and effectively explored.

Interconnection between Marine Spatial Planning and Blue Economy



Lets collaborate !!

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