

ELEMENTS AND SECTORS OF THE BLUE ECONOMY OF PAKISTAN

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Abstract

Pakistan's blue economy is poised for transformation, driven by a multitude of elements and sectors that define its maritime potential. This article offers a glimpse into the diverse elements and sectors that form the backbone of Pakistan's Blue Economy. These elements of Pakistan's Blue Economy encompass its extensive coastline along the Arabian Sea, rich marine biodiversity, strategic maritime location, and expansive Exclusive Economic Zone. These foundational elements lay the groundwork for several key sectors. The articles delve into what constitutes the more elements as core components and how, by aligning these elements, Pakistan can make progress and can have a significant impact on its economic growth. As Pakistan navigates the blue waters of its maritime resources, understanding and optimizing these elements and sectors are critical steps toward unlocking the full potential of its Blue Economy, fostering economic growth, environmental stewardship, and social well-being. By analyzing the contemporary policy patterns and sectoral divisions, this study aims to incorporate sustainable resource management, including innovation and the use of technology as a key component. It further finds that these sectors and elements are significant drivers for the growth of developing countries like Pakistan.

Keywords: Exclusive Economic Zone, Blue Economy, Arabian Sea, Elements.

Blue Economy of Pakistan

The ocean is a new economic boundary for the world. Oceans are the new source of supplying natural resources in the effort to keep up the process of economic development. It can increase employment, boost the economy, and is a source of addressing various climate changes the planet is facing and will face in the future. The blue economy emerged as a powerful tool for multiple states to expand their economy, not just on land, but also in the sea, by understanding its benefits. It has emerged as a critical component of the non-traditional security paradigm where their economic interest meets with the sustainable development, geopolitical, and geo-economic strategies that connect with the maritime domain. The blue economy provides immense opportunities like employment, tourism, resources like fisheries, minerals, coral reefs, deep-sea gems, hydrocarbon resources, and biodiversity, etc., for the states located near the oceans. Pakistan is one of the South Asian states with a coastline of 1046 km sq. It has the capacity to fully adopt the concept of the sustainable blue economy if properly implemented. The concept of blue economy gained attention from policymakers in Pakistan in 2018 when it was highlighted as part of the national security agenda in its National Security Policy-2018.

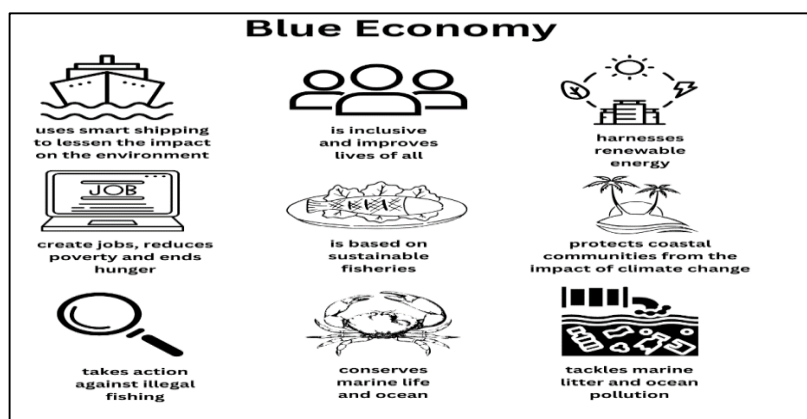
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The importance of geo-economics gained significance with Pakistan incorporating it into the National Security Policy (NSP) 2021, where more importance was given to economic development, moving away from the conventional use of military for the state's security. It aligned the idea of the core concept of NSP, safety, security, dignity, and prosperity, with economic security to improve the human and traditional security outcomes. This article aims to provide insights into the potential the blue economy holds for Pakistan by analysing its key elements and sectors as significant tools for development and growth.

Elements of the Blue Economy of Pakistan

Among the various elements of the blue economy are ships and shipping, shipbuilding, fishing, seabed resources, waterways, ports, and harbours, seaborne trade, marine, and coastal tourism, Exclusive Economic Zones, laws of the seas and oceans, and marine spatial planning¹. Additionally, declining fish stocks can produce more fish, produce sustainable fish yields, and create additional job possibilities. Coral reefs and mangroves, which the coastal ecosystem may supply, can aid in boosting coastal protection and can be useful in the event of natural disasters like storms and sea level rise².

Figure 1. Elements of the blue economy



Source: (Tanveer, 2022)

The transformation of traditional maritime sectors to more environmentally friendly practices is a crucial element of the blue economy. A good illustration of it is the fishing industry.

Principles for Sustainable Blue Economy

The world's oceans, seas, and coastal areas are among the greatest ecosystems on the globe and a priceless part of our natural heritage that are crucial for the sustenance and nutrition of billions of people globally, as well as the economic health of the majority of nations. However, human economic activity already puts these marine ecosystems' long-term capacity to offer food and jobs in jeopardy. There are multiple threats because of the uncoordinated policies by the authorities, but fortunately, more and more governments, organizations, and individuals in developed and developing countries are realizing how crucial it is to control the economic expansion of the seas using a more thorough, equitable, and scientific method. The realization that we must carefully plan and carry out our economic activities, balancing the need to raise living standards and promote welfare with the necessity of sustaining ecosystem health, is beginning to set in.

Humans are a vital component of the marine environment, and for the Blue Economy to continue to grow in a sustainable manner, both the public and private sectors must assume an active leadership role that also includes keeping promises made at the national, municipal, regional, and international levels. The WWF has proposed several criteria to ensure that the economic growth of the ocean would contribute to the development and sustainability of the current and future generations and that it would entirely focus on the enhanced country for a sustainable blue economy. These principles can be used by the governments, commercial and financial sectors, international organizations, and civil society organizations from any nation that has a mutual interest in the economic development of the sea. They can be used in any region of the oceans, seas, or beaches because they are universal. The WWF also gives an invitation to all the countries working on the blue economy to work on this principle to enhance their marine resources and get better economic development in this sector. A marine-based economy is part of a sustainability that:

1. Enhances political stability, livelihoods, income, employment, health, safety, equity, and food security, resulting in benefits for both current and future generations in terms of social and economic conditions.
2. Restores, guards, and upholds the marine ecosystems' intrinsic worth, diversity, productivity, and adaptability of the natural capital that is essential to profitability.

3. Ensures long-term economic and social stability while abiding by the limits imposed by our planet's resources by using clean technology, renewable energy, and circular material flow concepts. Is controlled by both governmental and private procedures, including Diverse, Knowledgeable, cautious, and adaptable, Transparent, and responsible, Comprehensive, cross-sectoral, and lasting. Persistent and entrepreneurial procedures.
4. The existing marine resources that support the livelihoods of billions of people must be preserved and restored.

The public and private sectors must follow the following to create a sustainable blue economy:

1. Establish clear, quantifiable, and enforceable goals and ambitions for a blue economy that can last.
2. Evaluate and share their performance in relation to these objectives.
3. Establish an equitable playing field in economics and law that offers the Blue Economy sufficient rules and incentives.
4. Effectively organize, supervise, and regulate the utilization of maritime resources and space using ecosystem-based thinking and inclusive techniques.
5. Create and implement best practices, standards, and guidelines that support a sustainable blue economy.
6. Understands how closely related the economies of the sea and the land are and how many of the dangers to the marine environment come from the land.
7. Actively work together by sharing information, best practices, lessons learnt, points of view, and concepts to create a future that is environmentally friendly and successful for everyone³.

Components of Blue Economy

An essential component of the blue economy is the need to balance the economic, social, and environmental aspects of sustainable development in connection to oceans. Given that ocean resources are scarce and that human activity has caused a sharp decline in ocean health, including damage from it, it can be difficult to find a balance in real-world situations concerning carbon dioxide emission levels, vitamins and minerals,

biological substances, plastic contamination, inappropriate aquaculture, ecosystem deterioration and damage, and the dissemination of exotic species.

The elements of a blue economy can be categorized generally into five groups.

1. The collection and exchange of marine life resources.
2. Marine non-living resource extraction and utilization (non-renewable).
3. Utilization of non-depletable renewable natural forces (tidal, wave, and wind energy).
4. Ocean-related trade and commerce.
5. Contribution to economic activities and the environment indirectly.

Diverse organizations are making up the blue economy, including long-standing ones like: fishing, tourism, and maritime transportation, as well as more recent ones like: aquaculture, offshore renewable energy, seabed mining, marine biotechnology, and bio-prospecting. Ocean ecosystem services, including: carbon sequestration, coastal protection, garbage disposal, and biodiversity. The biodiversity preservation that does not have markets play a key role in economic activity and other human endeavours⁴.

Sectors and Potentials of Blue Economy

The blue economy goes beyond the current system and views economic growth and sea health as mutually beneficial ideas. It comes from the realization that human-caused changes to ocean ecosystems cannot be sustained, much less accelerated, by mankind. Ecological harm and dangers to the environment brought on by economic activity are greatly reduced or mitigated in a blue economy⁵. As a result, ocean ecosystems' capacity to sustain this activity over the long term keeps improving and is stable in relation to economic activity. It is widely recognized as a long-term plan created to encourage sustainable economic growth through organizations connected to the ocean, while simultaneously improving social justice, safeguarding the environment, and boosting human well-being. The outputs from the lakes, rivers, and seas are used as a sustainable source of economic growth and for consumption. The following sectors and potentials are included in the general understanding of the blue economy:

Fishery and Aquaculture

There is great potential for sustainable fishing. Fish stocks are shown to be less successful than marine protected areas (MPAs) because of decades of dispute. The future

of this sector depends on increased stock and sustainable fishing. Contrarily, aquaculture offers a significant opportunity for sustainable growth, provided that sustainable production patterns are followed, and overfeeding, treatment, and overtreatment are avoided. The practice of aquaculture will continue to be more and more important for feeding the world's population. Numerous millions of people depend on aquaculture, thus there are a lot of opportunities. It could even be the sole source of protein that many people have access to.

Table 1: FAO Estimates Biannual Exports

Year	Amount of Aquaculture	Aquatic plant	Edible Fish
2009	55.7 million tons	12.76 million tons	56.81 million tonnes
	110.2 million tons	30.1 million tons	80.0 million tons
2022	Total aquaculture and fisheries = 184.1 million tons		

Source: (FAO, 2022)⁶

Maritime Transportation, Shipping/Ports

The maritime transportation/shipping sector and ports are essential elements of the blue economy. Nations without sufficient ports, shipbuilding or repair facilities, transportation infrastructure, or maritime development would find it challenging to fully participate in the global economy. Up to 90 percent of the volume and more than 70 percent of the value of all global trade are handled by ships and ports. With a total volume of 10.3 billion tons in 2016, there was a rise of 2.6 percent (1.5 percent in 2015). Although the trade involving containers or freight may be multimodal or even slow in terms of speed, the combined benefit is evident owing to cost-effectiveness and the ability to transport substantial amounts of cargo across greater distances. According to a study, the greatest containerized throughput handled in 2016 was in Asian ports and was 64 percent. Since then, it has been gradually rising due to rising demand and supply. Nearly 90 percent of the world's cargo is transported by sea. Therefore, it is impossible to separate trade, the maritime industry, and ports. The globalization of production and consumption, as well as rising demand and supply, are undoubtedly effects of the continuously expanding containerized transportation. Therefore, it is impossible to separate trade, the maritime industry, and ports⁷. The blue economy is open to new

business ventures, such as trade. Additionally, it protects and develops deeper blue resources, such as coastal fragility, customs, and carbon capture and storage, to help fragile states decrease the terrible impacts of poverty and climate change.

Coastal Tourism and Cruise Ship Industry

The Blue Economy's increasing maritime tourist industry and it has the capacity to expand more quickly. Tourism along the coast and in the maritime sector is heavily reliant on a healthy environment, particularly regarding water quality. Coastal tourism refers to travel along the shore and related businesses. In addition to traditional water-based tourist activities like swimming, surfing, diving, and nautical sports, and maritime tourism can also encompass land-based tourism that is not directly tied to beaches in coastal areas, etc. The practice of cruising is a form of coastal and maritime tourism. The cruise ship sector is expanding very quickly. An estimated 25.8 million people cruised in 2017, up 4.5 percent from the previous year. With 27.2 million passengers projected to board ships in 2018, cruise travel is on the rise. The entire economic impact of cruise travel on the world economy in 2016 was estimated at \$126 billion, up 7.6 percent from 2015. For the first time, the cruise sector employed more than 1 million people and brought in more than \$41 billion. Over the previous ten years, the cruise industry has experienced greater overall growth (64%) than the overall worldwide tourism industry (45%). Economic growth will be impacted by the anticipated increase in maritime tourism.

Marine Biotechnology

Considering the numerous social and economic domains in which marine biotechnology is used, it is a new sector of the blue economy. Oceanic living things, including sponges, microalgae, and other biological species, are abundant sources of medication. It is possible to create novel chemicals and molecules for the creation of drugs by creating the right culture conditions. In reality, marine biological resources were used in effective compositions, encouraging further study and development, as well as funding for biosynthesis and bio-prospecting. Beyond the development of new pharmaceuticals, tissue culture, aquaculture, and the production of medical devices are just a few examples of the much broader applications of marine biotechnology. Like this, the food and pharmaceutical industries greatly benefit from protein and enzymes derived from marine species. Biopolymers are used in a wide variety of products, including tissue regeneration, recyclable plastics, food additives, pharmaceutical and medical polymers,

and dressings for injuries, bio-adhesives, dental biomaterials, and scaffolds for 3D tissue culture. The public may need to support marine science education and research due to the knowledge-intensive nature of this industry in order to promote the broader application of marine biotechnology. There may be a wide range of additional uses for biological processes and technology with marine origins⁸.

Deep Sea Mining, Offshore Oil/Gas

Within the greater mineral extraction sector, deep-sea mining, also known as seabed mining or marine mining, is a relatively recent field. The procedure entails removing different minerals, metals, and other deposits, such as tin, diamonds, and sand, from the ocean depths. Private businesses and several nations, including the U.S., have invested in the development of technology to investigate the deep-sea environment and find possible mining locations. However, there are currently no deep-sea commercial mining operations operating. Any upcoming deep-sea mining operations would have to overcome the challenges posed by the harsh environment of the deep ocean, such as no sunlight, high pressure, and low temperatures in this habitat.

Remotely controlled extraction tools that dredge the seafloor or seamount crust are part of the mining designs. Companies across various nations, including the U.S., China, Japan, India, and Korea, have increased their research into hydrothermal vents as potential mining areas because of the growing prices of precious metals. In September 2017, Japan operationalized the first large-scale seabed mining project near a hydrothermal vent. If engineers and scientists can allay concerns about environmental deterioration, deep-sea mining might be extremely profitable. Investors anticipate quick and spectacular profits, according to market research from the mining industry. By 2030, they predict it will be valued at \$15.3 billion⁹.

Renewable Energy

In order to alleviate the power shortages and enable the blue economy to grow sustainably, the potential of the Blue Economy program attempts to understand the power requirements of developing coastal and maritime sectors and improve technologies that could integrate marine renewable energy¹⁰. Oceans have a lot of potential for renewable energy and can power a blue economy based on the wise utilization of ocean resources. Offshore renewable energy sources have the potential to help the power

industry decarbonize, as well as other end-use applications important to a blue economy, for example, shipping and water desalination. In comparison with the financial expansion and comprehensive renewable energy sources.

According to an IEA report titled *Ocean potential*, variations in ocean temperatures, salt content, tide, current, wave, and swell movements have the potential to generate anywhere between 20,000 and 80,000 terawatt-hours of energy annually. Offshore wind, floating solar arrays, wave, and tidal power, among other maritime renewable energy sources, are extremely promising for fostering energy independence and assisting nations in meeting their emission reduction targets under the Paris Climate Change Agreement. The following activities help to advance marine and hydrokinetic (MHK) or marine energy:

- Immediate rivers with in-stream turbines.
- Turbines powered by ocean currents in areas with strong marine currents.
- Deep tropical sea thermal energy converters.
- Wave power converters are installed in exposed coastal locations with large waves¹¹.

A huge benefit of this potential could be taken by wave tidal, ocean thermal power transformation, and salinity gradient energy, which are some of the emerging ocean energy technologies. etc., and in addition to the renewable energy, the oceans could also offer an essential location for the development of alternative renewable energy sources, where offshore renewable energy sources include floating solar photovoltaic (PV), fixed and floating offshore wind, and different ocean energy technologies. It can also offer important socioeconomic benefits, such as job development, better living conditions, regional value chains, and greater collaboration amongst blue economy participants in countries with coastal regions and island territories.

Small Island Developing States (SIDS) are well-positioned to become the primary beneficiaries of an offshore renewables-based blue economy, assisting in meeting some of their most urgent needs, such as:

- **Access to cheap electricity:** Renewable energy sources have the potential to substitute for costly power generation systems that are dependent on imported fuel. By making use of offshore variations, these sources can also reduce the requirement for constructing energy facilities on valuable land.

- **Fresh and potable water supply:** The provision of freshwater that is safe for consumption constitutes a critical challenge globally. The utilization of renewable energy technology presents a promising solution that can facilitate the attainment of locally sustainable desalination, thereby enhancing the availability of fresh potable water.

The following are the benefits of renewable energy gained from oceans and seas:

- **Shipping powered through renewable energy:** It is noteworthy that the category of vessels commonly referred to as bulk and container carriers, oil and chemical tankers, and others constitutes one-fifth of the global shipping fleet but is responsible for contributing 85 percent of the total net greenhouse gas (GHG) emissions associated with the shipping sector. Currently, there exist seven major ports that collectively contribute to approximately 60 percent of worldwide bunker fuel sales. Notably, the port of Singapore holds a preeminent position by supplying up to 22 percent of the global bunkering market.
- **Biofuels:** Biofuels offer a promising solution for reducing emissions due to their mature development status and compatibility with current ship engines and port infrastructure, as well as their viability in various blends. Clean biogas possesses the capacity to serve as a potential substitute for fossil-derived liquefied natural gas (LNG), currently being introduced in the market, as an intermediary fuel source in the near future.
- **Hydrogen:** In the quest for achieving zero-emission shipping, hydrogen exhibits considerable potential as a noteworthy clean energy source.
- **Renewable energy and desalination of water:**

The global populace has experienced a noteworthy surge over the past decade, exhibiting an approximately annual growth rate of 1.14 percent, thereby culminating in a population numbering approximately 7.79 billion individuals in the year 2020¹². Consequently, there exists an amplified demand for potable water in various domains, including but not limited to industry, agriculture, irrigation, power generation, and residential sectors, the latter of which accounts for approximately 60 percent of the water sourced from desalination processes. The utilization of saltwater desalination as the primary source of potable water has become increasingly relevant for various countries,

notably those situated in the Middle East and North Africa (MENA) region and other Small Island Developing States (SIDS), due to the continued strain faced by freshwater reservoirs¹³.

However, desalination, a process that converts seawater into freshwater, is often coupled with high costs and substantial greenhouse gas emissions due to its high energy requirements. The desalination process is augmented by various auxiliary resources, such as solar or photovoltaic technology, wind energy, solar thermal systems, and geothermal power¹⁴¹⁵. Each of these has discrete environmental and societal outcomes alongside potential economic benefits. Moreover, a comprehensive assessment of their influence on the blue economy is imperative, taking into consideration the established standards and guidelines at the local, regional, national, or international levels. For an activity to be classified as part of the blue economy, it must exhibit four key components of resource efficiency, such as:

1. Decreased food loss and waste throughout the value chain.
2. Improved energy efficiency resulting in a reduction of carbon emissions.
3. Provision of satisfactory employment opportunities.
4. Utilization of innovative financial or technological practices.

The proposed initiative would necessitate the provision of benefits encompassing environmental, societal, and economic aspects¹⁶¹⁷.

Conclusion

At its core, the blue economy offers a promising way to use ocean resources for growth without damaging the environment that sustains them. This article highlights that sectors such as fisheries, shipping, tourism, and marine energy can drive economic progress, but they also carry real risks if they are not managed carefully. The key issue is not whether these sectors should grow, but how that growth is guided. Without proper oversight, the same activities meant to generate prosperity can lead to resource depletion and environmental harm.

Governments need to move beyond fragmented approaches and adopt integrated ocean policies that connect different sectors under a single vision. Strong regulations, supported by reliable data and research, are necessary to ensure that development remains sustainable over time. At the same time, policies should encourage innovation

and the use of cleaner technologies, while also ensuring that rules are actually enforced. Beyond this, the public and private sectors of Pakistan need to work together to fulfil the requirements of sustainable development. Cooperation across countries is equally important, since marine ecosystems do not follow national boundaries. For developing states, policies must also focus on building local capacity, involving coastal communities, and making sure that the benefits of the blue economy are shared fairly.

The blue economy is not just about expanding economic activity at sea; it is about managing it responsibly. If supported by thoughtful policies and effective institutions, it can become a long-term solution that supports both economic needs and environmental protection.

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